A Quantitative Study on Critical Success Factors in Agile Software Development Projects; Case Study IT Company

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Abstract

While software play integral role in every aspect of the modern world, software development process still faces many problems. During development process in an organization, effective methodology has a crucial role in order to become accomplished. Agile approach is new methodologies which have been introduced recently as a new approach for developing software to increase productivity and efficacy of software development process compare to traditional methodologies. Whereas, accomplishment of this methodology is still anecdotal and deeper investigation in this area is scant in academic circles. The purposes of this research is to influence success of agile software development in subject factor of organization, people, process, technical and project dimensions under terms of quality, scope, timeless and cost. This study has conducted a survey in order to investigate important success factors of agile software development process using quantitative approach. Preliminary After sufficient literature an explanation and list of potential factors for agile methodology based on previous studies were introduced. Afterward, factor and reliability analysis were conducted to mix this primal list into a finalized list of potential critical success factors in four mentioned dimensions. For each agile success factors term of quality, scope, time, and cost has been investigated. In order to collect required data a questionnaire was conducted among employees in a famous software development company who are mostly working based on agile methodology. This survey will make the personnel's feedback and analysis their ideas about the variety of factors of agile methodologies which they are usually implemented in software development projects. Dependent sample tests, independent test related to the gender and multiple regression techniques as in full regression model and the last one is an optimized regression model which is done via the stepwise screening procedure. Final result of this study proved and rejected selected hypotheses. These hypotheses were

about relationship between factor in four dimensions and quality, scope, time, and cost by using agile process. This questionnaire and analysis of this case study has proved some of authors' hypothesis like the fact that by using agile methodology organization dimension is related directly to quality of product instead of reduction of total cost or using team management techniques can affect timeless factor instead of cost reduction. Finally, researcher makes more suggestions in order to make success factors more effective and increase productivity during the development process and to have more accomplishment in agile base projects.

Key words:

Agile methodology, Cost, Quality, Software development, Success factor, Scope, Time

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Contents

1. Chapter 1: Introduction

By growth of technology in recent decades, software has become very essential in all facets of the modern world, whereas software development process itself is complicated process. Unlike many efforts which have been done before to apply variety of software engineering methodologies, software development process has not yet been consistently effective and faces some problems yet. These problems cause rejection in final product (software), delays in delivery time and system, abandoning final products, and not pass products. Even software projects which are successfully finished and are already applied in systems may need expensive continuously maintenance support or other software services and fine release (Chow, T.,& Cao, D.B., 2008). The top shortcomings have impressed the bottom line of software development process in organizations and caused huge challenges. This research study tries to figure how agile software development process in organization can be improve in order to avoid the above problems of waste in time and money and inefficiency through development process .recently a methodology in software development process has been introduced called Agile methods, which operate totally differently from traditional approaches in software development process. In this chapter back ground and brief information about software development and famous methodologies, information about agile methodology and back ground knowledge about agile process and production has been presented. In addition, in this chapter purpose of this study and problems which this study will try to answer has been mentioned. Afterward, research questions which are bases for this study has been described and limitations with addressing these questions have been presented. Importance of this study and reason for choosing this area and people who can get benefit from this study and back ground of author and general structure of this thesis work are other concept which will be covered in this chapter.

1.1 Background

1.1.1 Background knowledge about software development and methodologies

The process of generating and evolvement of software programming happened gradually (Malik, H., & Siew Hock, O, 2009). Like all other technological fields programming languages and software development modified during the time and they become so different

compared to what we use as software development process and programming language today (Klimeš,C., & Procházka,J, 2006). In 1970 unfinished software projects and inability to support new products caused software crises. First idea of development approach become evident after software crises, in order to decrease the expenses and overcome the timing problem of process (Klimeš,C., & Procházka,J, 2006).To overcome these crises, it became essential to fallow development process according to methodologies. For more information about history of software development check the history of the history of software development article by Martin Campbell-Kelly 2007 published by IEEE.

1.1.2 Background knowledge about agile methodology

Long time ago, in first years of developing any systems, customers had stable desires which make the process easy for developer. In those circumstances, it was proper if developer fallow a stable method. Over time, the development process faced more dynamical projects in competitive industry. These changes caused some difficulties for development process which were necessary to be considered (Malik, H., & Siew Hock, O, 2009). Some of other problems in software development were mentioned as: desire change by customer, timing and budget difficulties, essentiality of customer involvement, communication problems (Malik, H., & Siew Hock, O, 2009). According to these complexities, the concept of agile methodology generated to respond new circumstances (Landaeta, R. E., et all 2011). Applying agile method into system development process is supposed to help the organization to become more productive in shorter time with avoiding extra cost in this competitive, rapidly changing business environment (Malik, H., & Siew Hock, O, 2009).

Agile manifesto announce principles that motivated and makes software developers powerful by depending on excellent technical features and simple designs to create business value and delivering working software to end user constantly at regular short time intervals. Agile have implemented several practices that researches show these practices deliver greater value to customers. The fundamental aspect of these practices is self-organizing teams' idea. This idea refers to the team members who are collocated and do their task at a pace that their creativity and productivity doesn't reduced because of team working. The principles announce practices that accommodate any modification in requirements at any step through the development process. In addition, based on this manifesto customers or end users are actively involved all

through development process. This practice will facilitate their feedback and reflects that can help development team to come up with more satisfying outcomes. These principles are not formal definition for agility, and more precisely they can be introduce as guidelines and frameworks for delivering high-quality software in an agile approach. Whereas individual rules and practices of agile methodology aren't entirely new in software community, the method in which they are collated together into a coherent "theoretical and practical framework" is certainly new in this area (Williams, L.A., Cockburn, A., 2003). The agile manifesto was articulated, after developers and people who were supposed to work base on agile method and researchers have been trying to explicate agility and variety of its facets. At its core, agility entails ability to quick respond to any modification and flexibly create in the business and technical domains (Henderson-Sellers, B., Serour, M.K., 2005 ; Highsmith, J., Cockburn, A., 2001). Other facets in agile methodology exploration consist of lightness or leanness (i.e., having minimal formal processes) (Cockburn, A.,2007) and other related concepts are explained as nimbleness, rapid, dexterity, suppleness or changes (Erickson,J., et al., 2005). In one sentence, these ideas suggest a "light methodology that promotes maneuverability and speed of response" (Cockburn,A., 2007).

1.1.3 Background knowledge about agile process and production

One competitive advantage in global competition market is producing high quality products. In order to produce high quality products, defective products eliminated through 100% screening. For the economic reasons and industrial environment concerns, defective agile methodology processes are reworked to be more serviceable items. Agile process is also an important topic in reverse logistics where used and second hand products are reworked to increase chance for waste of money and environmental problems for all productions. (Widyadana,G.A.,WEE,H.M., 2012). This is where production separate in many parts and gets different meanings such as valuable production which come from value product (VP) as an economic concept formulated by Karl Marx. Second item is organization productivity which means an average measurement of the efficiency of production through software development process. Generally, Productivity can be explained as the ratio of production output to everything which is necessary for producing it. These requirements for production consist of materials and inputs of capital, labor, land, energy, etc. On the other side, The evaluation of organization productivity can be explained as a total output per one unit of a

total input. We see that as a measure of the average productivity is often difficult to interpret correctly. Based on these aspects of production meaning in organization we will use in next chapter to define hypothesis for relation between agile methodology process and mentioned aspects of production in organizations.

1.2 Description of Research Problem

As it has been mentioned in previous chapters also, the popularity of agile methodology is proved by survey studies which have been done previously refer to secession (3.3.1). Lots of affords has been done about agile projects. Shortly here it can be mentioned that Ramesh, B. Et all (2006) have done a great afford in this area , Rayside, D., et all (2009) has researched about agile specifications or recently Singh,A. (2012) also, has talked about some problems of agile. Some of these pitfalls have been mentioned as internal and external communication problem, misunderstandings in requirements and some others (Singh,A., 2012). Full versions of previous researcher's claims about problems have been explained more in later secession (3.2.3). By overviewing nearly most of research works which have been done in this area it's clear that, agile challenges have become almost obvious. However, in practice still there are some projects which face challenges during their process and some success factors doesn't seem to be effective enough. Consequently, this research work will try to make some limitations in this area and consider the practical process of agile base project to figure out the source of success and pitfalls or challenges and how focus on the most serious problems and hopefully to come up with some possible solution to have the most optimized workflow.

This research study reached to identify and provide insight into success factors of agile methodology that help software development projects to complete the development process with more accomplishment. In literature review chapter of this research success factors of agile methodology referring to previous studies has been presented. Also reliability of success factors has been Performed and analyzed. Factor analysis on success factors and consolidated them into a final success factors for Agile projects in different categories such as: Organizational, People, Process, Technical, and Project is what has been done in this study. A web-based survey was conducted to gather information from technical people, and the collected data were analyzed using the multiple methods by SPSS. The analysis addresses the following questions:

- Find relationship between success factors of Agile software development projects and projects success criteria as cost, quality, timeless, scope

1.3 Overall Research Aim an Objectives

In today's every day changing business environment, the critical requirement of staying successful is to find out and meet the challenges and success factors and concentrate on success factors . If the organization be able to meet this requirement and predicting it properly, the organization can become more productive for stakeholders and as a result, it will become more accomplished. This goal is possible by means of adapting agile development methodology and concentrating on its success factors. Millet. S (2011) like other researchers believe that interaction between all the project members include managers , development teams and etc and end users who can be sponsors , customers and etc, will help the agile methodology to finish the tasks in proper time effectively . In this methodology tasks are done by their priority and the emergency requirements will be handled first. Based on Millet (2011) Statement there is a repetitive cycle in agile methodology which maximize chance of success, the working demo of product will be delivered regularly and will result the user pleasure. It also will result saving money and time (Millett, S,et all,2011).

The purpose of this research is first of all to provide a practical example and references from a company in which agile have been applied as software development methodology. In order compare various ideas about success factors of agile methodology with potential reason for problem and success of agile software development. The second purpose of this research is to develop some contribution about this previous research study methodology in system development process, through figuring out the practical agile success factors roles during implementation of agile methodology. As a result of this contribution I expect to come up with a possible solution to reduce the pitfalls in agile base systems and have more accomplished projects. In fact, by doing literature review on related papers and books the researcher find out that in spite of the fact that agile methodology has been investigated by many researchers and experts and has been embedded in many development systems processes, just less researches have been done research about success factors of agile in organization which implement this methodologies and their practical problems.

1.4 Research Questions

The research questions are frame work for the research projects. These questions will lead thesis during the process and will define the thesis surrounding and will keep us focus on content of our research. In this research the below question is the main question of this research which guide the author through this work and in order to answer this main question some sub questions has been raised which help to describe main question in more detailed and step by step. Main questions are:

Measure affected of success factors in agile. These factors are mentioned as organizational factor , technical factors , process factor , people and project factors by implementing this methodology in system through software development process in terms of "quality, scope, timeless, and cost" dimensions?

- What is the effect of team environment factor in terms of quality and cost?
- What is the effect of team capability in term of timeless and cost?
- What is the effect of project management process in term of quality and cost?
- What is the effect of software engineering in terms of quality and cost?
- What is the effect of scheduler in term of scope and cost?

This thesis will try to come up with answer to above questions. The answer to these questions will mostly be based on literature review and questionnaire by referring to the fact that this is a kind of confirmatory question. Previously most of problems with this methodology have been investigated by variety of researchers. That is to say, in this question I will try to measure effect of some success factors of agile methodology implementation in term of time, quality and cost and scope which are critical dimensions in any software projects. Some sub questions to help to find answers for main question has been raised as above.

All of sub questions have been raised to give brief introduction and consider the whole process of implementing agile to help having a clear idea about main question. In first step these questions have been considered by literature review of previous works .In addition these questions have been answered by Empirical study to compare the hypothesis which have been raised by literature review with result of questionnaire in practical industry to accept or reject these hypothesis. All the questions will be completely explained and answered in analysis and result in chapter 4 and 5.

1.5 Limitations and Delimitations

Software development process is a wide area and there are various kinds of tools, technologies and techniques related to improvement of this process, but here in this thesis the author just will focus on agile methodology in development process regardless of covering all features and will just focus on some specific factors of limited subjects which calls success factors of agile methodology. Although the agile methodologies process and system development process has been widely studied by author but, the author has mostly investigated a specific factors in people, project, organizational, process and technical subject in term of limited dimensions as time , cost, quality and scope . In fact, the main purpose was to narrow down the research area in specific subject factors that organization may require to consider the most during implementation of agile method management in their process from management and business process points of view instead of talking about the whole methods and areas of agile like agile modeling, extreme programming, agile unified process, etc. Which are mostly technical features.

1.6 Significance of This Study

In this every day changing environment exigency of having adaptable methodology in software development process, lead researchers to come up with agile methodology. These system methodologies are necessary to be considered and be embedded in academic environments and in commercial environments. These methodologies have been investigated by several researchers during past years; it has been proved that these methodologies have advantages and negative effects. Previous researches have investigated scopes and objectives and other features of these methodologies. It is important for an organization to decide about kinds of methodology it needs to apply in to the project in order to get its desired result according to this mention in figure 1.1 development of agile methodology in software is increase during recent decade. In this study the agile methodology which is one of the most frequent used methodologies has been investigated to measure the effect of success factors of agile software development in order to increase the chance of success in projects.

Agile development methodology has absorbed many peoples interest from the software industry. Like what has been mentioned in literature review of this research work a survey in

the USA and Europe represents the fact that 14% of companies are using agile methods, in addition 49% of software companies that familiar with agile methods are interested in applying them into their development process. In last years, thesis which relate to this topic and the agile conference has increase in number to attract a more attendance than many conferences in software engineering. Some researchers have described agile development as a paradigm switch through software engineering process. This process has come up from some independent resources which studies software life cycles and iterative software development. These studies represented the fact that new paradigm takes a host from novel topics to forehead of software engineering topics especially in research area. These topics have been through behind in past years by researchers who have been inspired by old paradigm, as a result in this domain a backlog in research problems exist which should be solved. All the existing research so far that was shown is almost fulfilling the empirical studies that is collected today.

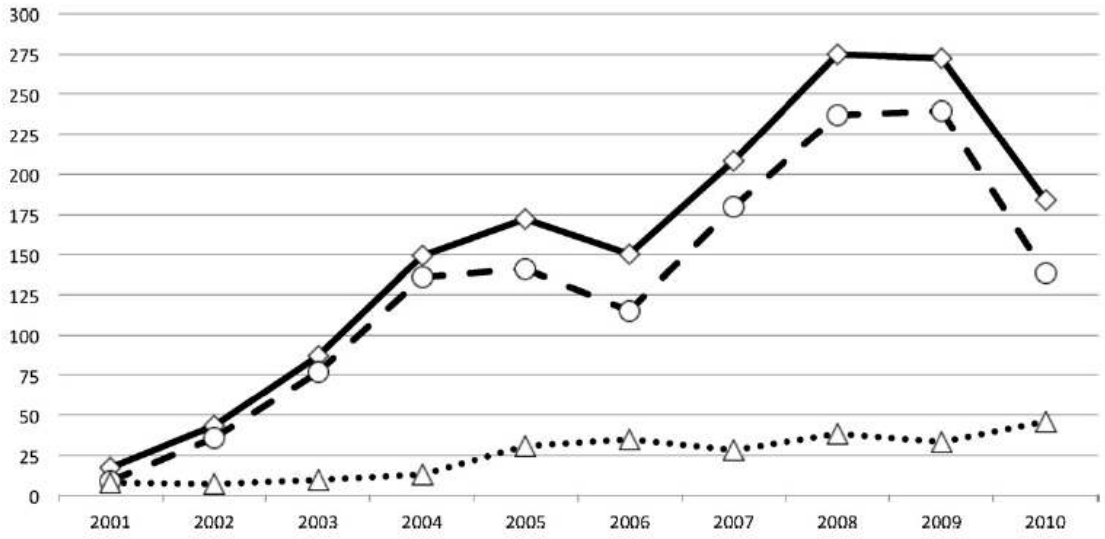

Figure 1.1: Agile software development publication from 2001 to 2010, total number (top), conference papers (middle) and journal articles (bottom), (Dingsŏyr, 2012)

Figure 1.1 presents the growth of agile methodology during last decade. This growth is a witness for importance of agile and the reason that this study focuses in this methodology as an effective methodology in software development projects.

The capability of fast adaption and long term planning of agile development has made it so famous and popular in software development industry (Dinakar, K., 2009).But how well that

this scientific approach is implementing in organization in practice and forcing this approach to come up with best possible result is what author looks for in this study.

a) The high popularity of agile base systems referring to Dyba, T., & Dingsoyr, T.,(2009)
b) Agile software development process results high quality referring to Bhasin, S.,(2012) And Sfetsos,P., & Stamelos,I., (2010)
c) A high place for improvement in agile base system to have the most possible effective development process

Are the reasons that author has tried to find contribution in success factors of agile base projects.

1.7 Target group

This research work includes two types of target groups first one is theories and academicals group which has been investigated by literature reviews and second one is all involved people who are working with this methodology in variety of organizations. The theoretical target groups are the researchers who are researching in software development area. In fact, this thesis work can be helpful for the people who are looking forward to understand some basic information about agile methodology in software development process. In addition, this research work can considered as a reference for researchers in business and management area as well. Since, it gathers information and data about agile methodologies from management point of view to end users. The practical target groups of this thesis work are the people involved in organizations from end users to head managers. More in detail, this research can be used as a source for the organizations who are working on system development especially the ones who are agile base. In fact, these organizations can use this reference to evaluate the reason of failure or calculate the chance of success and increase their chance of success in any agile base project regardless of the technical features. All the organizations in software development project can take a look at this research to have stable and much effective work in their projects.

1.8 Background of the author

The author of this thesis has got a bachelor degree of information technology engineering in 2009 and her bachelor thesis was about investigating the possibility of applying software phase of Information Communication Technology in IRAN. Her research interest is knowledge management, Research methodology for information systems, software design, decision support application, systems analysis and design. The author has published her paper in international software computing technology conferences ICSCT 2011 about Co-design of RAD and ETHICS methodologies and International Conference on Informatics for Development, ICID 2011 about Dilemma of Consciousness in robots. These back ground in related fields were so effective and help the author to do the research in right direction to be able to finish the work.

