A STUDY TO INVESTIGATE AND CLASSIFY CSFs OF AGILE SOFTWARE PROJECT: SOFTWARE ENGINEER'S PERSPECTIVE



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Abstract

Software projects are considered successful if they are completed in time and within budget. Normally in traditional software development, projects get failed because of these factors. To overcome these problems, agile software methodologies came into market formally since last decade. It has enough evidence to say that agile projects are performing better than traditional. Now the need arises to know what factors which were making it successful are and out of these factors, which one are the most important. There are a lot of critical success factors in the literature which are responsible for the success of agile projects related to organization, people, process, project and technical, team and customer dimensions. Researchers have already classified them on different criteria's (time, cost, scope, and quality) to measure the success of software projects. There is limited work on identifying the critical success factors which influence the major dimensions. There is a need to identify, classify and prioritize the factors based on major dimensions which have been mentioned in the literature. This ranking will highlight the importance and ranking of factors which will help the software industry to address them. So, the perception of software engineers is also required to get the best critical success factors. The objective of this study is to identify, classify and then prioritize the critical success factors that influence the success of software development projects using agile methodologies in Pakistan. Delphi approach was used to achieve the objective of the study and the research is coducted in three rounds. The study used a mixed method approach where qualitative data was collected through literature and from the experts of filed through the Delphi process. Later, identified factors were prioritized quantitatively through Analytical Hierarchical Process (AHP) i.e. multiple-criteria decision analysis approach. The results of our research will be useful for the developers by helping them to identify what factors can be used for the success of software projects.

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Chapter 1
Introduction

A project is a unique effort which has a start and an end that is controlled by a team to accomplish certain targets with parameters of cost, time, and quality. Moreover, the project is objective based, has dependent actions, certain span and uniqueness. A project has got uncommon attributes, for example, having a particular start date and end date, explicit objectives, a lot of complex relation between different activities and a restricted spending plan. software project the board is an art and exploration of arranging and driving software projects[1]. Several companies are relying on software project development to attain information and communication improvement and innovations. Despite of the truth that software program industries are committing massive investments to their ventures, they're completing the requirements to deliver the projects on time, within the given price range but do not promise quality to their customers. A contemporary study informed that nearly 65 percentage of software initiatives do not arise to their earmark desires and time, and usually do not meet their task goals due to inappropriate choice of methodologies for software development[2]. Whilst software is so vital for all aspects of the modern world but software program development itself isn't a perfect procedure. Agile software engineering techniques have currently emerged as a new and exclusive way of developing software program in comparison to the conventional methodologies. However, their achievement has not generally been so reliable. Since the 1990s, Agile software development as a development approach has attracted more and more attention. Because it allows for dealing with rapidly changing demands, Agile software development is widely accepted and applied by organizations. This attracts researchers to get an in-depth understanding so that it can be applied smoothly and effectively[3]. Through these studies, we can clearly know its value, principles, development process, development method, and other detail parts. The study field of Agile software development is very widely so that the opinions on each field may differ from researches.

As Agile becomes the new norm, tracking and control of methodology application start to play a vital role. Today, agile projects are almost four times more likely to succeed than traditional, sequential Waterfall projects - 39% vs. 11% (The Standish Group,

2015). However, Agile just recently became a dominant approach in IT with 67% of organizations using pure agile or leaning towards agile. A major uptick in Agile adoption began in 2009-10, with over half of organizations switching to agile during the last five years[4]. The agile strategy is used to lessen the chances of the failures that arise using traditional approaches so that a lightweight framework can be present to help the organizations and ensure that the teams are responding fast and iteratively. When the practical adaptation of agile comes, the initial step is organizations start with the agile manifesto, which states that an Agile methodology has 4 values and 12 principles. [5]. Studies show there are three main reasons for project failures in software industry these issues are a poor approach to manage the project no proper risk assessment no strict following of software engineering practices and lack of funds that's why there is still need of to provide this industry a well-structured framework to get successful in their projects. In Pakistan, the software industry is in its initial stages when we compare it with international industry despite the financial crisis this industry has groomed so much this growth can be improved by analyzing the success factor and overcoming the failure issues[6].

1.1 Need of the Study

Researchers have distinguished agile key factors in various prospects like the project, individuals, process and so on which impact the Pakistan business towards progress yet there is constrained research on the prioritizing of these success factors dependent on agile techniques for software project. But there is an absence of an organized model of these elements which tells the significance of these success elements. By knowing the positioning of success factor or elements under agile project will give a guide to embracing agile project for a software development project which is challenging for the Pakistan industry. This study will propose a model to adopt the agile project that impacts the accomplishment of software development projects. This study will also focus on quantitative and qualitative research strategy was utilized in this examination to comprehend the practical experience of agile experts with the agile project success investigating the human, project, and process, hierarchical, specialized, political and innovative factors in Pakistan organizations.