1.9 Structure of Dissertation

This study can be divided in to 5 chapters and several sessions in each chapter. All these chapter and secession will try to coherently cover all the essential information and data in this study including introduction which introduce briefly the area in which this thesis work has been done, research methodology that this research work has be designed based on it, theory part which gather all essential argument related to field of study, empirical part which shows the hypothesis of thesis in practice and analysis of these hypothesis and finally the conclusion part. As in figure 1.2 illustrate structure of the different chapter and connection between these parts has been painted.

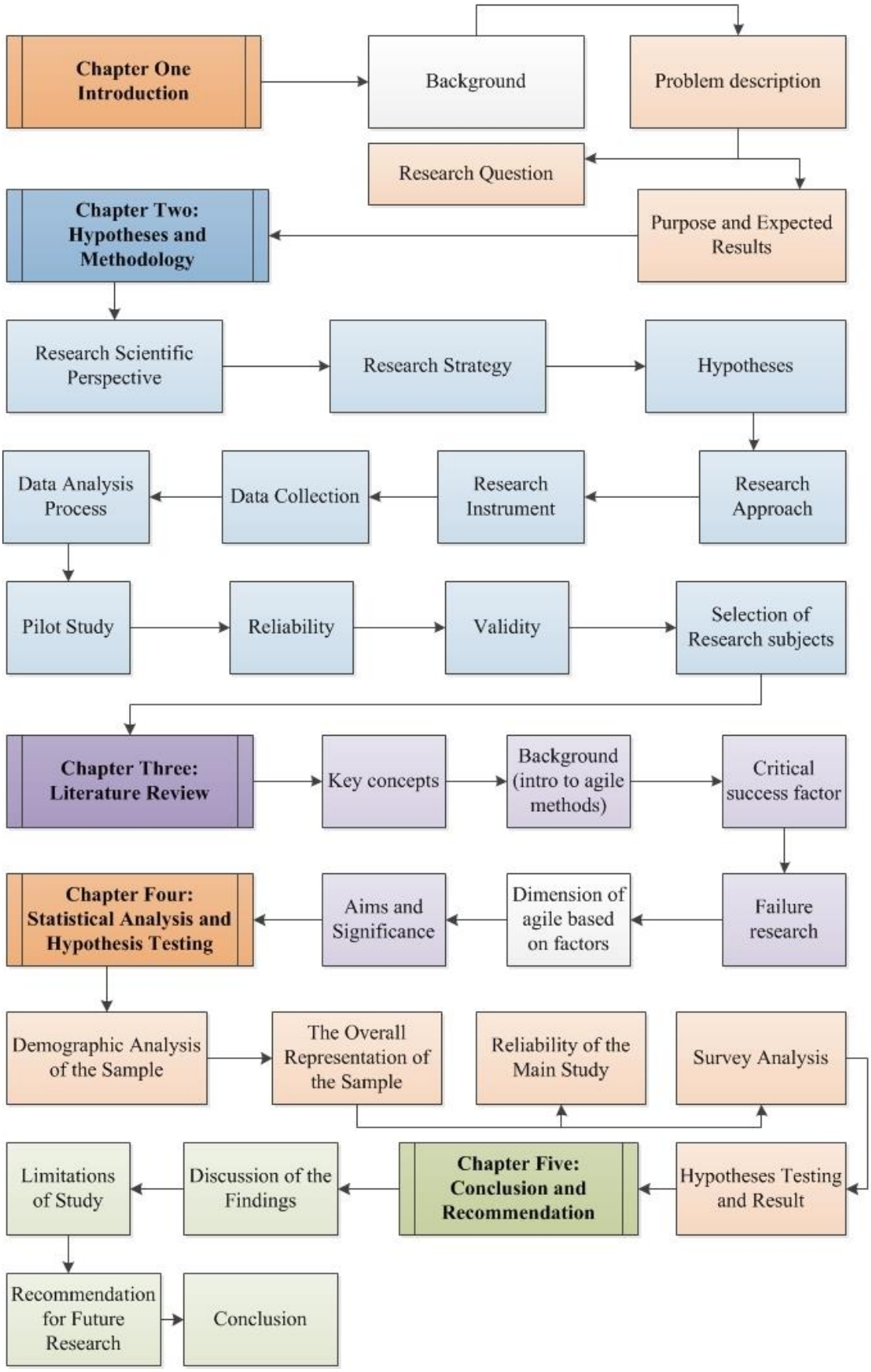

Figure 1.2: Review of thesis chapters

Chapter 2: Hypotheses and Methodology

2.1 Introduction

This chapter explains the methodology and research design approach that author has fallowed in this thesis in order to help the reader about result of this research and find the proper answer to the questions. During the third chapter the research methodology would be clarified and related hypothesizes would be identified. At the beginning, this part include the strategy of research, research approach and authors scientific perspectives. Then, data selection method has been described. As an important part the analysis model which has been used in this research has been presented in this chapter. Finally, the author has evaluated the validation of her findings and also has mentioned the way that practical and scientifically conclusion of this study has been depicted.

2.2 Research Scientific Perspective

During a research design when it comes to scientific prospective of research, it is essential for the author to think about Epistemological position of the work (Bernard,H.R., 2000). Scientific researchers consider epistemological position as clash between positivism versus hermeneutics. (Bryman, A.&Bell, E.2011;Wright,V.1971).Worth to mention that Positivism is the philosophy which refers to social science whereas hermeneutics refers to humanities. According to business research method book of Bryman & Bell (2007) Hermeneutics has been introduced as an approach that fundamentally created fort understanding or interpretation of texts and their relation, and theological text in a part of it as well. The general idea behind it is the purpose is text analysis is to collect meaning of that text from author point of view (Bryman,A. & Bell,E.2007) The way for figuring out the concept of text data is hermeneutics method of analysis. As far as there is no general art of understanding in common manner, instead there are some kinds of hermeneutics (Schmidt,L.K.,2006). Mentioned in Gadamer book (2004) hermeneutics are the phenomenon in which subject of investigation are textual data like other experienced objects (Gadamer,H.G.,2004)

Bryman & Bell (2007) explains ‘’ Positivism is an Epistemological position that advocate the application of the natural science to the study of social reality and beyond’’. (P.16) Positivism research concern is statistical data, No matter if this data is obtained from interview or other resource it clears some facts. Interestingly, these facts released from

positivism research are all consider as account. Silverman (2005) also claims that positivism aim is "to generate data which are valid and reliable, independent to the research setting" (Silverman, D., 2005). In order to develop positivism method the researcher should accept the theories first and result of it will be quantitative research in which accepted theories have been testing statistically (Somekh, B.&Lewin.C.,2005). Generally positivism method is proper of resolving the difficulties and questions of philosophies in social science. The Positivism method is based on explanation, it is better to be deductive, research are based on generalization, the boundaries between facts and values are clear, it is quantitative and data are statistical, there is no place for feeling on findings, researcher does not create object to study (Gummesson,E.,2000) .

Whereas, this thesis work is mostly based on organizations understanding and their construe for agile method, the domain of thinking in this thesis is wide and tries to test the accepted theory as a result it is more deductive. The author have tried to have generalized result by asking as many people as possible in order to get the more generalized contribution. Pre understanding of theory and examining it in statistics plays integral role to be applied in agile system completely, By these explanations above, that proper Epistemological position for this thesis work has been choose to be Positivism method. Preferred data in this research are quantitative, feelings are involved in the nature of any development group subconsciously, as a result it's essential to consider the feeling for researcher, and the aim of this study is to have a created contribution about agile methodology (Gummesson,E., 2000).

2.3 Research Approach

A related case study research approach was selected to explore the concepts of coordination strategy and coordination effectiveness based on empirical data from ongoing software development projects. This approach has been used as an acceptable path to explore phenomena in natural aspect of information system development concepts and approaches in a situation where events cannot be controlled and in situation where it is critical to capture and consider the detail in a specific situation. Furthermore, this method is suitable for confirming existing theory, which was the principal objective of the research (Eisenhardt ,M.K.,and Graebner,M.E., 2007). To ensure accepted standards for validity and reliability, the study followed guidelines developed by Dube.L., and Pare.G., (2003) for carrying out

rigorous deductive confirmatory positivist case study research in the field of information systems.

This thesis study contains 2 sessions – literature review and empirical analysis. As it has been describe in many chapters of this study this thesis work is a quantitative study which evaluates some factors of agile methodology in practical software development process in a company. As a result both literature review and empirical study is essential to get the result. The empirical chapter contains questionnaire and quantitative method is the most proper method in this study. It worth to mention that, the empirical part helps to confirm what has been collected through literature review. The reason is that data analysis helps to figure out the practical and real success factor in term of critical factors in software development process which cannot be certainly stated just through theoretical research.

In the theoretical chapter author has conducted the literature review. In this literature review most of relevant contents about agile methodology, agile success factors, and critical factors in software development process has been covered and explained as well as refined in the research work. The purpose was to figure out what previous studies have been done in this area and what are related knowledge contributions. As a result author could take the essence and discard the dregs. In this study research questions has been established base n findings from literature review. The best way for collecting data and analyzing ad evaluating the collected data has been chose based on findings from literature review.

Theoretical studies and literature review also is a witness that although lots of studies about agile has been done already but few of them has considered success factors in agile. (Referring to section 3.7) As a result, research question 1 conducted. In order to be able to find answer to general question 1 some sub question which focuses more in details has been conducted as well. The sub question 1 find answer for relationship between the team environment in agile and quality of product and cost of product which are very essential points in software development process. The research question 1.2 conducted afterwards to find out the team capacity affect in timing and cost of the process. Question 1. 3 considers effect of agile management approach in quality and cost of product and question 1.4 considers agile software engineering approach affect in quality and cost of product finally question 1.5 considers agile scheduler factor effect in scope of projects and their cost. All these sub questions were conducted to figure out and come up with solutions to the main research question 1 step by step . As discussed in section (3.7) about previous studies few previous knowledge contributions have

been considered and even these few researches has focused in other terms of software development process.

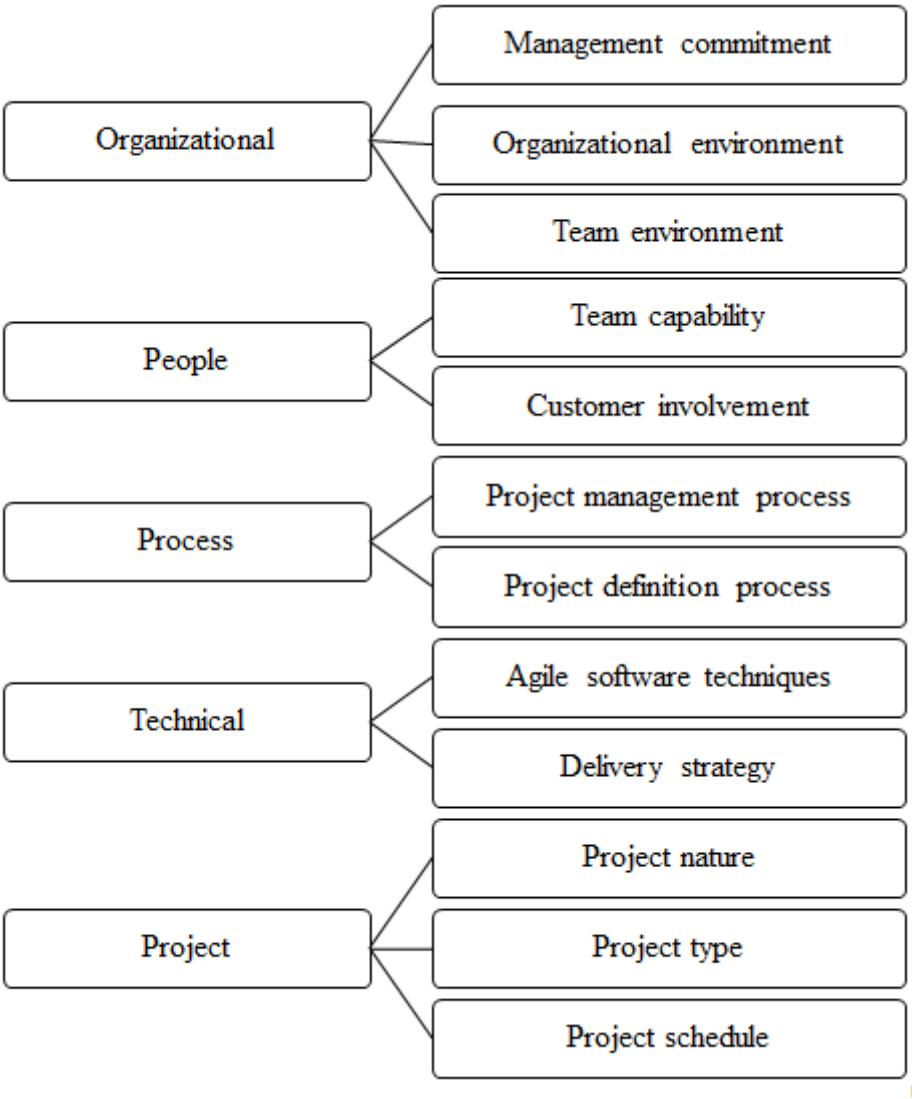

Figure 2.1: Relation of dimensions of agile methodology process

One of the benefits of using figure 2.1 is standardization which leads to the fact that questionnaires tend to be more objective than interviews. Likewise, by collecting data via questionnaires the results can be analyzed objectively compare to the other forms of research. On the other side, just standardizing the questionnaires does not let the researcher explaining any special points from questions which there is a chance it lead to misinterpretations. However, a pilot study can help the researcher in order to solve this problem (Saunders et al., 2009).

Agile Matrix of variables: $\left[a_{i,j}\right]$ which $\{i:1,...,m\} and \{j:1,...,n\}$

In this case m is 5 and n is 4, which will be cause 20 options but based on reviewed cases 10 item selected from this combinations. In addition, one of the most important concerns during the study is the lack of time. Although, in some situation using questionnaires can take a long time in terms of designing, applying and analyzing data. Nonetheless, it could be named as one of the swifter ways to collect large amounts of data from many people in a short time in a comparative cost effective way, compared to open ended questions which generate large amounts of data that take a long time to analyses and process (Saunders et al., 2009). However, it is important to mention that, if respondents think they will not benefit from responding especially if the questionnaire takes long time, it could be possible that respondents answer the questionnaire superficially. Therefore, it is very important to explain why this data is being collected and how the outcomes will be beneficial (Saunders et al., 2009).

Table 2.1: Agile process dimensions and factors

Subject	Factor	Organization			
		Quality	Scope	Timeless	Cost
Organizational	Team environment	☑	-	-	☑
People	Team capability	-	-	☑	☑
Process	Project management process	☑	-	-	☑
Technical	Agile software engineering	☑	-	-	☑
Project dimension	scheduler	-	☑	-	☑

Following discussion in the previous chapter suggests:

- Quality which mean delivering a good working product
- Scope which mean meeting all requirements by the customer
- Timeliness which mean delivering on time
- Cost which mean within estimated cost and effort

In this research study Survey methods has been choose in order to collect the data. In spite of the fact that, all questions are standard and these questions are collected to be as easy as possible to perceive by respondents. In this research study most of people speak English no matter whether they are native speaker or not (see appendix 1 for further information). Two critical steps exist before dividing the main questionnaires; underling the fact that this studies

main purpose is to analyze the dimensions like quality and scope, timeliness and cost for agile factors of Organizational and People, Process and Technical in software development process which are measured by the academic research. The questionnaires is distributed by the author among all respondents and the author collected the filled out questionnaire from respondents after several days – a method described as "delivery and collection of a questionnaire" (Saunders et al., 2009).

Table 2.2: Factors of each parameter in people, organization, and process

Organizational	People	Process
• Support System	• Competence	• requirement management
• Sponsor or manager	• Expertise	• project management process
• Cooperative organizational	• Motivation	• configuration management
• Communication	• Managers knowledgeably	• face-to-face meetings
• Universally acceptation	• Management style	• working schedule
• Collocation of team	• Coherent	• commitment and presence
• work environment	• Self-organizing teamwork	• authority
• Rewards system	• customer relationship	

In order to make the process easier for respondents, questions were designed in closed-ended format. Likewise, the questionnaire was designed to collect demographic and descriptive personal information. The data are relevant to the respondents' opinions of and level of contentment in their current job.

Table 2.3: Different parameters in technical and project factor

Technical	Project
• coding standards up front • simple design • refactoring activities • documentation • delivery of software • features • integration testing • technical training to team	• Project nature • variable scope requirement • accelerated schedule • multiple independent teams • up-front cost evaluation • up-front risk analysis

2.4 Research Strategy

It is essential for an author to fallow scientific standards to have scientific and good research (Cooper,D.,et Schindler,R.P., 1998). Bryman et Bell explain that research strategy clearly means general collection in order to the conduct the business research (Bryman,A.&Bell,E.,2007). The variety of research strategies can be categorized as the action research, surveys, experimental study, Ethnography, the grounded theory, archive study and finally case study based on how the author will define the research process (Saunders.M., et al., 2009). The decision about strategy of research is made by researcher mostly based on nature of the research questions and the problems. There are two types of study, exploration and evolution study. Mostly explorative study creates new theory and knowledge about a specific area that not much studies has been done in that area and the subject is almost unknown (Babbie, E., 1995).On the other side when lots of researches have been done in an area and the future result of investigations appear based on previous studies this is an evolutionary study (Andersen, 1994).

2.5 Hypotheses

Essential information in order to create the hypothesis has been explained and literature review guides the author to build research questions. Agile method has been introduced in previous studies whereas still it's essential to assess agile factors with a view point to evaluate the strength of dependence between variables. In this study hypothesis has been

tested to define false or true status for the statement about variable's relation. The independent variable effect the depended variable in positive manner or negative one and the dependent variable is the one that is seeking in the study. There is another kind of variable which names moderate variable and is directional variable and explains weakness or strength between dependent and independent variables (Saunders et al., 2009).

Consequently, this study looks for evaluating success factors of agile projects which are team environment, team capability, project management process, software engineering techniques these are independent variable and timing, quality, cost and scope which are dependent variable. Based on these explanations hypothesis are applied as below. Based on this assumption the hypotheses can be presented by using the null (H_o) and alternative (H_1)

Hypothesis 1:

Hypotheses based on Organizational dimension:

- H_o the existence of agile team environment is a success factor that contributes to the successful agile software development projects in terms of Quality
- H_1 the existence of agile team environment is a critical success factor that contributes to the successful agile software development projects in terms of Cost

Hypothesis 2:

Hypotheses base on People dimension:

- H_o the existence of team capability is a critical success factor that contributes to the successful agile software development projects in terms of Timeless
- H_1 the existence of team capability is a critical success factor that contributes to the successful agile software development projects in terms of Cost

Hypothesis 3:

Hypotheses based on Process dimension:

- H_o the existence of agile project management process is a critical success factor that contributes to the successful agile software development projects in terms of Quality
- H_1 the existence of agile project management process is a critical success factor that contributes to the successful agile software development projects in terms of Cost

Hypothesis 4:

Hypotheses based on Technical dimension:

- H_o The existence of agile software engineering techniques is a critical success factor that contributes to the successful agile software development projects in terms of Quality
- H_1 The existence of agile software engineering techniques is a critical success factor that contributes to the successful agile software development projects in terms of Cost

Hypothesis 5:

Hypotheses based on Project dimension:

- H_o project dimensions variable with emergent requirements is a critical success factor that contributes to the successful agile software development projects in terms of Scope
- H_1 project dimensions with emergent requirements is a critical success factor that contributes to the successful agile software development projects in terms of cost

2.6 Qualitative or quantitative Method

It is usually difficult for author to distinguish between quantitative or qualitative method. The quantitative method supplies the evaluation of measurements in a statistical and systematic plan, Therefore it is the most suitable method for positivism (Cassell,C. et al, 1994). In

quantitative method data can be performed and evaluated in numeric form which makes it possible to re-apply the survey in the future and reach a reasonable comparison. Bryman also explains that Quantitative research can be explained as research strategy which mostly focuses on quantity in collecting and analyzing the data (Bryman,A.&Bell,E.,2007).

On the other hand data in qualitative method is presented in the configuration of words rather that numeric form (McNail,P.,1985). Naturally this approach is more focused on better understanding of meaning instead of measurement as a result it's flexibility is much higher (Gordon, W. , Langmaid, R., 1988). The qualitative method is best capable for hermeneutics theory since it deals with the complexity of a certain research questions (Cassell,c. et al, 1994). As Bryman has stated also, Qualitative strategy can be explain as a strategy of collecting data and analysis by having concentration in words (Bryman,A.&Bell,E.,2007).

In this research work, the quantitative approach has been chosen since it most aims to come up with clear relationship between variable. For this purpose it was essential to evaluate the involved peoples' idea about variety of aspects of this methodology. Likewise, considering the pitfalls, problems and difficulties are the basic focus of this research work, it necessarily demands for empirical consideration among involved people to explain the relations. Furthermore, this study is based on accepting previous theories regarding these problems and just the concentration will be collecting quantitative data in order to measure the seriousness and reasons of these problems and this aim is also possible by a survey. By analysis of collected quantitative data generalization of the theory will be possible also.

2.7 Data Collection

According to the research objective the whole process of gathering essential data and preparing them for analysis is called data collection part process. It worth to mention that there are variety of approaches to collect the essential data (Saunders,M.K., et all., 2009). Due to the research method which have been used whether the method is qualitative or quantitative the data collections process differs also. The required data in qualitative method can be collected by having interview or to have live observations. Also, analyzing a case study can provide the essential data for qualitative method. It worth to mention that these procedures can be used together if it is necessary (Sale,J.E.,et all., 2002). On the other side, for collecting data in quantitative method questionnaire is on common way

(Mertens,D.M.,1998) . In addition, it can be said that collecting data in quantitative method is possible by investigating through acceptable amount of information to come up with much deeper analysis in an area and validating finings. Text analysis which means to read and analyze previously researches and books related to research is used in lots of researches as well. In this study, as text analysis method lots of reliable books, researches have been read and analyzed and summarized by author to create required scientific base for further investigation. idea of all involved people in organization from customer to employees and managers have been collected in order to have much deeper view regarding evaluation of agile success factors , as a result distributing questionnaire was the best option of collecting data.

2.8 Pilot Study

In this research, a pilot study helps to identify where respondents have had any problems in answering and understanding the questions, as well as evaluating the general quality of the instrument to show how well it would succeed or not . Hence, a pilot study was carried out before publishing any questionnaire to find out any defects in the questionnaire and to carry out tests for reliability.

The pilot study was carried out through hand delivery and collection of questionnaires. The number of selected respondents is adequate in order to contain any major differences in the population of the study, which could have an influence on the results. According to (Saunders.M., et al. 2009, p.394), the minimum number of pilot for most student questionnaire is 10. As well (Saunders.M.,et al. 2009, p.394) proves that this number is sufficient for this type of survey between 50 and 150 participants. Therefore, 85 questionnaires were delivered to respondents who were chosen randomly form a staff lists provided by the related department and in order to make sure that these people did not also participate in the main field study the name of them were removed from the list and the questionnaires were collected.

Among the answers only 60 of them were useable (effective response rate was 70%). The 25 outstanding questionnaires were not used for analysis because 15 of them were incomplete and others of them were not collected because the respondent had lost his questionnaire.

In addition, during the collection of the questionnaires the respondents were asked about the user-friendliness of them, and their feedback showed that there was no significant problem during the process, and the response rate was 70%.

$$T_{\text{rr}} = \frac{T_{\text{nr}}}{T_{ns} - I} = 70\%$$

In the above formula T_{rr} is Total respondent rate, T_{nr}: Total number of responses and T_{ns}: Total number in sample and I is Ineligible,

On the other side the formula below has been used for active respondent rate as

$$T_{\text{arr}} = \frac{T_{\text{nr}}}{T_{ns} - (I + U_n)} = 70\%$$

T_{ar} presents the Active respondent rate and U_n presents Unreachable

2.9 Data Analysis Process

Data analysis includes testing, classifying, rearranging and sometimes comparing and combining the gathered data to get new outcome (Yin, R.K., 1994). This analysis secession has been states as the most important and intractable part of quantitative research as a result in this thesis data analysis procedure chapter has been carried out with high accuracy. Text analysis helps the researcher to figure out deeper meaning of concepts and find reliable answer for the research questions. Having a strategy will help this approach to be fallow in right direction. In this study the author has selected some reliable sources as main resource of investigation and by the text analysis in this study the author has summarize theories and arguments from variety of resources in agile method area. The process of implementing agile methodology and scrum method for management has been investigated through different researches and from different prospective. Problems with this methodology that may cause the projects fail have been discover by analysis of previous researches. In this study author has categorized the most obvious pitfalls by finding many researches in this area and rereading and comparing them. This analysis helped the author to come up with some

questions related to the reason of these pitfalls which there was not enough information about this issue in previous researches.

In addition, according to the quantitative method of this research huge amount of data through a distributed questionnaire has been gathered. Questionnaire method has been chosen due to the reasons which has completely explained in chapter (2.6).through a pilot study which will be completely explained in chapter (2.7) the questions and structure of questionnaire has been checked and the proper questions and answers has been chosen and analyzed by SPSS software. The analysis process will be completely presented in data analysis chapter. This analysis of collected data has been compared and structured based on the text analysis and theory findings. Through Final analysis, the theoretical part will be examined and compared with empirical findings in order to accept or reject generated hypothesis.

2.10 Reliability of findings

As mentioned explanation for Reliability has extent to the data collection techniques and methods or data analysis process which will come up with consistent findings (Saunders et al., 2009, P. 149). That is to say, the reliability of scale evaluates the internal consistency. The research has good reliability when all used items for making up the scale are assessed under the same attribute. Although, the internal consistency can be assessed in variety of methods, Cornbach's coefficient alpha is one of most common method. This method is used in statics (Pallant,J., 2010). Referring to what Pallant (2010) explains, in cornbach's coefficient alpha the average correlation among used items for making up the scale indicates an indication in values. These values ranging from 0 to 1, higher value of item indicates greater reliability. The 60 questions of the questionnaire that were associated with success factors in agile methodology were examined for reliability (Appendix 2). In social science researches in order to have an ''acceptable'' reliability coefficient should be 0.700 or higher (Pallant, 2010). According to the pilot study the alpha coefficient for the 18 items was 0.756 which explains that the scale of this research has high internal consistency (See table 2.4).

Table 2.4: Reliability Statics

Cronbach's Alpha	Alpha Based on every Standardized Items	N of Items
.756	.810	18

2.11 Validity of findings

Due to the fact that each academic research can be a base for further study having valid and reliable finding has crucial role in a research work. In 2009 Saunders et al. state an explanation of validity which is evaluating through final result of a method of study which has been picked to get ideal result (Sekaran,U .,2003). Hair also states again that the validity of a research work can be evaluated based on these criteria relation, validity of build ups, text validation'' (Hair et al., 2000). In quantitative research validity has been presented as the true measurement of the research work and how much can result of a study be truth worthy (Joppe,M ., 2000,P.1) validity of a research can be obtained by looking for answers for specific questions through previous researches in Same area (Golafshani, N. 2003). Particularly for quantitative research three basis for evaluating validity has been introduced as match between outcome of research and real world which called internal validity of study, generalization of an study which calls external validity and determines whether finding of a study can be generalize and be applied in more populations, the last one is proper contracture validity (Yin,R.K.,1994).

As motioned, the validity of a scale refers to an agreement between questions and scales. This agreement evaluates what they were supposed to evaluate. Although still a clear cut indicator that exactly evaluates a scale's validity has not been discovered (Pallant,J.,2010). As a result, in this study the questionnaire was generated based on Spector's (1985) approach, and has been examined several times, still it was essential to confirm the validity of the questionnaire even before distributing the pilot study. As first step, the draft of questionnaire was discussed with known and valid people about agile software development in this company. Afterward vague questions were edited. Finally, in this study validity has been accepted via positive feedback from testing validate people in terms of clear and understandable questions. In this study, author has tried to apply internal validity in her finding to consider how close the empirical study is to theory findings in agile methodology for software development process.

2.12 Method of presenting result

The written format is one of common used method for research. The findings in this thesis have been presented through written text. The written document perfectly describes and presents finding from literature reviews and text analysis. According to the nature of quantitative study some measurement by SPSS software has been done. Consequently, in addition to the written text this study presents the result of analysis by SPSS software through statistics, charts, diagrams and etc.

2.13 Summary

In this chapter the generated hypotheses are presented and the methodology of this thesis work is interpreted. Also, the reasons for choosing this research strategy and research approaches has been explained. The pilot study before distribution of questionnaire and by validity evaluation of pilot study, and the proper minimum sample size for study is determined. In order to get the most possible precise and reliable outcome to analyses agile factors, the explained sample size in next chapter was derived as suitable sample size. In last sessions of this chapter the process of collecting data via questionnaires through the respondents has been are explained. In the next chapter of this thesis work the literature review about key concepts of agile and software development which helped the author to conduct the hypothesis will be presented.

Chapter 3: Literature Review

3.1 Introduction

Process of software development has been the center of attention for many managers, engineers and researchers due to a large percentage of failures in the software industry. range of failure which caused by inability of involved people to provide software solution that best matches the requirements in proper time, or providing essential solutions which one of them is maintenance nightmare and in worst case scenario inability of involved people to provide any kind of solution (abandoned software projects). One of most important difficulties that make software development special process and leads development process to face above mentioned problems is that during the development process both technology and the business environment modifies constantly (Williams.L.A., Cockburn,A., 2003). These changes happen because of technology advancement and improvement these days. technology these days improves even more dynamic than the period of time which Agile movement initiate development; this fact leads customers to face many problems not only to verify and decide about their requirements at the beginning part of their ordered project but even to have a simple and clear idea of what exactly they need at the time and to form their needs and desires only after iterations of the demo of the final product. The process of structuring and explaining requirements consist of changes as well. These explained fact in today's situation is the result for creation of variety of methodologies and implementing them that embrace changes like SCRUM, Extreme Programming, Lean Software Development, Kanban, Crystal, etc.

During these past years agile method has proven that its able to overcome many of the problems which has been presented in previous paragraph. This methodology has become pioneer in software development industry. The agile approach fundamentally is driven and handled by self-organizing groups. These self-organize teams have the power and ability to coordinate their duties by themselves. This fact increases productivity in the whole development process and enables all employees to learn what they don't know and innovate what they think they need , at the end makes them satisfied with what they do (Smite et al., 2010a).

In the traditional plan-driven (waterfall) software development processes, work is coordinated by managers and there is a clear separation of roles (Moe.N.B.,et al., 2010). Similarly, in larger organizations there is a tendency of organizing people around component teams – grouping people in the way that they have the influence over the small part of the product thus giving the teams less control and losing the ability of close collaboration. Introducing new features in the organization of that kind requires synchronization of many different component teams (Larman,C., 2011). In the agile approach, a self-organizing team decides how work is coordinated and has the complete control over development process and introduction of new features.

However, many organizations, and especially large organizations, still base their software development around plan driven or component teams. The transition of such teams to agile teams and how to overcome difficulties that occur during that process has been the subject of many case studies (Moe.N.B., et al., 2010). All of them agree that this kind of transition is a hard process. That process often has dead ends in means of trying and abandoning various software development practices that do not work for the current team. Sometimes it is filled with team members' frustration, skepticism, denying, but regardless of everything mentioned, achieved benefits ramify the cost of transition.

As Smite et al. (2010a) comprehend there is a growing need for companies to explore global sourcing leading to distributed software projects with geographically, temporally and socio-culturally dispersed teams facing additional challenges when trying to successfully implement agile values and principles. The research in Smite et al. (2010b) has shown that it is possible to successfully apply agile principles in distributed environment although these two can be considered as opposite extremes.

3.2 Key concepts

3.2.1 Key idea of System development

As it has been described by many researchers System development is "the set of people, development process and tools that applies to the development sequence." If a system development is a collection of transformations from goals to requirements to design to code. This is the development system which makes the transformations happen.

After software crises as has been mentioned in previous secession created methodologies in this area helped the developer to concentrate in one phase instead of working in all project at the same time. In fact, methodology divides the development process in to several parts and expert's finish each part at specific time and process to the next one until the project is finished (Malik, H., & Siew Hock, O, 2009). These methodologies helped developers to move forward in what they do in more organized manner. Although these methodologies were useful in software development industry, still there are some unsatisfied results in development projects. As Bhattacharya states in her research'' costs associated with evolution are high, yet new releases contain bugs and fail to operate as desired and we still need to restart most programs to enable updates'' while lots of researches and afford has been done on this issue (Bhattacharya, P., 2011).

As mention that the key purpose of system development is to prevent the traditional statistic lifecycle of past development approach which was mostly required and used in system with dynamic and adaptable one. In modern development process each step has been predicted and designed precisely with attribution like flexibility and aggregation capacity. Variety of researchers like has introduced several patterns for system development to reach the mentioned goals for more information about this subject you can refer to a process for system development.

3.3 Background (introduction to agile methods)

The word ''agile'' itself represents the meaning of flexibility in process and responsiveness, so agile methods applies its capability and potential abilities in order to survive in an situation where there are constant alteration and come up with acceptable achievements. (Anderson,D.J., 2004, p. xxviii). This ''maneuverability'' in software business is a characteristic that is more important than ever these days since ''deploying software to the Web has intensified software competition further than before'' and ''staying in business involves not only getting software out and reducing defects but tracking continually moving user and marketplace demands'' (Cockburn,A., 2002, p. xxii). The official definition of Agile is called '' agile manifesto'' in 2001 a group of developers mentioned outstanding points on software process methodologists. These people attended a meeting to approve for a better method of developing software. The ''Agile Manifesto for Software Development''

presented on the Agile Alliance website states that agile clears and uncovers better approaches for software development by means of applying it to the process and help other people to do it.

Referring to this organ the below values are presented

Emphasizing in Individuals through working software instead of comprehensive documentation or customer involvement in every step instead of contract negotiation is being responsive about modifications instead of plan. There are many software development methods that can be called ‘‘agile’’, and the list varies depending on different viewpoints, but in general the list in the literature includes Extreme Programming , Scrum, Feature-Driven Development, Dynamic System Development Method, Adaptive Software Development , Crystal, and Lean Software Development.

3.4 Critical success factor

Critical Success Factor is introduced as an approach which detects names and evaluates an organization’s performance. This approach was first explained by Rockhart (1979) and after that year was developed and became established in better way (Bullen.C.V., Rockhart,J.F., 1981; Rockhart .J.F., Crescenzi,A.D., 1984). Critical Success Factor is explained by Bullen.C.V and Rochart.J.F., (1981) as limited number of domains in which real satisfaction will result and ensure accomplishment specially in competitive performance for all individuals , departments and organization. Critical success factors are key areas where every things are supposed to be done in right method through business process in order to flourish the accomplishment and in order to achieve manager’s goals.

In software development project area, the Critical Success Factors method has also been considered in recent studies. Critical success factors in development projects are usually found to be relevant to project management techniques basis or to relevent to the combination of software development and business strategy (Bytheway,A.J., 1999). Another research works explains that Critical success factors in software development projects contains variety of dimensions, start from the development life cycle , estimation and validation and end to executive management and project management, or resource management and strategic planning (Bosghossian,J.Z., 2002).

3.4.1 Success factors in agile software development projects

So far , any formal study on Critical Success Factors in the Agile software development project has not been fund based on recent researches in previously reviewed literature or practitioner literature which are relevant to agile development process topic. Although, some case studies and theoretical researches about successes or pitfall problems in agile implementation in agile development projects existed and some of them has been referenced in this study. Overviewing both failures and successes factors in literature review will help author to identify the possible success factors in agile development projects, on the other side failures factors which can help professionals to understand what and how to avoid certain serious problems and critical issues these facts are important for success of a project.

3.4.2 Failure research in agile software development projects

Failure or searching for Problem are mostly done based on ‘‘lessons learned’’ method which is from special kinds of projects, whereas they are usually similar adequate to be generalized. Some of researchers has focused mostly on generic software development process and generated 10 points of software development project failure. Interesting enough, in minimum chance 7 of which are determined prior to the design process or before one line of code is written. Cohn.M., Ford.D., (2003) has researched about pitfalls in transitioning organizations through agile development processes, while Larman.C. (2011) explains in detail mistakes and misunderstandings which has occurred in agile projects so far. Another research by Boehm.B., and Turner.R., (2005) focuses on management difficulties in implementing agile development process and a study by Nerur.S., et al. (2005) covers pitfalls not only from management point of view but also from people, process, and technology dimensions point of view for migrating to agile development process . Based on the above-mentioned literature, failures or problems can be classified into four categories: organizational factor, people factor , process, and technical factors are these four categories.

3.5 Dimension of agile based on factors

3.5.1 Organizational

Organizational context includes variables such as rewards, culture, training, and resources. Collective rewards help motivate groups whose tasks were made interdependent, while individual rewards acknowledge members whose performed tasks reflect individual responsibilities (Shore, J., Warden, S., 2008) . Several agile teams (including those studied here) work within an organizational environment. We thus included this subgroup as input. Organizational can have many factors to determine but in this thesis we will affect items in success or fail or system in executive support system, commitment of sponsor or manager, corporation in organization culture instead of hierarchical, process of Oral communication replacing high number and worth on face-to-face communication, accepting to apply agile methodology universally, gathering the whole team, facility with the most suitable agile base environment which is proper for agile style and rewards system appropriate for agile process.

3.5.2 People

Interactions among team members and interactions with other teams, customers, and suppliers directly affect team performance (Cao, L., Mohan, K., Xu, P., Ramesh, B., 2009). Group processes also mediate the relationship between inputs and outcomes. Team interpersonal processes and work procedures are considered group processes. Examples of group processes are team cohesion, communication between team people , and conflict in management process which presents the fact that how they coordinate their activities (coordination processes). Moreover, agile methods and their practices are work procedures played by team members that may affect productivity directly or, at least, mediate the relationship between input factors and productivity outcomes. Because agile methods focus on people, teamwork, and their interactions through agile practices, all those processes may have a significant influence on team productivity and were included in our framework. In this thesis we are discuss about team members with competence and expertise, team members with motivation, managers knowledgeably in agile process, adaptive management style, self-organizing teamwork and good customer relationship

3.5.3 Process

Based on previous step about people we can reach to process of agile methodology as discussed. Process contains information about how to fallow agile-oriented needs for

management or following agile-base project management, also information about following agile-base configuration management process, least but not last information about how to follow strong communication method which its critical point is mostly about daily face-to-face meetings ,following honoring regular working schedule–no overtime, following strong customer commitment and presence and following customer having full authority.

3.5.4 Technical

Experience is defined as encounters that one undergoes or lives through (Conboy, K., 2009). In the software industry all around the world , experience can be accompanied by previous obtained technical knowledge (e.g., the variety of SDMs) a software engineer or a software developer possesses that prior research about software development and software products has shown the variety of programming languages mastered and created by a developer to be a better indicator and representative of software knowledge and expertise compare to the length of experience (Doran, H.D., 2004). Previous research has suggested that experience is an important factor that increases an individual's ability to manage knowledge (Chetankumar ,P.,& Muthu,R. ,2009). Cohen.M., and Levinthal.P, in 2004 suggested that individuals have the capacity to understand knowledge in areas where they have previous experience because individuals learn, or absorb, knowledge by associating it with what they already know. Thus, developers with more experience are more capable of understanding and managing knowledge about the agile methodology. Technical parties which review in this thesis are acceptable and well generated coding standards up front, implementing simple design, rigorous refactoring activities, proper amount for documentation, constant delivery of software, delivering important features in beginning, applying correct integration test and appropriate technical training for the team members.

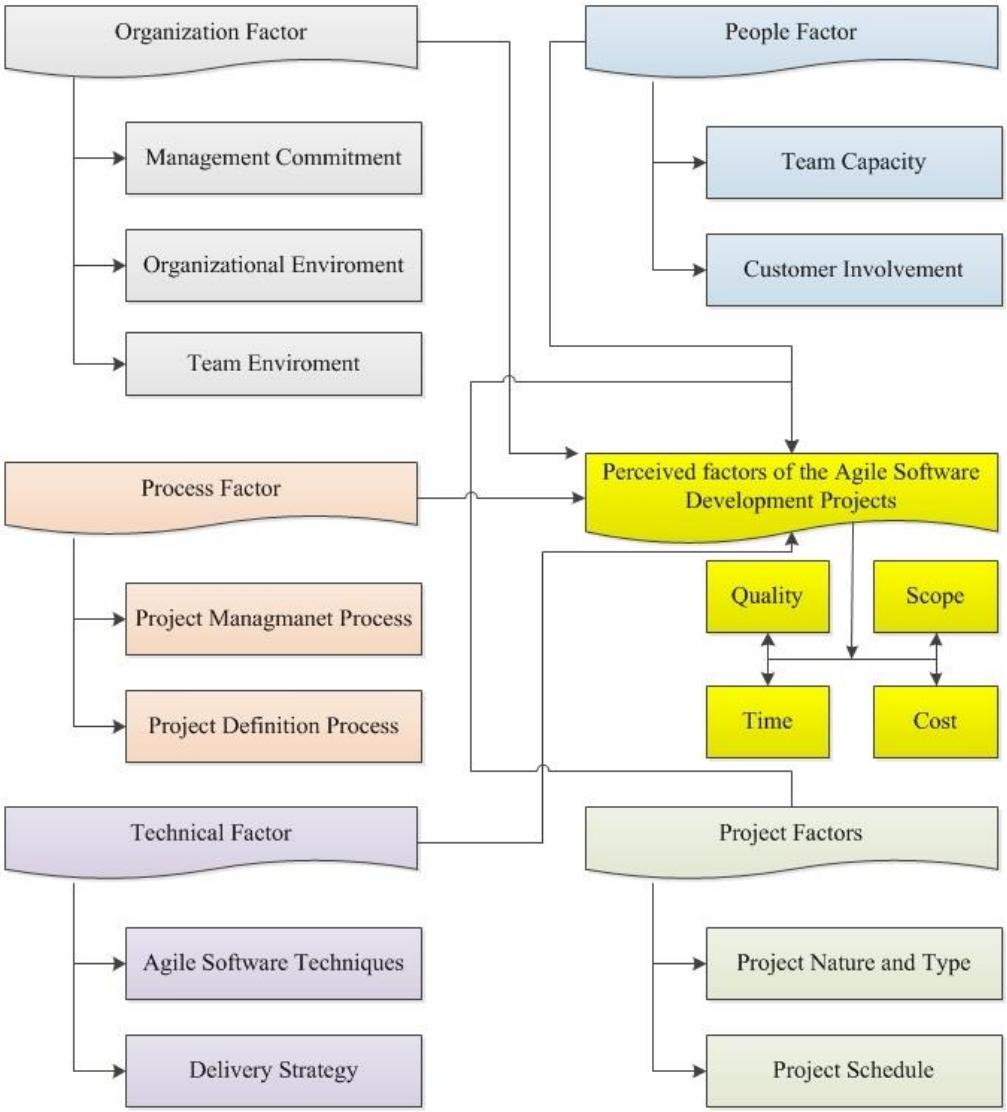

Figure 3.1: Factors of each element

3.5.5 Project

Software project is the science of planning, designing and leading software development process. Software project it is a sub discipline extracted from project management where software development projects are planned, applied and monitored . Based on this meaning project aspects which mentioned are life-critical, variable scope, dynamic, accelerated schedule, team, multiple independent teams, up-front cost evaluation and up-front risk analysis.

Referring to figure 3.1 all of these items illustrated and relation of each party to main goal of find success factors are estimated.

3.6 Previous knowledge contribution

As show in table 3.1 previous study of agile software development divided by researcher source, dependent and independent variable based on successful case study.

Table 3.1: Summary of prior studies

No	Source	Methodology studied	Independent variables studied	Dependent variables
1	Hardgrave et al.	Custom-created methodology based on the structured development paradigm	Perceived usefulness, complexity, social pressure, perceived compatibility, organizational mandate	Intention to follow methodology
2	Hardgrave and Johnson	Object-oriented systems development	Subjective norm, organizational usefulness, personal usefulnes, perceived behavioral control (internal), perceived behavioral control (external)	Intention to use new ISD process
3	Johnson	Object-oriented systems development	Perceived usefulness, perceived ease of use	Behavioral intention
4	Higgins and Hogan	Information engineering (IE) systems development methodology and software	Cross-functional team spirit, top management support, user participation, technical transfer	Perceived success of IE implementation
5	Iivari and Huisman	Systems development methodology	Management commitment, sound implementation plan, methodology training, good change management, understanding of methodology	Implementation of Systems development methodology
6	Roberts and Hughes	Systems development methodology	Management commitment, sound implementation plan, methodology training, good change management, understanding of methodology	Implementation of Systems development methodology
7	Roberts et al.	Systems development methodology	Understanding methodology specifics and benefits, system personnel manager involvement with and responsibility for organizational SDM transition, functional manager involvement and support, external support, use of models	Implementation of Systems development methodology

As stated by many authors (Smite et al., 2010b; Hansson et al., 2006) agile development practice has always been ahead of research. Academic research has mostly been involved with trying to understand what is going on and exploring in a scientific way techniques and procedures which were already established and used by the community of software developers and agile practitioners.

One example has been work by Hansson et al. (2006) where they investigated the differences between industrial practices and agile development practices in several companies. They have concluded that the actual industrial practices used by companies were dependent on companies' characteristics and projects on which they worked on. Another study (Chow.T.,

Cao,D.B., 2008) among agile professionals has shown that only 10 out of 48 hypotheses were critical to success of agile projects. Based on the survey from that study in the work presented here we have tried to identify critical success factors in agile software projects on the sample of companies operating in SEE region (region sometimes referred as Western Balkans). Similarly to the authors of previous study we have used statistical methods to evaluate responses we received from our interviewees and verify obtained model. It can be debated whether model driven estimation based on statistics such as the one used in our study is the proper method to use when it comes to software engineering. For example, a study by (Johansson.C.,2000) suggests that the use of statistics is perhaps inappropriate in the field of software engineering due to all the difficulties associated with interpreting the results and many existing uncertainty factors. Similarly, Jørgensen and Boehm (2009) suggest that the use of both formal methods and expert judgment might be best. They also conclude that future efforts should be headed toward judgment based methods. Nevertheless, we have decided to use the same method as in previous study mainly to make more accurate comparison with the results of previous study. Since our study was not able to confirm the model developed in the previous study, in conclusions of this research as part of our research efforts we announce the use of AHP (Analytic Hierarchy Process) in order to create a better model. Our survey was conducted among developers from IT Company. The general characteristic of our questioners is that they mostly work in distributed environments meaning that they face additional challenges mentioned in the section above. We were interested in whether these specific environmental factors will influence the conclusions made by (Chow.T., Cao,D.B., 2008). In an article by Freudenberg and Sharp (2010) which was created as a result of panel discussion where practitioners identified the list of issues related to agile software development they would like to be researched. This survey will hopefully show the difference to the previous study which can be attributed to both demographic and distributed teams effect.

3.7 Summery

In this chapter a brief introduction , key concepts in agile methodology a brief back ground and critical factors in agile methodology which help the projects to be more successful has been introduced and previous knowledge contribution has been collected in a table to illustrate what has been done in this area before. . In the next chapter of this thesis work statistical data analysis will be computed and the result will be presented.

Chapter 4: Statistical Analysis and Hypothesis Testing

4.1. Introduction

This section presents the findings followed by the analysis of the data collected. First, the profile of the sample is presented in the form of descriptive statistics. The reliability of the questionnaire is analyzed briefly, then the demographic characteristics of the sample are analyses, subsequently the research instrument and the hypotheses are tested using one sample tests, independent t-test and One-way ANOVA tests. Finally, further analyses on each facets of quality, scope, timeless and cost of organization versus key agile process factor such as organizational, people, technical and project dimension.

4.2 Sampling

Non-Probability sample is to conduct the survey by collecting data from individuals of organization or company as representative (Bryman, A., & Bell, E.,2011). This method of collecting data as sample has some advantages and disadvantages. The limitation of non-probability sampling is that its target people are accurately representative. By covering as much population as possible and having accidental alternatives the validity and reliability in non-probability sampling will increase. In this study although the representative group who are familiar with agile methodology has been chose and the sampling method is non-probability sampling but due to acceptable population of responders the validity of this study can be determined.

The survey of this research study has been distributed among all employees of one software development company. The responders include; managers, developers, supervisor and other employees like who work in technique and support department. The author believes that each person in agile base company can have impact in success of projects and their feedback is important. As a result the questionnaire has been distributed among variety of people in different departments. There were around 400 people working in this company whereas 132 response obtained by researcher. Consequently, the sample is restrained and covers 125 employees of company.

The reason that this population has been choose in this study relates to the fact that the organization consists of a many employees and variety of departments such as technical

support, quality control , development , sales and marketing , and Human Resources. Since employees of these departments have different roles and responsibilities, they therefore have different educational and experience backgrounds. As a result, this study by means of this sample size will cover variety of employees with different background referring to their work experience, their experience of working with agile methodology , ages and their education level and some other related items which mentioned in appendix 1 form.

Based on advice given by Schmidt.L,K.,(2006) this study was planned to use more than 125 individuals in its sample size. In addition, according to Saunders et al. (2009) for most business research the confidence level selected is 95 per cent within a 1 to 5 per cent margin of error. In this study the population has a total of 132 employees out of which a sample of employees from various departments was chosen to participate in the research. Based on a confidence level 95% and confidence interval of 7, the number of people which must be chosen to take part in this study is derived to be 125. Therefore according to the expected 95% per cent active respondent rate the questionnaires were delivered to 132 respondents in order to make sure at least 125 useable questionnaires would be collected.

4.3 The Field Study

The total numbers of 125 questionnaires for this research were distributer to employees in variety of departments; this number is except from people who had participated in the pilot study. The questionnaires with the staff list of respondents for each of departments were distributed to the representative of the departments. A list from respondents' names that get the questionnaire was generated to collect the responses afterwards. It took three day to distribute the questionnaires and it took 30 days to the collect respondents.

To avoid responder's misunderstandings, a cover letter was attached to the questions. This cover letter describes the purpose of the study clearly. This cover letter guaranty that responses would not effect on employees' current position and their answers would be completely confidential. Selected employees from different departments were different in marital status, sex, age and some other demographic factors. Finally, the responses were collected by asking employees to put the questionnaires in the box during next ten days from date that questionnaire has been delivered. Fortunately, Most of the employees participated and in this study with enthusiasm.

4.4 Selection of Research subjects

After assessing the pilot study, the questionnaire was delivered in hardcopy to the respondents. The respondents were selected by the probability sampling method. This would ensure that the sampling was done without any bias and interference in the study, providing a true representation of the whole population (Saunders.M.,et al., 2009). Hence, names selected from the staff lists which the name of respondents who attended in the pilot study has been removed. Although before delivering the questionnaires it was emphasized that the research only aimed to analyses the level of for the academic research, and it was made clear the absolute confidentiality to allow respondents to respond freely, some conflict during collecting data was predictable. One of the most important concerns in the research was for respondents, who, in order to receive some bonus or benefits from their company, needed to be very positive about their view about agile process, which might cause the result to be unreliable. On the other hand, there was a likelihood that they might not answer freely, so, in this situation again, the results of the study might not be a suitable scale for measuring the level of agile process and success factors for the employees in this IT Company.

4.5 Demographic Analysis of the Sample

The demographic characteristics of the study are illustrated in this section. Figure 4.1 shows the distribution of demographic analysis (e.g. gender, age, length of experience and salary) in related company.

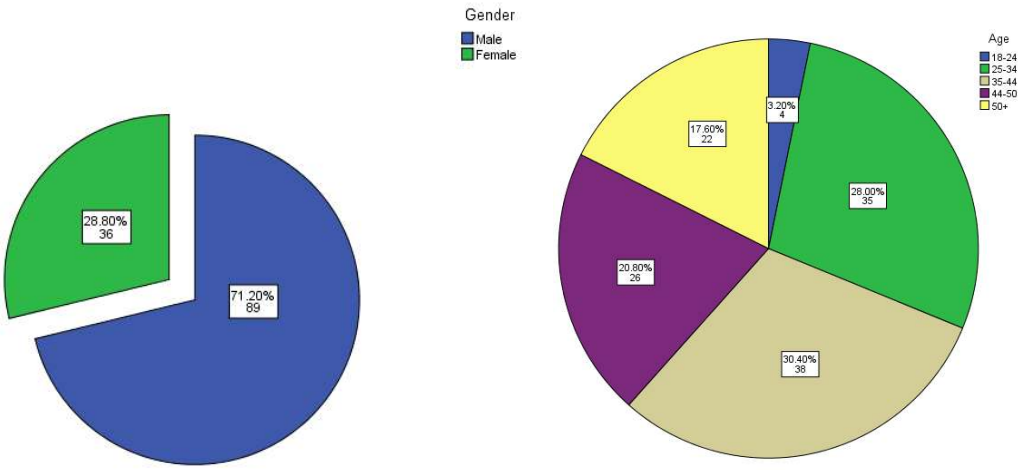

Figure 4.1: Age and Gender Information

Figure 4.1 show that male employees comprise the majority of staff: 89.00 per cent of this company which use agile process. It can be clearly seen that mainly men prefer to work in the software development company. However, there were also 36.00 per cent women, making up a comparatively low proportion of employees. It must be mentioned that men work in wide sections of company and as show in figure 4.2 around 88.80 per cent of employee are married and only 11.20 of them single. This numbers show this average age of employees are above 25 years old and one of main objective of the company is hiring experienced, and married.

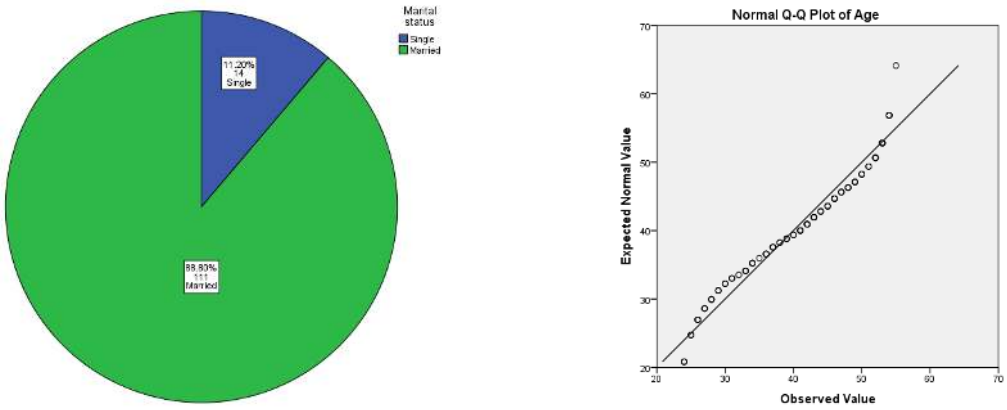

Figure 4.2: Marital status information, normal Q-Q plot of age

Figure 4.1 also shows that approximately 50 per cent of total employees in company have around 6 years work experience and know agile process for around 3 years. Indeed the largest group of employees is in the age group 35 ~ 44 by 30.40 per cent and the second one is in the age 25 ~ 34 with 28.00 per cent. However, the employees in the range of 44 ~ 50 with 20.60 per cent are the third largest group, while employees with between 18 ~24 are the smallest group with only 3.20 per cent and 50+ age group are only 17.60 per cent. This range of employee between 25 to 50 effect wok experiences in agile process experience.

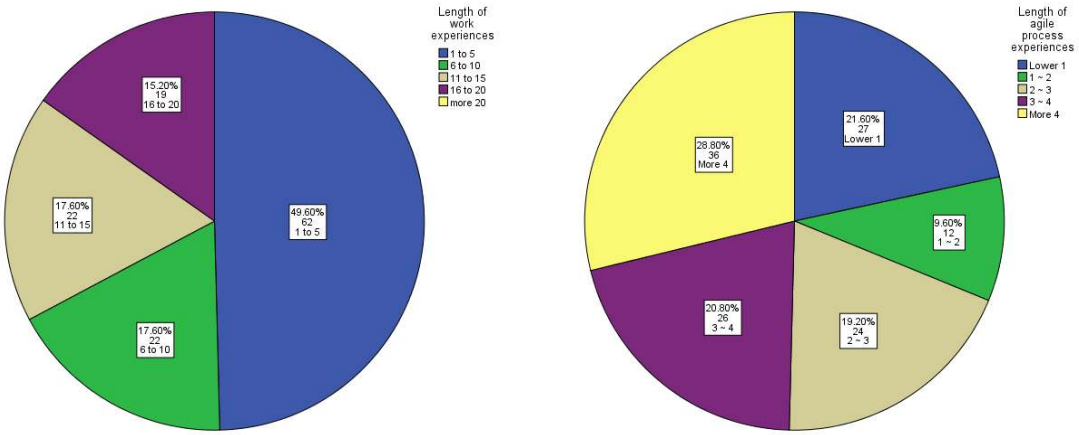

Figure 4.3: length of work experience and length of agile process experience

Figure 4.3 shows the work experiences distribution of employees in this company. Employees with between 1-5 and 6-10 years' experience made up the two largest groups of staff in the company. Together they comprised over 60 per cent of all members in the organization. The employees with 1-5 years' experience accounted for approximately 50 per cent of all employees. Likewise, staff with 6-10 years' experience comprised approximately 18 per cent of the total. By contrast, the employees with 11-15 years' experience have about 17.60 per cent and between 16-20 years almost 15.20 per cent. It can be seen than the employees with more than 20 years' experience comprise only 0 per cent of the organization.

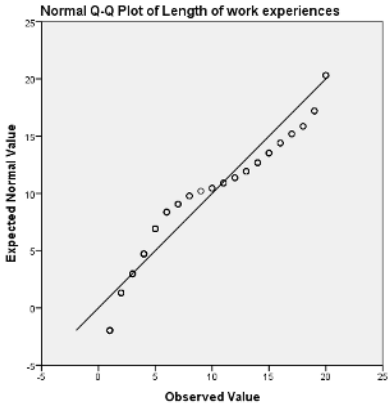

Figure 4.4: Normal Q-Q plot of work experiences

Employees with between 1-3 years' agile process experience made up the largest groups of staff in the company. Together they comprised over 50 per cent of all members in the organization. The employees with lower 1 years' agile process experience accounted for approximately 21.60 per cent of all employees. Likewise, staff with 1-2 years' agile process experience comprised approximately 9.60 per cent of the total. By contrast, the employees with 2-3 years' agile process experience have about 19.20 per cent and between 3-4 years almost 20.80 per cent. It can be seen than the employees with more than 4 years' agile process experience comprise only 28.80 per cent of this company. By considering the difficulty of a job in agile process in this company working area and production manufacturing the practical reasons just mentioned demonstrate why middle range employees which known agile process naturally constitute the vast majority of total employees.

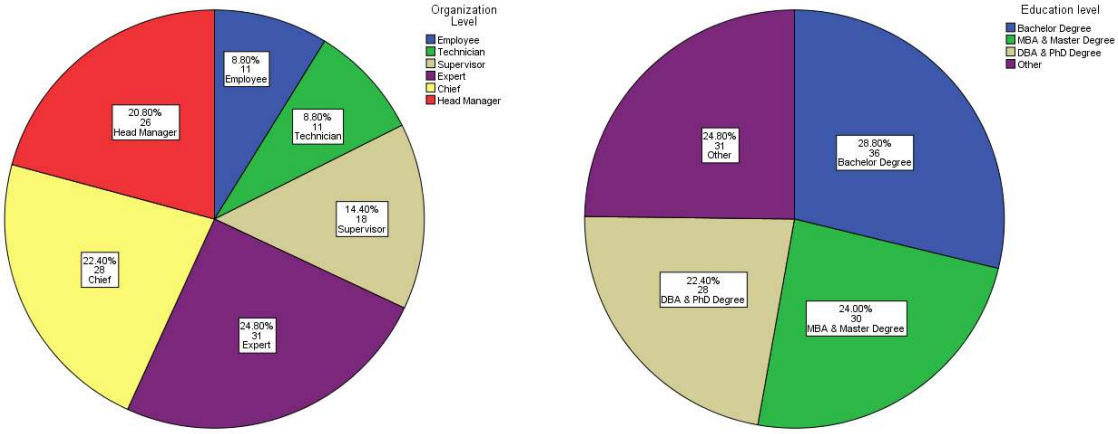

Figure 4.5: Organization and educational level distribution

Figure 4.4 gives some information about circumstance of education level in this company. The B.Sc. and the Master's/ Master's+ categories comprise groups of employees respectively with 28.80 per cent and 24.00 per cent. By contrast, the staffs with DBA and PhD degrees are with 22.40 per cent. The industry attracts staff with a wide range of educational and vocational qualifications, with the majority being aligned to practical demands of software development Company.

The pie chart 4.5 shows the variety of distribution of organization sectors in the firm. In the overview of the graph it could be seen 17 major sectors which the amounts of related sectors to software development are above 60 per cent and total number of employee which corporate to this survey is 125 users.

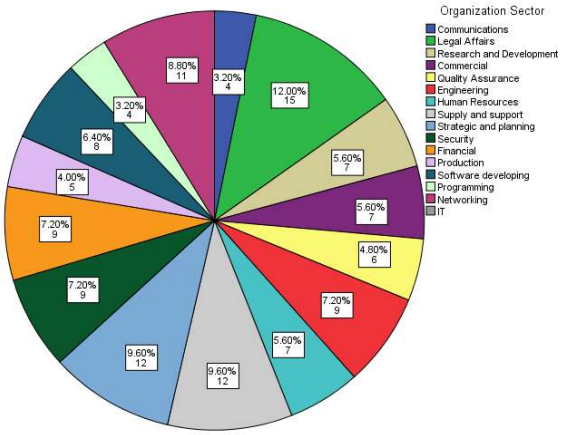

Figure 4.6: Organizational sectors

4.6 The Overall Representation of the Sample

The sample provides a clear picture of the agile process in software development in mentioned company. By considering factors of agile versus organization sectors such as quality, scope, timeless and cost, it could be clearly seen than the majority of the employees working in manufacturing are above 6 years' experience and know agile process above 4 years. The data on age indicate that the employees in the age group between 35 and 44 years of age are the largest in this company. The experience outcome suggests that employees with between 1 and 10 years of experience comprise the majority of the company workforce. As for the level of education in the organization, most employees have a Bachelor's degree. This information was extracted by the questionnaires.

4.6.1 Reliability of the Main Study

A common and most used method for how qualified a thesis tests or survey is, can be done through as reliability analyses. Reliability analyses evaluates how much consistent a test is through a period of time, across variety of items or across different raters. Best method for evaluating the reliability is to get internal consistency reliability, since this kind while happen only by complete monitoring and rating a test just once. The primary rules for highlighting internal consistency reliability are that each question about a related topic and supposed to measure something should be related to each other or linked to each other . The test or survey should not just be a set of irrelevant questions. For example, if you have some questions which are statistical test, respondent who has answered one question correctly has more chance for answering other questions correctly as well. One common and trustable kinds of reliability analysis is coefficient alpha or called Cronbach's alpha . This test examine how exactly items evaluate a single construct, like the verbal ability or mathematics anxiety.

The reliability of the questions from one to eighteen were analysed by Cronbach alpha test in order to ensure the main study is reliable. The result in this level was improved from the pilot study Cronbach alpha; therefore the reliability was acceptable. The Cronbach alpha was 0.756 for the total eighteen questions of satisfaction. For the Cronbach alpha test be reliable the score must be greater than or equal to 0.7. The statistical data of Cronbach's alpha test is shown in table 4.1 (Appendix 11)

Table 4.1: Reliability Statistic

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.756	.810	18

Table 4.2: Reliability Statistic

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
X	60	1.47	4.18	3.0480	.59206
Valid N (list wise)	60				

4.7 Survey Analysis

The following analysis has been conducted over a survey that was answered by the whole staff of the company. The sample consisted of the developers who constitute the developing task force of the organization. A thorough analysis will be performed on the following chapters; the goal of this chapter is to show the results of the survey and to provide a simple summary of the responses.

Question 1: How do you estimate your understanding of Agile Methodologies?

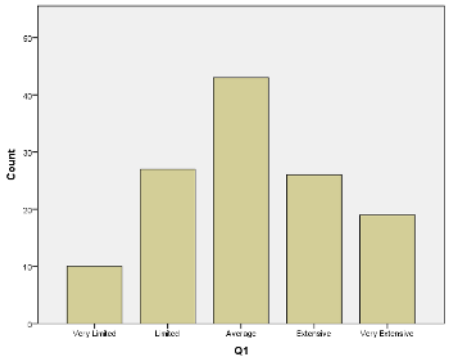

Figure 4.7: Histogram of Q1 versus count of answers

A first analysis of these results indicates that they are actually following the right way of writing the code. Through this question indicate understanding of agile process by employees

in this company. The figure shown upper average range is more than 50 percent of employees.

Question 2: How do you estimate your understanding of Agile Methodologies?

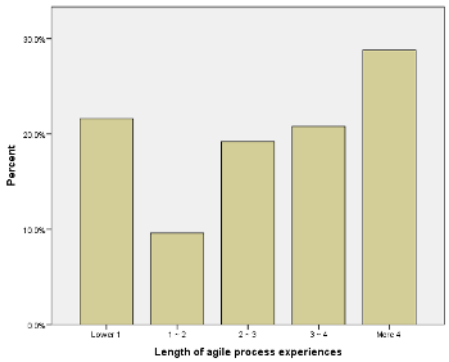

Figure 4.8: Histogram of Q2 versus count of answers

There is mention that indicates knowledge of employees by their work experiences in agile process in software development. This figure show that more than 50 percent of employees have over 3 years' experience in this filed.

Question 3: Has adoption of management commitment in organization dimension of agile process effect delivering a good working product?

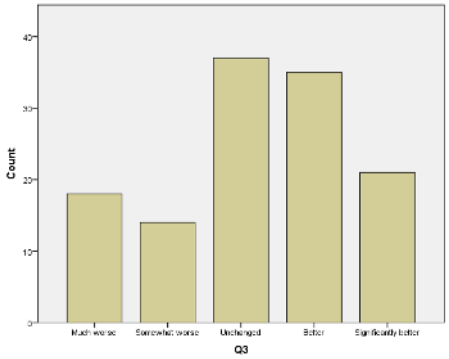

Figure 4.9: Histogram of Q3 versus count of answers

There are two approaches for answering this question. The first one says that testing should distinguish management commitment in organization and effect of agile process in quality. This leads to two ideas, that a person testing a code that is not his/her can find goals in relation of organization and quality. Therefore, we see that there is significant part of the developers who are being supported for the testing phase, something that Lean states not to be adequate.

Question 4: Has agile logistical arrangements in organization dimension of agile process effect delivering a good working product?

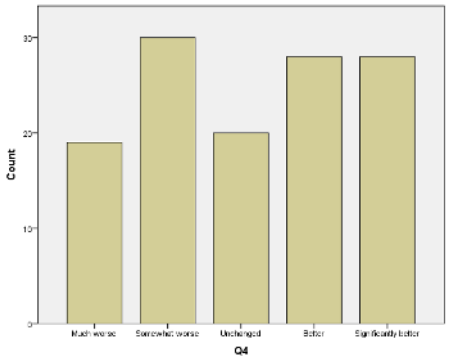

Figure 4.10: Histogram of Q4 versus count of answers

In this question we believe that it can make relation between organization factor and quality of products. This question will estimate success or failure of first hypothesis which indicate in previous chapter.

Question 5: Has management commitment in organization dimension of agile process effect total estimated cost and effort?

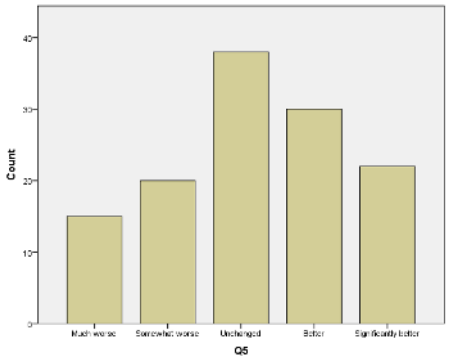

Figure 4.11: Histogram of Q5 versus count of answers

This question clearly states that the relation between organization in agile process and total cost of projects.

Question 6: Has team work in People dimension of agile process effect delivering on time?

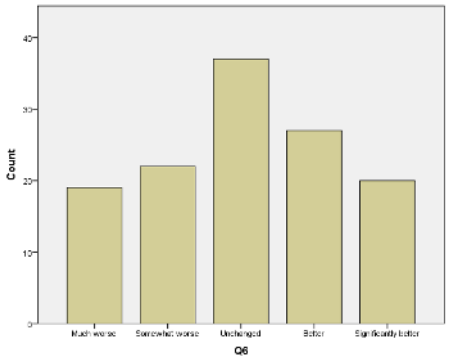

Figure 4.12: Histogram of Q6 versus count of answers

From these answers this is an obvious fact that developers as employee estimate effectiveness of delivering on time of projects.

Question 7: Has customer relationship in people dimension of agile process effect delivering on time?

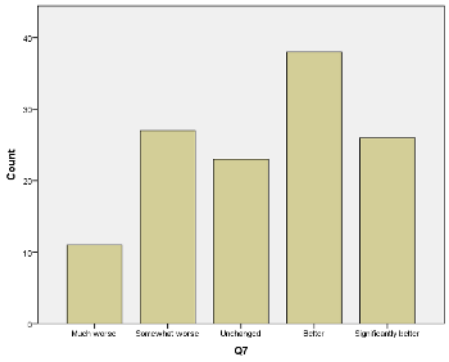

Figure 4.13: Histogram of Q7 versus count of answers

It is therefore very important that customer relationship for making customization effect delivering. As mentioned in figure more employees estimated that customization reduces delivering of time and will reach better time schedule that traditional work.

Question 8: Has customer relationship in people dimension of agile process effect total estimated cost and effort?

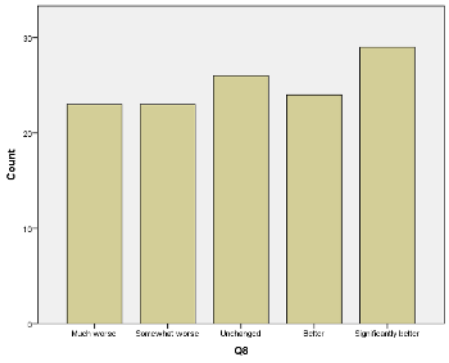

Figure 4.14: Histogram of Q8 versus count of answers

With this question we aim to measure the cost of the released products, if they spend a lot of cost in fixing bugs it means that there is not enough quality during the development process. On the contrary, the answers show that they are not having many difficulties to achieve projects with high quality since they don't spend a significant amount of time in fixing problems and bugs. This might be due to the fact that the majority of the products that have been already released are not very complex and, therefore, they are less likely to have a high rate of bugs or problems.

Question 9: Has necessary skill-set in people dimension of agile process effect total estimated cost and effort?

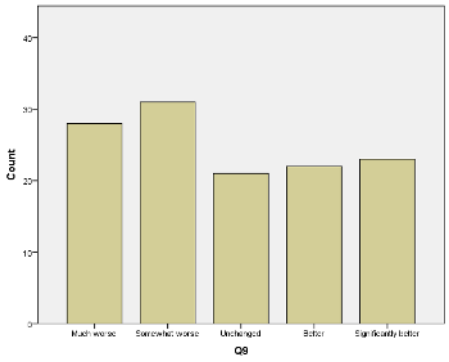

Figure 4.15: Histogram of Q9 versus count of answers

One of the key thing is skill-set says about assigning tasks is that this should be done by the developers; each of them should be able to choose what they want to do in total cost.

Question 10: Has progress tracking mechanism in process dimension of agile process effect delivering a good working product?

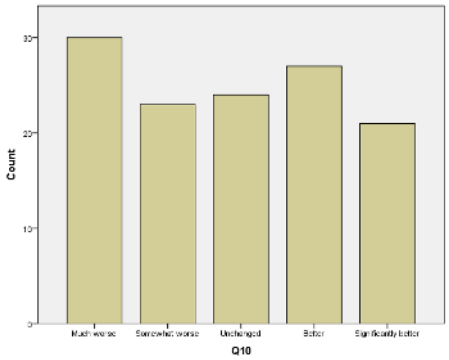

Figure 4.16: Histogram of Q10 versus count of answers

By this question, we are trying to analyze progress tracking mechanism and quality of product. By this question we are going to find tracking in process factor will effect quality of product which shows in figure it will not much effective.

Question 11: Has progress tracking mechanism in process dimension of agile process effect delivering a good working product?

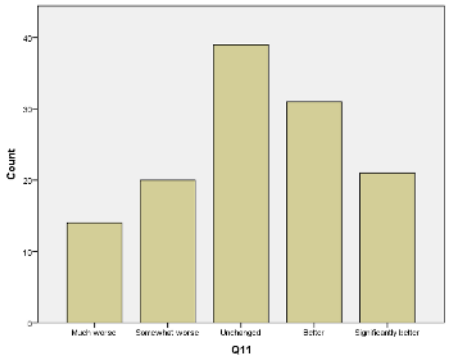

Figure 4.17: Histogram of Q11 versus count of answers

This is similar to question 10 which the difference relies in that further improvement can mean delivering of good products.

Question 12: Has customer presence in process dimension of agile process effect total estimated cost and effort?

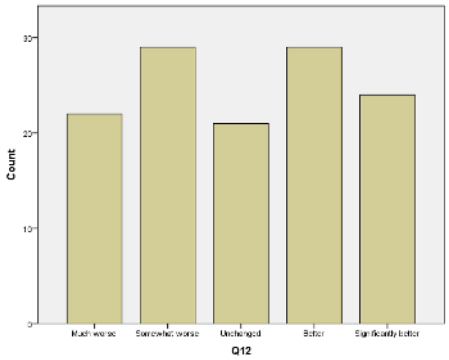

Figure 4.18: Histogram of Q12 versus count of answers

The goal of the question is to analyze the customer presence effect total cost in delivering software on time, to see if they realize about how often employee do so.

Question 13: Has completion set of correct agile practices in technical dimension of agile process effect delivering a good working product?

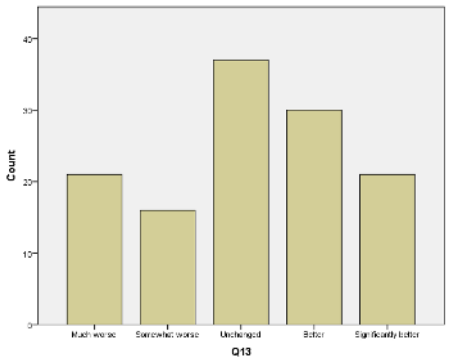

Figure 4.19: Histogram of Q13 versus count of answers

More than an analysis question, this question helped us to know the technical dimension of work inside the organization to reach quality of production.

Question 14: Have technology and tools in technical dimension of agile process effect total estimated cost and effort?

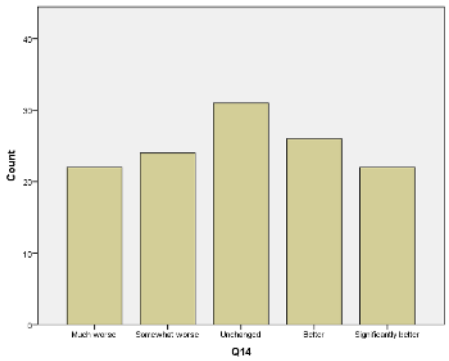

Figure 4.20: Histogram of Q14 versus count of answers

A first analysis of these results indicates that they not only usually achieve cost estimations; it also means that they seem to be confident about their skills technology and tools in cost estimating.

Question 15: Have multiple independent teams in project dimension of agile process effect meeting all requirements by the customer?

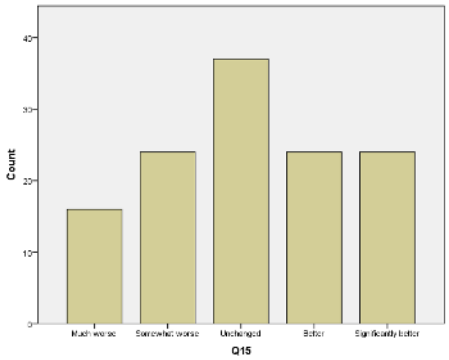

Figure 4.21: Histogram of Q15 versus count of answers

This question is used to measure the amount of time they spend in multiple independent teams planning and doing follow up by scopes.

Question 16: Have life-critical and schedule in project dimension of agile process effect meeting all requirements by the customer?

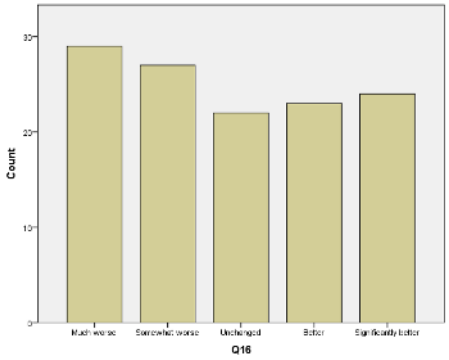

Figure 4.22: Histogram of Q16 versus count of answers

Question 17: Have life-critical in project dimension of agile process effect total estimated cost and effort?

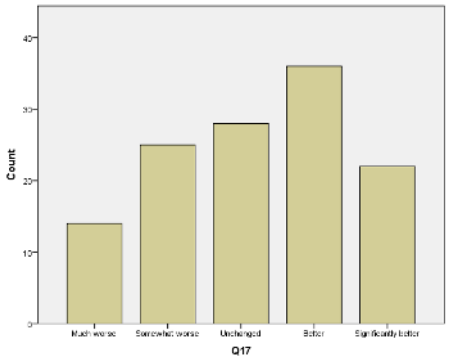

Figure 4.23: Histogram of Q17 versus count of answers

Question 18: Have risk analysis in project dimension of agile process effect total estimated cost and effort?

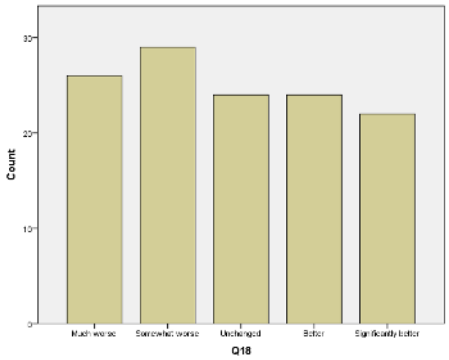

Figure 4.24: Histogram of Q18 versus count of answers

The last question of the survey is designed to measure the size of all currently ongoing projects. With this information we will be able to better analyze the management side of the organization.

4.8 Hypotheses Testing and Result

The dependent Sample, independent t-test for gender and One-Way ANOVA test for the other factors are employed in order to test the hypothesis.

4.8.1 Dependent Sample t-test

The Dependent-Sample t-test allows us to test whether a sample Mean is significantly different from a population mean when only the sample Standard Deviation (s) is known. T-test can be applied to the research when the author has continuous data collected from a group that you want to compare that group's average score to some known criterion value (probably a population mean).

Based on hypothesize one the One-Sample T-Test Output is presented in table 4.1. This output consists of two parts: one of them is One-Sample Statistics and the other one is One-Sample Tests. Result from The One-Sample Statistics is explained as sample size is presented as (N), mean, standard deviation, and the standard-error-of-the-mean (the standard deviation divided by the square route of N) for each variable being tested.

The One-Sample Tests output reports the t obtained, the degrees of freedom (df = n-1), the two tailed alpha level or level of significance (Sig.), and the difference between the sample

mean and the population mean. As what the confidence intervals full field, this confidence interval is the range of scores for which in this study 95 % confident that it contains the true mean difference found in the population.

Table 4.3: T-Test result

One-Sample Statistics			Test Value = 3					
Questions	N	Mean	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Q3	125	3.22	1.906	124	0.059	0.216	-0.01	0.44
Q4	125	3.13	1.02	124	0.31	0.128	-0.12	0.38
Q5	125	2.70	-2.81	124	0.006	-0.296	-0.5	-0.09
Q6	125	3.06	0.487	124	0.627	0.056	-0.17	0.28
Q7	125	3.33	2.891	124	0.005	0.328	0.1	0.55
Q8	125	2.91	-0.704	124	0.483	-0.088	-0.34	0.16
Q9	125	2.71	-2.326	124	0.022	-0.288	-0.53	-0.04
Q10	125	2.89	-0.878	124	0.382	-0.112	-0.36	0.14
Q11	125	2.68	-2.976	124	0.004	-0.32	-0.53	-0.11
Q12	125	3.03	0.256	124	0.798	0.032	-0.22	0.28
Q13	125	3.11	0.957	124	0.341	0.112	-0.12	0.34
Q14	125	2.79	-1.76	124	0.081	-0.208	-0.44	0.03
Q15	125	3.21	1.838	124	0.069	0.208	-0.02	0.43
Q16	125	3.27	2.13	124	0.035	0.272	0.02	0.52
Q17	125	2.86	-1.263	124	0.209	-0.144	-0.37	0.08
Q18	125	2.90	-0.83	124	0.408	-0.104	-0.35	0.14

With respect to the first hypothesis regarding the organizational team environment to quality and cost of agile process in software development, we have a mean obtained for question 3 to 5 which indicate 3.22, 3.13, and 2.7. In this regard, hypothesis 1 related to the organization dimension indicated H_0^1 is accepted because M_{Q_3} and M_{Q_4} is upper than 3 and $P \leq 0.5$ means we'll be wrong no more than 5% of the time. By this proven M_{Q_5} upper and lower bond in both negative and mean is below 3 which indicate H_0^1 is correct which indicate effectiveness of quality to team environmental of organization.

By respect to the second hypothesis regarding the people team capacity to timeless and cost of agile process in software development, we have a mean obtained for question 6 to 9 which

indicate 3.06, 3.77, 2.91, and 2.71. In this regard, hypothesis 2 related to the people dimension indicated H_0^2 is accepted because M_{Q6} and M_{Q_7} is upper than 3 and $P \leq 0.5$ means we'll be wrong no more than 5% of the time. By this proven M_{Q_8} lower bond is negative and upper in positive but for M_{Q_9} upper and lower bond in both negative and mean is below 3 which indicate H_0^2 is correct which indicate effectiveness of timeless to people team capacity of organization.

Table 4.4: result of analysis

Subject	Factor	Organization			
		Quality	Scope	Timeless	Cost
Organizational	Team environment	☑❖	-	-	☒❖
People	Team capability	-	-	☑❖	☒❖
Process	Project management process	☒❖	-	-	☑❖
Technical	Agile software engineering	☑❖	-	-	☒❖
Project dimension	scheduler	-	☑❖	-	☒❖

By respect to the third hypothesis regarding the project management process to quality and cost of agile process in software development, we have a mean obtained for question 10 to 12 which indicate 2.89, 2.68, and 3.03. In this regard, hypothesis 3 related to the process dimension indicated H_1^3 is accepted because $M_{Q_{10}}$ and $M_{Q_{11}}$ is lower than 3 and $P \leq 0.5$ means we'll be wrong no more than 5% of the time. By this proven $M_{Q_{10}}$ upper bond is negative and upper in positive but for $M_{Q_{11}}$ upper and lower bond in both negative and mean is below 3 which indicate H_1^3 is correct which indicate effectiveness of process to cost of project management.

According to the forth hypothesis regarding the technical in agile software engineering to quality and cost, we have a mean obtained for question 13 to 14 which indicate 3.11 and 2.79. In this regard, hypothesis 4 related to the process dimension indicated H_0^4 is accepted because $M_{Q_{13}}$ is upper than 3 and $P \leq 0.5$ means we'll be wrong no more than 5% of the time. By this proven $M_{Q_{13}}$ lower bond is negative and upper in positive but for $M_{Q_{14}}$ upper

and lower bond in both negative and mean is below 3 which indicate H_0^4 is correct which scheduler in Project dimension to scope factor of agile process.

Finally based on table 4.2 indicate that as 5 hypothesis which relate 5 main subjects and factors to organization sections which indicate by ❖, and by single t- test SPPS calculation 5 make relation according to selected hypothesis which indicate by ☑.

4.8.2 Independent t-test of Gender

In this case, in order to analyses the difference in agile process in software development between the groups of respondents (females and males) an independent sample t-test, which is a parametric test is performed. In this test 89 employees are mail and 36 employees are female. According to Pallant (2010), an independent-samples t-test is used in a situation in which two groups are compared to figure out whether there is a significant difference in the mean scores. In order to fulfill the test the mean of each factors are computed and they are used as dependent continuous variables; gender is transferred to the role of independent variable. The independent t-test is performed to measure the overall success factors of agile software development satisfaction by concentrating on Spector's nine facets. Therefore, hypothesis 1 to 5 is tested show in figure 4.3.

According to previous result of single t- test we will distribute it for these two groups. The result from the test (Appendix 3) indicates that,

Table 4.5: Result of independent t-test

Independent Samples Test													
Group Statistics					Levene's Test for Equality of Variances		t-test for Equality of Means						
	G	Mean	Std. Deviation	Std. Error Mean	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
												Lower	Upper
Q3	M	3.21	1.238	0.131	0.704	0.403	-0.035	123	0.972	-0.009	0.251	-0.506	0.489
	F	3.22	1.355	0.226			-0.033	59.938	0.973	-0.009	0.261	-0.531	0.514
Q4	M	3.11	1.335	0.142	3.694	0.057	-0.195	123	0.846	-0.054	0.278	-0.605	0.496
	F	3.17	1.577	0.263			-0.182	56.365	0.856	-0.054	0.298	-0.652	0.543
Q5	M	2.73	1.146	0.121	0.316	0.575	0.392	123	0.696	0.091	0.233	-0.371	0.554
	F	2.64	1.268	0.211			0.375	59.348	0.709	0.091	0.244	-0.396	0.579

Q6	M	3.12	1.214	0.129	3.854	0.052	0.925	123	0.357	0.235	0.254	-0.268	0.737
	F	2.89	1.45	0.242			0.857	55.875	0.395	0.235	0.274	-0.314	0.783
Q7	M	3.43	1.196	0.127	3.464	0.065	1.376	123	0.171	0.344	0.25	-0.151	0.838
	F	3.08	1.422	0.237			1.279	56.059	0.206	0.344	0.269	-0.195	0.882
Q8	M	2.97	1.418	0.15	0.034	0.854	0.682	123	0.497	0.189	0.277	-0.359	0.736
	F	2.78	1.355	0.226			0.695	67.612	0.489	0.189	0.271	-0.353	0.73
Q9	M	2.58	1.338	0.142	0.673	0.414	-1.633	123	0.105	-0.444	0.272	-0.981	0.094
	F	3.03	1.464	0.244			-1.572	59.952	0.121	-0.444	0.282	-1.008	0.121
Q10	M	2.83	1.448	0.153	0.74	0.391	-0.695	123	0.488	-0.196	0.282	-0.755	0.363
	F	3.03	1.383	0.231			-0.709	67.612	0.481	-0.196	0.277	-0.749	0.356
Q11	M	2.65	1.099	0.116	7.322	0.008	-0.413	123	0.681	-0.098	0.238	-0.57	0.373
	F	2.75	1.442	0.24			-0.368	52.225	0.714	-0.098	0.267	-0.634	0.437
Q12	M	2.97	1.394	0.148	0.101	0.751	-0.826	123	0.41	-0.228	0.276	-0.775	0.319
	F	3.19	1.411	0.235			-0.822	64.117	0.414	-0.228	0.278	-0.783	0.326
Q13	M	3.15	1.266	0.134	0.64	0.425	0.456	123	0.649	0.118	0.259	-0.395	0.632
	F	3.03	1.424	0.237			0.434	58.586	0.666	0.118	0.273	-0.427	0.664
Q14	M	2.76	1.297	0.137	0.165	0.686	-0.371	123	0.712	-0.097	0.262	-0.616	0.421
	F	2.86	1.397	0.233			-0.359	60.727	0.721	-0.097	0.27	-0.638	0.444
Q15	M	3.2	1.226	0.13	1.387	0.241	-0.08	123	0.937	-0.02	0.251	-0.517	0.477
	F	3.22	1.376	0.229			-0.076	58.713	0.94	-0.02	0.264	-0.547	0.507
Q16	M	3.35	1.391	0.147	1.307	0.255	0.939	123	0.349	0.265	0.282	-0.293	0.823
	F	3.08	1.519	0.253			0.905	60.016	0.369	0.265	0.293	-0.321	0.851
Q17	M	2.9	1.244	0.132	0.988	0.322	0.59	123	0.556	0.149	0.252	-0.351	0.648
	F	2.75	1.36	0.227			0.568	59.945	0.572	0.149	0.262	-0.376	0.673
Q18	M	2.75	1.408	0.149	0.32	0.573	-1.812	123	0.072	-0.497	0.274	-1.04	0.046
	F	3.25	1.339	0.223			-1.852	67.927	0.068	-0.497	0.268	-1.033	0.039

4.9 Summary

This chapter draws together the statistical analyses as reported from primary data which was collected by the researcher. The demographic analyses were explained with the research alongside hypothesis tests by doing single t-test and independent t-tests for gender and one ANOVA test for the others. Although the result of testing the hypotheses does not indicate any significant differences between males and females, it proves that there is a similar shape relationship between hypothesis and results.

In the next chapter the result from the research will be compared by the theories of the literature review section. Following this the limitations and recommendations for future study will be discussed.

Chapter 5: Conclusion and Recommendation

5.1. Introduction

The main aim of performing this study has been to investigate and understand the relationship between main factors such as:

- Team environment in organizational subject
- Team capability in people subject
- Project management process in process subject
- Agile software engineering in technical subject
- Scheduler in project dimension subject

In terms of:

- Quality
- Scope
- Timeless
- Cost

The result from the statistical analysis is presented in the previous section. This section considers some relevant conclusions from the results and findings from employees in mentioned company to address the research questions. At the end, some limitations of the research and proposed managerial implications will be argued, along with some recommendations for future research.

5.2. Discussion of the Findings

In the previous section, we have described a conceptual framework for examining the acceptance of agile methodologies. The framework suggests that acceptance of agile methodology is influenced by knowledge management outcomes (i.e., knowledge creation, knowledge retention, and knowledge transfer). In turn, knowledge management outcomes are influenced by ability-related factors (i.e., SDM self-efficacy, experience, training and external support), motivation-related factors (i.e., career consequence, top management support, voluntariness, subjective norm, and organizational culture), and opportunity-related factors (i.e., teamwork, communication, shared understanding, and arduous relationship).

Further, the inclusion of agile methodology characteristics (i.e., perceived usefulness, perceived ease of use, perceived compatibility, result demonstrability, and perceived maturity) can add to the understanding of acceptance of agile methodology. This conceptual framework has both theoretical and practical contributions. In terms of theoretical contributions, the framework builds on a knowledge management perspective to provide a fresh view synthesizing various factors that can potentially influence acceptance of agile methodologies. In terms of practical contributions, the framework consolidates current knowledge on acceptance of agile methodologies which can provide guidance to organizations interested in getting their developers to use these new methodologies. We elaborate on the contributions to research and practice, and highlight some potential future research issues below.

Generally in this study, the literature review reflects the generally accepted agile success factors and the associate research and literature on it. Agile success in software development and some supporting theories are discussed. This review demonstrates that no single factor can be isolated. The variable of quality, time, cost and scope by factors of organization, people, process, technical and project must be controlled for in a study which seeks to comprehensively determine and explain the dynamic underlying agile software development in a given company. Based on the different theories outlined above it appears that the results achieved are not universal, they are likely to differ from situation to situation. And therefore there is no clear significant or insignificant relationship between the agile software development dimensions and variables.

5.3. Limitations of Study

Notable limitations of this research work are because of bias in the publications collection and the potential problem in data collection and extraction inaccuracy. In order to make sure that data collection process was unbiased, the researcher has proposed and developed special research protocol before defining final research questionnaire. In this research work questions has been used as a basis and keywords were defined prior to finalization .these research key words that helps researcher to clarify and extract the most relevant literature. Although, in first place the fact that software development terms are not always standard and there is possibility they be discipline or special language specifications. Due to this fact, choice of terms, high risk is threaten this work that relevant literature were ignored and omitted. In order To avoid limitation referring to selection bias, pilot study in every step of the literature review process and in search strategy has been conducted. Also, careful citation management,

for clarifying weaknesses in the selection process has been applied. In addition, due to the fact that focus of this study is on empirical chapter, this study has fallowed ‘‘lessons learned” papers which are based merely referring to the professional people’s opinion.

Another thing that help author to ensure the unbiased extraction of articles, is called multistage method which was used and involved four researchers who have reported their reasons of inclusion/exclusion in every stage, this method has been explained in Section 3 and also as recommended by Kitchenham. When the author monitored data collection process, some articles lacked important details about the design and findings, due to this fact author modified too much in what actually has been collected. As a result , data from all the initial studies were collected by the author in consensus meeting referring to a predefined collection form (available in Appendix 2 to 7). Many articles consist of sufficient information for this study which makes them proper for being document in the data collection form. frequently in most works methods were not explains in enough detail , and suffer from bias issue , special validity of work were not addressed well .Also, methods of data collection and data analysis were not explained as well , same as samples and study settings . These lacks create the possibility that collection process resulted in inaccuracy especially in the data.

5.4. Recommendation for Future Research

There are many avenues for future research into the acceptance of agile methodologies. We will highlight two fruitful avenues. The first avenue is to empirically validate our conceptual framework. Future theoretical development may be advanced by empirically validating the crucial factors that have dominant effect on the acceptance of agile methodologies. Prior studies on the acceptance of technology have suggested that characteristics of the technology are significant determinants of the acceptance of various technologies or IT tools .However, it is unclear whether technology characteristics will still dominate in the agile methodologies context, because no existing study has empirically examined the various characteristics in our proposed conceptual framework. Moreover, Sultan and Chan noted that characteristics of technology may not be crucial when the subjects are experienced programmers. Empirical testing of our conceptual framework will be very valuable in understanding the weight that organizations should place on different characteristics in promoting developers' acceptance of agile methodologies.

A second avenue of research is to tease out the effects of different characteristics on the three knowledge management outcomes respectively. For example, communication may have a stronger influence on knowledge transfer than on knowledge creation and retention, as communication in software engineering is often related to knowledge transfer. Moreover, organizational culture is a broad concept that has many dimensions. In this paper, we focus only on the knowledge aspect i.e., the knowledge culture in organizations.

As organizational culture can be operational as multiple dimensions, they may influence the process of accepting agile methodologies differently. Future research can examine different operational of organizational culture, as well as cultural differences between individual developers.

5.5. Summery

This research study set out to use survey data to explore the critical success or failure factors of agile software development projects using quantitative methods. The data collected from 125 employees who contribute in company provided enough empirical information for statistical analysis to arrive at a number of conclusions.

In this study we have tried to verify the classification of critical success factors previously described in study by research studies which mentioned in literature review. The regression analysis done on our collected data has introduced ten factors that could potentially be considered as critical success factors in terms of quality, scope, timeliness and Cost. On the opposite side, the obtained results did not confirm all hypothesis and 5 factor rejected which based on previous study can be considered as critical success or failure factors in the space of SPSS data analysis. However, our results match with the results from the previous study in suggesting that strong executive support and project type has no influence on the success of agile project.

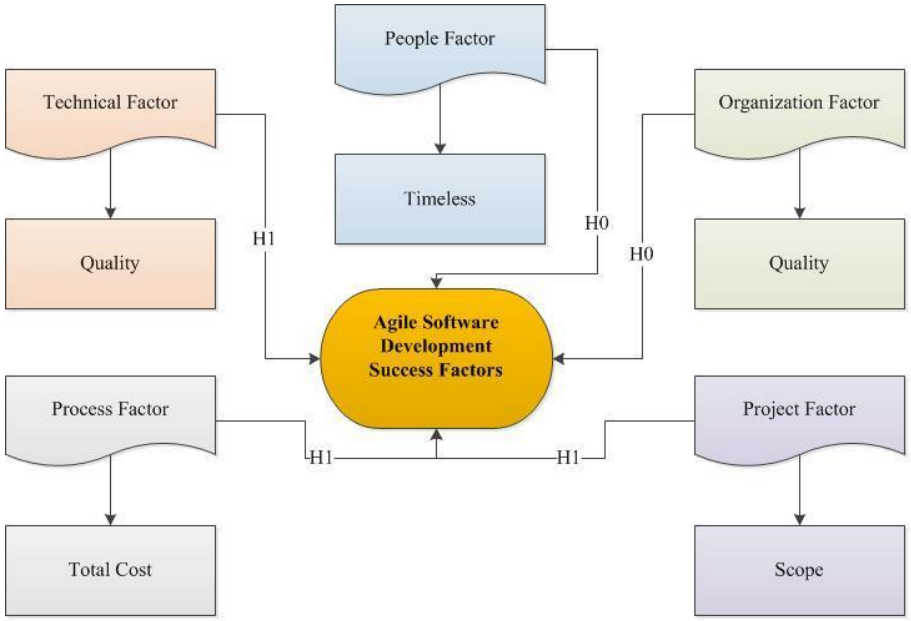

Figure 5.1: Agile software development success factors

A recently published survey of research literature (McLeod and MacDonell, 2011) covering period 1996‑2006 with focus on empirical analyses has proposed a new classification framework of the types of factors that are believed to have important influence on project success. Their classification largely overlaps with the classification observed in this study. As mentioned in figure 5.1, this research similarly suggests that team environment in organization and agile software engineering in technical factor is affected by quality of product. By this analysis people team capability effected by timeless of project and Project management process affected by cost. In our study only 5 out of 10 hypotheses proved right and together with 5 out of 10 proven in leads us to conclusion that we should try to formulate different success factors or try to model the success of agile projects with different method.

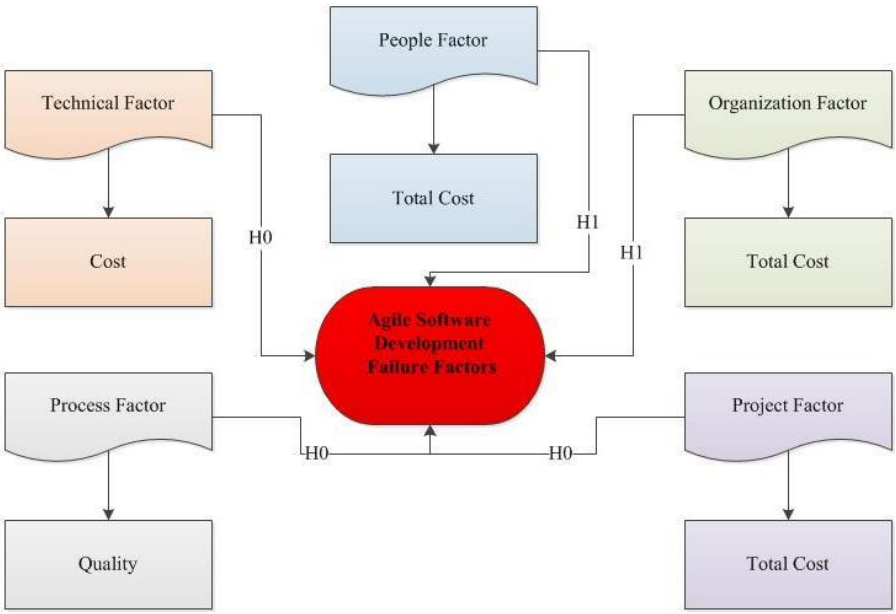

Figure 5.2: Agile software development failure factors

As show in figure 5.2, five hypotheses make failure factors in agile software development illustrate. In this case, this research results are available to us that show the benefits agile practices have to the project factors. As a possible other direction to consider in the near future we plan on investigating how we can expand the domain on which agile practices should be applied and consider their use to stop building worthless software at the first place . The key contribution of this research is to reduce a multitude of anecdotal success factors to three critical ones based on survey data analysis. As long as the Agile project picks a high-caliber team, practices rigorous Agile software engineering techniques and executes a correct Agile-style delivery strategy, the project could be likely to be successful. It provides a focus for the management when they embark on adopting Agile methods in their software development projects.

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Appendix

Appendix 1

Section A. Personal Information

NO	Items	Please Check Each Item				
1	Age	18-24	25-34	35-44	44-50	50+
2	Gender	Male	Female			
3	Marital status	Single	Married			
4	Organization Level	Employee	Technician	Supervisor		
		Expert	Chief	Head Manager		
5	Education level	under Diploma	Diploma	Bachelor Degree	Master Degree	
		PhD	Other			
6	Length of work experiences	1 to 5	6 to 10	11 to 15	15 to 20	21+
7	Organization Sector	Communications	Legal Affairs	Research and Development	Commercial	
		Quality Assurance	Engineering	Human Resources	Supply and support	
		Strategic and planning	Security	Financial	Production	
		IT	Software developing	Programming	Networking	

Section B. Agile Process Questions

No	Questions	Please Check Each Item				
1	How do you estimate your understanding of Agile Methodologies?	Very Limited	Limited	Average	Extensive	Very Extensive
2	How many years have prarical experiences in Agile Methodologie fileds?	< 1	1 ~ 2	2 ~ 3	3 ~ 4	4 <
Questions		Much worse	Somewhat worse	Unchanged	Better	Significantly better
3	Has adoption of management commitment in organization dimension of agile process effect delivering a good working product?	1	2	3	4	5
4	Has an agile logistical arrangement in organization dimension of agile process effect delivering a good working product?	1	2	3	4	5
5	Has management commitment in organization dimension of agile process effect total estimated cost and effort?	1	2	3	4	5
6	Has team work in People dimension of agile process effect delivering on time?	1	2	3	4	5
7	Has customer relationship in people dimension of agile process effect delivering on time?	1	2	3	4	5
8	Has customer relationship in people dimension of agile process effect total estimated cost and effort?	1	2	3	4	5
9	Has necessary skill-set in people dimension of agile process effect total estimated cost and effort?	1	2	3	4	5
10	Has progress tracking mechanism in process dimension of agile process effect delivering a good working product?	1	2	3	4	5
11	Has progress tracking mechanism in process dimension of agile process effect delivering a good working product?	1	2	3	4	5
12	Has customer presence in process dimension of agile process effect total estimated cost and effort?	1	2	3	4	5

13	Has completion set of correct agile practices in technical dimension of agile process effect delivering a good working product?	1	2	3	4	5
14	Have technology and tools in technical dimension of agile process effect total estimated cost and effort?	1	2	3	4	5
15	Have multiple independent teams in project dimension of agile process effect meeting all requirements by the customer?	1	2	3	4	5
16	Have life-critical and schedule in project dimension of agile process effect meeting all requirements by the customer?	1	2	3	4	5
17	Have life-critical in project dimension of agile process effect total estimated cost and effort?	1	2	3	4	5
18	Have risk analysis in project dimension of agile process effect total estimated cost and effort?	1	2	3	4	5

Appendix 2
Pilot study

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Items	N of Items
.728	.778	18

Item Statistics

	Mean	Std. Deviation	N
Q1	3.13	1.081	60
Q2_A_Y	3.32	1.467	60
Q3	3.02	1.081	60
Q4	3.28	1.136	60
Q5	2.40	.924	60
Q6	3.13	1.081	60
Q7	3.28	1.136	60
Q8	3.25	1.492	60
Q9	2.47	1.321	60
Q10	2.87	1.384	60
Q11	2.77	1.110	60
Q12	2.93	1.376	60
Q13	3.02	1.081	60
Q14	2.70	1.331	60
Q15	3.17	1.092	60
Q16	3.28	1.367	60
Q17	2.90	1.217	60
Q18	2.72	1.367	60

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1	50.50	74.763	.640	.	.689
Q2_A_Y	50.32	90.966	-.187	.	.767
Q3	50.62	74.240	.670	.	.686
Q4	50.35	72.231	.744	.	.678
Q5	51.23	79.301	.470	.	.706
Q6	50.50	74.763	.640	.	.689
Q7	50.35	72.231	.744	.	.678
Q8	50.38	80.003	.212	.	.727
Q9	51.17	83.531	.109	.	.735
Q10	50.77	84.250	.068	.	.740
Q11	50.87	77.033	.494	.	.701
Q12	50.70	87.739	-.067	.	.753
Q13	50.62	74.240	.670	.	.686
Q14	50.93	83.148	.123	.	.734
Q15	50.47	74.762	.633	.	.689
Q16	50.35	85.723	.012	.	.745
Q17	50.73	74.097	.588	.	.690
Q18	50.92	90.790	-.183	.	.763

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
53.63	87.897	9.375	18

Appendix 3
Descriptive

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
X	125	1.50	4.13	3.0780	.47649
Valid N (listwise)	125				

Appendix 4
T-Test

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Q3	125	3.22	1.267	.113
Q4	125	3.13	1.403	.125
Q5	125	2.70	1.178	.105
Q6	125	3.06	1.285	.115
Q7	125	3.33	1.269	.113
Q8	125	2.91	1.397	.125
Q9	125	2.71	1.384	.124
Q10	125	2.89	1.427	.128
Q11	125	2.68	1.202	.108
Q12	125	3.03	1.397	.125
Q13	125	3.11	1.309	.117
Q14	125	2.79	1.322	.118
Q15	125	3.21	1.266	.113
Q16	125	3.27	1.428	.128
Q17	125	2.86	1.274	.114
Q18	125	2.90	1.402	.125

One-Sample Test

	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Q3	1.906	124	.059	.216	-.01	.44
Q4	1.020	124	.310	.128	-.12	.38
Q5	-2.810	124	.006	-.296	-.50	-.09
Q6	.487	124	.627	.056	-.17	.28
Q7	2.891	124	.005	.328	.10	.55
Q8	-.704	124	.483	-.088	-.34	.16
Q9	-2.326	124	.022	-.288	-.53	-.04
Q10	-.878	124	.382	-.112	-.36	.14
Q11	-2.976	124	.004	-.320	-.53	-.11
Q12	.256	124	.798	.032	-.22	.28
Q13	.957	124	.341	.112	-.12	.34
Q14	-1.760	124	.081	-.208	-.44	.03
Q15	1.838	124	.069	.208	-.02	.43
Q16	2.130	124	.035	.272	.02	.52
Q17	-1.263	124	.209	-.144	-.37	.08
Q18	-.830	124	.408	-.104	-.35	.14

Appendix 5
Independent Samples Test

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Q3	Male	89	3.21	1.238	.131
	Female	36	3.22	1.355	.226
Q4	Male	89	3.11	1.335	.142
	Female	36	3.17	1.577	.263
Q5	Male	89	2.73	1.146	.121
	Female	36	2.64	1.268	.211
Q6	Male	89	3.12	1.214	.129
	Female	36	2.89	1.450	.242
Q7	Male	89	3.43	1.196	.127
	Female	36	3.08	1.422	.237
Q8	Male	89	2.97	1.418	.150
	Female	36	2.78	1.355	.226
Q9	Male	89	2.58	1.338	.142
	Female	36	3.03	1.464	.244
Q10	Male	89	2.83	1.448	.153
	Female	36	3.03	1.383	.231
Q11	Male	89	2.65	1.099	.116
	Female	36	2.75	1.442	.240
Q12	Male	89	2.97	1.394	.148
	Female	36	3.19	1.411	.235
Q13	Male	89	3.15	1.266	.134
	Female	36	3.03	1.424	.237

Q14	Male	89	2.76	1.297	.137
	Female	36	2.86	1.397	.233
Q15	Male	89	3.20	1.226	.130
	Female	36	3.22	1.376	.229
Q16	Male	89	3.35	1.391	.147
	Female	36	3.08	1.519	.253
Q17	Male	89	2.90	1.244	.132
	Female	36	2.75	1.360	.227
Q18	Male	89	2.75	1.408	.149
	Female	36	3.25	1.339	.223

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Q3	Equal variances assumed	.704	.403	-.035	123	.972	-.009	.251	-.506	.489
	Equal variances not assumed			-.033	59.938	.973	-.009	.261	-.531	.514
Q4	Equal variances assumed	3.694	.057	-.195	123	.846	-.054	.278	-.605	.496
	Equal variances not assumed			-.182	56.365	.856	-.054	.298	-.652	.543
Q5	Equal variances assumed	.316	.575	.392	123	.696	.091	.233	-.371	.554

	Equal variances not assumed			.375	59.348	.709	.091	.244	-.396	.579
Q6	Equal variances assumed	3.854	.052	.925	123	.357	.235	.254	-.268	.737
	Equal variances not assumed			.857	55.875	.395	.235	.274	-.314	.783
Q7	Equal variances assumed	3.464	.065	1.376	123	.171	.344	.250	-.151	.838
	Equal variances not assumed			1.279	56.059	.206	.344	.269	-.195	.882
Q8	Equal variances assumed	.034	.854	.682	123	.497	.189	.277	-.359	.736
	Equal variances not assumed			.695	67.612	.489	.189	.271	-.353	.730
Q9	Equal variances assumed	.673	.414	-1.633	123	.105	-.444	.272	-.981	.094
	Equal variances not assumed			-1.572	59.952	.121	-.444	.282	-1.008	.121
Q10	Equal variances assumed	.740	.391	-.695	123	.488	-.196	.282	-.755	.363
	Equal variances not assumed			-.709	67.612	.481	-.196	.277	-.749	.356
Q11	Equal variances assumed	7.322	.008	-.413	123	.681	-.098	.238	-.570	.373
	Equal variances not assumed			-.368	52.225	.714	-.098	.267	-.634	.437
Q12	Equal variances assumed	.101	.751	-.826	123	.410	-.228	.276	-.775	.319
	Equal variances not assumed			-.822	64.117	.414	-.228	.278	-.783	.326
Q13	Equal variances assumed	.640	.425	.456	123	.649	.118	.259	-.395	.632

	Equal variances not assumed			.434	58.586	.666	.118	.273	-.427	.664
Q14	Equal variances assumed	.165	.686	-.371	123	.712	-.097	.262	-.616	.421
	Equal variances not assumed			-.359	60.727	.721	-.097	.270	-.638	.444
Q15	Equal variances assumed	1.387	.241	-.080	123	.937	-.020	.251	-.517	.477
	Equal variances not assumed			-.076	58.713	.940	-.020	.264	-.547	.507
Q16	Equal variances assumed	1.307	.255	.939	123	.349	.265	.282	-.293	.823
	Equal variances not assumed			.905	60.016	.369	.265	.293	-.321	.851
Q17	Equal variances assumed	.988	.322	.590	123	.556	.149	.252	-.351	.648
	Equal variances not assumed			.568	59.945	.572	.149	.262	-.376	.673
Q18	Equal variances assumed	.320	.573	-1.812	123	.072	-.497	.274	-1.040	.046
	Equal variances not assumed			-1.852	67.927	.068	-.497	.268	-1.033	.039

Appendix 6
Frequencies

Statistics

		Age	Gender	Marital status	Organization Level	Education level
N	Valid	125	125	125	125	125
	Missing	0	0	0	0	0
Mean		40.38	.29	.89	4.06	2.43
Std. Error of Mean		.825	.041	.028	.137	.103
Median		41.00	.00	1.00	4.00	2.00
Mode		54	0	1	4	1
Std. Deviation		9.218	.455	.317	1.536	1.152
Variance		84.980	.207	.100	2.360	1.328
Skewness		-.170	.948	-2.491	-.489	.088
Std. Error of Skewness		.217	.217	.217	.217	.217
Kurtosis		-1.163	-1.120	4.271	-.685	-1.429
Std. Error of Kurtosis		.430	.430	.430	.430	.430
Range		31	1	1	5	3
Minimum		24	0	0	1	1
Maximum		55	1	1	6	4
Sum		5048	36	111	507	304
Percentiles	25	33.00	.00	1.00	3.00	1.00
	50	41.00	.00	1.00	4.00	2.00
	75	48.50	1.00	1.00	5.00	3.50

Statistics

		Length of work experiences	Organization Sector	Q1	Q2_A_Y	Q3	Q4
N	Valid	125	125	125	125	125	125
	Missing	0	0	0	0	0	0
Mean		8.08	7.95	3.14	3.26	3.22	3.13
Std. Error of Mean		.516	.378	.104	.135	.113	.125
Median		6.00	8.00	3.00	3.00	3.00	3.00
Mode		5	2	3	5	3	2
Std. Deviation		5.771	4.223	1.159	1.508	1.267	1.403
Variance		33.300	17.836	1.344	2.273	1.606	1.967
Skewness		.675	.046	.014	-.317	-.344	-.071
Std. Error of Skewness		.217	.217	.217	.217	.217	.217
Kurtosis		-.849	-1.088	-.746	-1.320	-.808	-1.328
Std. Error of Kurtosis		.430	.430	.430	.430	.430	.430
Range		19	14	4	4	4	4
Minimum		1	1	1	1	1	1
Maximum		20	15	5	5	5	5
Sum		1010	994	392	407	402	391
Percentiles	25	4.00	4.00	2.00	2.00	2.00	2.00
	50	6.00	8.00	3.00	3.00	3.00	3.00
	75	13.00	11.00	4.00	5.00	4.00	4.00

Statistics

		Q5	Q6	Q7	Q8	Q9	Q10	Q11
N	Valid	125	125	125	125	125	125	125
	Missing	0	0	0	0	0	0	0

Mean		2.70	3.06	3.33	2.91	2.71	2.89	2.68
Std. Error of Mean		.105	.115	.113	.125	.124	.128	.108
Median		2.00	3.00	4.00	3.00	2.00	3.00	3.00
Mode		2	3	4	2	2	1	2
Std. Deviation		1.178	1.285	1.269	1.397	1.384	1.427	1.202
Variance		1.387	1.650	1.609	1.952	1.916	2.036	1.445
Skewness		.537	-.083	-.280	.213	.384	.048	.359
Std. Error of Skewness		.217	.217	.217	.217	.217	.217	.217
Kurtosis		-.637	-.979	-1.053	-1.251	-1.119	-1.329	-.699
Std. Error of Kurtosis		.430	.430	.430	.430	.430	.430	.430
Range		4	4	4	4	4	4	4
Minimum		1	1	1	1	1	1	1
Maximum		5	5	5	5	5	5	5
Sum		338	382	416	364	339	361	335
Percentiles	25	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	50	2.00	3.00	4.00	3.00	2.00	3.00	3.00
	75	4.00	4.00	4.00	4.00	4.00	4.00	3.00

Statistics

		Q12	Q13	Q14	Q15	Q16	Q17	Q18
N	Valid	125	125	125	125	125	125	125
	Missing	0	0	0	0	0	0	0
Mean		3.03	3.11	2.79	3.21	3.27	2.86	2.90
Std. Error of Mean		.125	.117	.118	.113	.128	.114	.125
Median		3.00	3.00	3.00	3.00	4.00	3.00	3.00
Mode		2	3	2	3	4	2	2

Std. Deviation		1.397	1.309	1.322	1.266	1.428	1.274	1.402
Variance		1.951	1.713	1.747	1.602	2.038	1.624	1.965
Skewness		-.022	-.210	.306	-.134	-.273	.275	.117
Std. Error of Skewness		.217	.217	.217	.217	.217	.217	.217
Kurtosis		-1.309	-.975	-1.017	-1.016	-1.309	-1.063	-1.273
Std. Error of Kurtosis		.430	.430	.430	.430	.430	.430	.430
Range		4	4	4	4	4	4	4
Minimum		1	1	1	1	1	1	1
Maximum		5	5	5	5	5	5	5
Sum		379	389	349	401	409	357	362
Percentiles	25	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	50	3.00	3.00	3.00	3.00	4.00	3.00	3.00
	75	4.00	4.00	4.00	4.00	5.00	4.00	4.00

Statistics

		Age Groups	Length of work experiences	Length of agile process experiences
N	Valid	125	125	125
	Missing	0	0	0
Mean		3.22	1.98	3.26
Std. Error of Mean		.101	.102	.135
Median		3.00	2.00	3.00
Mode		3	1	5
Std. Deviation		1.133	1.136	1.508
Variance		1.284	1.290	2.273
Skewness		.172	.669	-.317

Std. Error of Skewness		.217	.217	.217
Kurtosis		-.990	-1.063	-1.320
Std. Error of Kurtosis		.430	.430	.430
Range		4	3	4
Minimum		1	1	1
Maximum		5	4	5
Sum		402	248	407
Percentiles	25	2.00	1.00	2.00
	50	3.00	2.00	3.00
	75	4.00	3.00	5.00

a. Multiple modes exist. The smallest value is shown

Appendix 7
Frequency Table

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	24	4	3.2	3.2	3.2
	25	3	2.4	2.4	5.6
	26	4	3.2	3.2	8.8
	27	3	2.4	2.4	11.2
	28	4	3.2	3.2	14.4
	29	4	3.2	3.2	17.6
	30	3	2.4	2.4	20.0
	31	3	2.4	2.4	22.4
	32	1	.8	.8	23.2
	33	4	3.2	3.2	26.4
	34	6	4.8	4.8	31.2
	35	1	.8	.8	32.0
	36	5	4.0	4.0	36.0
	37	5	4.0	4.0	40.0
	38	2	1.6	1.6	41.6
	39	4	3.2	3.2	44.8
	40	2	1.6	1.6	46.4
	41	5	4.0	4.0	50.4
	42	5	4.0	4.0	54.4
	43	6	4.8	4.8	59.2
	44	3	2.4	2.4	61.6

	45	5	4.0	4.0	65.6
	46	6	4.8	4.8	70.4
	47	3	2.4	2.4	72.8
	48	3	2.4	2.4	75.2
	49	4	3.2	3.2	78.4
	50	5	4.0	4.0	82.4
	51	3	2.4	2.4	84.8
	52	5	4.0	4.0	88.8
	53	6	4.8	4.8	93.6
	54	7	5.6	5.6	99.2
	55	1	.8	.8	100.0
	Total	125	100.0	100.0	

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	89	71.2	71.2	71.2
	Female	36	28.8	28.8	100.0
	Total	125	100.0	100.0	

Marital status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	14	11.2	11.2	11.2
	Married	111	88.8	88.8	100.0

	Total	125	100.0	100.0	

Organization Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employee	11	8.8	8.8	8.8
	Technician	11	8.8	8.8	17.6
	Supervisor	18	14.4	14.4	32.0
	Expert	31	24.8	24.8	56.8
	Chief	28	22.4	22.4	79.2
	Head Manager	26	20.8	20.8	100.0
	Total	125	100.0	100.0	

Education level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor Degree	36	28.8	28.8	28.8
	MBA & Master Degree	30	24.0	24.0	52.8
	DBA & PhD Degree	28	22.4	22.4	75.2
	Other	31	24.8	24.8	100.0
	Total	125	100.0	100.0	

Length of work experiences				
	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	1	10	8.0	8.0	8.0
	2	10	8.0	8.0	16.0
	3	7	5.6	5.6	21.6
	4	16	12.8	12.8	34.4
	5	19	15.2	15.2	49.6
	6	6	4.8	4.8	54.4
	7	6	4.8	4.8	59.2
	8	6	4.8	4.8	64.0
	9	1	.8	.8	64.8
	10	3	2.4	2.4	67.2
	11	4	3.2	3.2	70.4
	12	3	2.4	2.4	72.8
	13	5	4.0	4.0	76.8
	14	5	4.0	4.0	80.8
	15	5	4.0	4.0	84.8
	16	4	3.2	3.2	88.0
	17	3	2.4	2.4	90.4
	18	2	1.6	1.6	92.0
	19	6	4.8	4.8	96.8
	20	4	3.2	3.2	100.0
	Total	125	100.0	100.0	

Organization Sector

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Communications	4	3.2	3.2	3.2
	Legal Affairs	15	12.0	12.0	15.2
	Research and Development	7	5.6	5.6	20.8
	Commercial	7	5.6	5.6	26.4
	Quality Assurance	6	4.8	4.8	31.2
	Engineering	9	7.2	7.2	38.4
	Human Resources	7	5.6	5.6	44.0
	Supply and support	12	9.6	9.6	53.6
	Strategic and planning	12	9.6	9.6	63.2
	Security	9	7.2	7.2	70.4
	Financial	9	7.2	7.2	77.6
	Production	5	4.0	4.0	81.6
	Software developing	8	6.4	6.4	88.0
	Programming	4	3.2	3.2	91.2
	Networking	11	8.8	8.8	100.0
	Total	125	100.0	100.0	

Q1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Limited	10	8.0	8.0	8.0
	Limited	27	21.6	21.6	29.6
	Average	43	34.4	34.4	64.0
	Extensive	26	20.8	20.8	84.8

	Very Extensive	19	15.2	15.2	100.0
	Total	125	100.0	100.0	

Q2_A_Y

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	27	21.6	21.6	21.6
	2	12	9.6	9.6	31.2
	3	24	19.2	19.2	50.4
	4	26	20.8	20.8	71.2
	5	36	28.8	28.8	100.0
	Total	125	100.0	100.0	

Q3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	18	14.4	14.4	14.4
	Somewhat worse	14	11.2	11.2	25.6
	Unchanged	37	29.6	29.6	55.2
	Better	35	28.0	28.0	83.2
	Significantly better	21	16.8	16.8	100.0
	Total	125	100.0	100.0	

Q4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	19	15.2	15.2	15.2
	Somewhat worse	30	24.0	24.0	39.2
	Unchanged	20	16.0	16.0	55.2
	Better	28	22.4	22.4	77.6
	Significantly better	28	22.4	22.4	100.0
	Total	125	100.0	100.0	

Q5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	15	12.0	12.0	12.0
	Somewhat worse	52	41.6	41.6	53.6
	Unchanged	26	20.8	20.8	74.4
	Better	19	15.2	15.2	89.6
	Significantly better	13	10.4	10.4	100.0
	Total	125	100.0	100.0	

Q6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	19	15.2	15.2	15.2
	Somewhat worse	22	17.6	17.6	32.8

	Unchanged	37	29.6	29.6	62.4
	Better	27	21.6	21.6	84.0
	Significantly better	20	16.0	16.0	100.0
	Total	125	100.0	100.0	

Q7

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	11	8.8	8.8	8.8
	Somewhat worse	27	21.6	21.6	30.4
	Unchanged	23	18.4	18.4	48.8
	Better	38	30.4	30.4	79.2
	Significantly better	26	20.8	20.8	100.0
	Total	125	100.0	100.0	

Q8

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	22	17.6	17.6	17.6
	Somewhat worse	36	28.8	28.8	46.4
	Unchanged	23	18.4	18.4	64.8
	Better	19	15.2	15.2	80.0
	Significantly better	25	20.0	20.0	100.0
	Total	125	100.0	100.0	

Q9

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	28	22.4	22.4	22.4
	Somewhat worse	38	30.4	30.4	52.8
	Unchanged	21	16.8	16.8	69.6
	Better	18	14.4	14.4	84.0
	Significantly better	20	16.0	16.0	100.0
	Total	125	100.0	100.0	

Q10

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	30	24.0	24.0	24.0
	Somewhat worse	23	18.4	18.4	42.4
	Unchanged	24	19.2	19.2	61.6
	Better	27	21.6	21.6	83.2
	Significantly better	21	16.8	16.8	100.0
	Total	125	100.0	100.0	

Q11

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Much worse	22	17.6	17.6	17.6
	Somewhat worse	38	30.4	30.4	48.0
	Unchanged	35	28.0	28.0	76.0
	Better	18	14.4	14.4	90.4
	Significantly better	12	9.6	9.6	100.0
	Total	125	100.0	100.0	

Q12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	22	17.6	17.6	17.6
	Somewhat worse	29	23.2	23.2	40.8
	Unchanged	21	16.8	16.8	57.6
	Better	29	23.2	23.2	80.8
	Significantly better	24	19.2	19.2	100.0
	Total	125	100.0	100.0	

Q13

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	21	16.8	16.8	16.8
	Somewhat worse	16	12.8	12.8	29.6
	Unchanged	37	29.6	29.6	59.2
	Better	30	24.0	24.0	83.2

	Significantly better	21	16.8	16.8	100.0
	Total	125	100.0	100.0	

Q14

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	23	18.4	18.4	18.4
	Somewhat worse	36	28.8	28.8	47.2
	Unchanged	29	23.2	23.2	70.4
	Better	18	14.4	14.4	84.8
	Significantly better	19	15.2	15.2	100.0
	Total	125	100.0	100.0	

Q15

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	13	10.4	10.4	10.4
	Somewhat worse	26	20.8	20.8	31.2
	Unchanged	32	25.6	25.6	56.8
	Better	30	24.0	24.0	80.8
	Significantly better	24	19.2	19.2	100.0
	Total	125	100.0	100.0	

Q16

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	19	15.2	15.2	15.2
	Somewhat worse	25	20.0	20.0	35.2
	Unchanged	16	12.8	12.8	48.0
	Better	33	26.4	26.4	74.4
	Significantly better	32	25.6	25.6	100.0
	Total	125	100.0	100.0	

Q17

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	17	13.6	13.6	13.6
	Somewhat worse	43	34.4	34.4	48.0
	Unchanged	23	18.4	18.4	66.4
	Better	25	20.0	20.0	86.4
	Significantly better	17	13.6	13.6	100.0
	Total	125	100.0	100.0	

Q18

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much worse	26	20.8	20.8	20.8

	Somewhat worse	29	23.2	23.2	44.0
	Unchanged	24	19.2	19.2	63.2
	Better	24	19.2	19.2	82.4
	Significantly better	22	17.6	17.6	100.0
	Total	125	100.0	100.0	

Age Groups

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-24	4	3.2	3.2	3.2
	25-34	35	28.0	28.0	31.2
	35-44	38	30.4	30.4	61.6
	44-50	26	20.8	20.8	82.4
	50+	22	17.6	17.6	100.0
	Total	125	100.0	100.0	

Length of work experiences

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 to 5	62	49.6	49.6	49.6
	6 to 10	22	17.6	17.6	67.2
	11 to 15	22	17.6	17.6	84.8
	16 to 20	19	15.2	15.2	100.0
	Total	125	100.0	100.0	

Length of agile process experiences

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lower 1	27	21.6	21.6	21.6
	1 ~ 2	12	9.6	9.6	31.2
	2 ~ 3	24	19.2	19.2	50.4
	3 ~ 4	26	20.8	20.8	71.2
	More 4	36	28.8	28.8	100.0
	Total	125	100.0	100.0	

University of Borås is a modern university in the city center. We give courses in business administration and informatics, library and information science, fashion and textiles, behavioral sciences and teacher education, engineering and health sciences.

In the **School of Business and IT (HIT),** we have focused on the students' future needs. Therefore we have created programs in which employability is a key word. Subject integration and contextualization are other important concepts. The department has a closeness, both between students and teachers as well as between industry and education.

Our **courses in business administration** give students the opportunity to learn more about different businesses and governments and how governance and organization of these activities take place. They may also learn about society development and organizations' adaptation to the outside world. They have the opportunity to improve their ability to analyze, develop and control activities, whether they want to engage in auditing, management or marketing.

Among our **IT courses**, there's always something for those who want to design the future of IT-based communications, analyze the needs and demands on organizations' information to design their content structures, integrating IT and business development, developing their ability to analyze and design business processes or focus on programming and development of good use of IT in enterprises and organizations.

The **research** in the school is well recognized and oriented towards professionalism as well as design and development. The overall research profile is Business-IT-Services which combine knowledge and skills in informatics as well as in business administration. The research is profession-oriented, which is reflected in the research, in many cases conducted on action research-based grounds, with businesses and government organizations at local, national and international arenas. The research design and professional orientation is manifested also in InnovationLab, which is the department's and university's unit for research-supporting system development.

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