In recent years agile project has turned into the overwhelming one for a wide range of programming improvement ventures. Agile project is created to beat the failures that

come from conventional or classical methodologies, and to propose a lightweight system for helping organizations and groups to respond quickly and iteratively. There has not been any conventional examination of key success factors (KSF's) in the Agile project of developing a project. However, there are contextual analyses and research hypotheses on successes or failures/ issues in agile execution and agile software development. The review of both successes and failures in the literature will be helpful in recognizing the possible success factors in Agile software development. In this study, we review the literature along with it conduct a quantitative an qualitative study to determine the success factors in agile project for Pakistani industry.

1.2 Research Problem

Success or failure of software depends upon the different factors/criteria of the software projects. Researchers have already identified agile key factors in different dimensions (like project, people, process etc.) which influence the Pakistan industry towards success but there is limited research on the classification of these success factors based on agile methodologies for software development project. Also there is lack of prioritize model of these factors which tells the importance of these factors. By knowing ranking of factors under methodology will provide roadmap to adopt agile methodology for software development project which is also challenging for Pakistan industry and also proposing a model for adopt agile methodologies that influence the success of software development projects. Although many studies provide the knowledge and analysis of ASD, there are still many problems in development practices, such as low quality of products and low success chance of development. So researchers focus on the mandatory factors to ASD to address these problems.

Generally, most literature just collected critical success factors (CSFs) of ASD without any in-depth analysis. It is challenging for software practitioner to decide and adopt the agile for a specific project based on different factors and criteria[8]. To overcome these challenges, agile software methodologies came into industry and there is enough prove to say that agile projects are performing better than traditional. Now the need arises to know the factors which were making it successful. There are a lot of critical success factors in the literature which are responsible for the success of agile projects related to organization, people, process, project and technical, team and customer dimensions. Researchers have already classified them on different criteria's (time, cost, scope, and

quality) to measure the success of software projects. There is limited work on identifying the critical success factors which influence the major dimensions. There is a need to identify, classify and prioritize the factors based on major dimensions which have been mentioned in the literature.

1.3 The Aim and Objectives

The main purpose of the study is to identify the success key factors that contribute to the success of software development projects while using agile methodologies. Following are sub objectives:

1. To identify different key success factors to adopt agile methodology that influences the Pakistan industry in terms of success.

2. To classify the identified factors based on leading agile methodology for the software development project.

3. To prioritize the key success factors by proposing a model for adopt agile methodologies that influence the success of software development projects.

1.4 Research Questions

1. What are the success factors to adopt agile methodology for software development project that affect the Pakistan industry?
2. What are the dimensions of the identified factors based on leading agile methodology for software development project?
3. Which factors are most crucial which leads towards success under agile methodology for software development project?

1.5 Expected Outcomes

According to the aim and research questions, the expected outcomes are presented as follows:

- A list of CSFs of Agile project.
- A list of CSFs associated with identified factors and classified.
- A list of CSFs in the prioritize form to propose a model.

1.6 Significance of Study

This study will be useful and beneficial for software industry to overcome the challenges in software projects. It will improve business and organizational quality at international as well domestic level. The prioritization of CSFs can help the software engineers to be aware of important aspects of software projects success.

1.7 Thesis Structure

This thesis is decomposed into chapters: Introduction, Literature review, Research Methodology, Results, and Discussion, Conclusion and future work. The figure 1.1 can make the structure more visible.

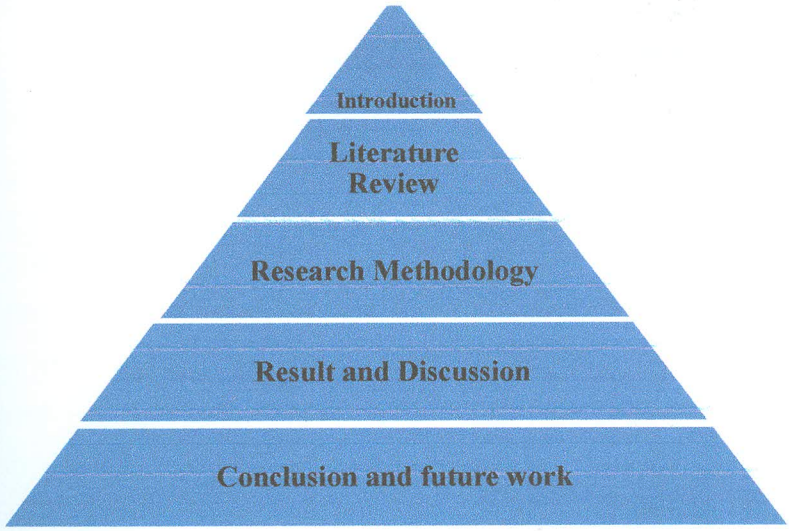


Figure 1.1: The structure of this thesis

1.8 Summary

There are some challenging factors in software projects including: Incapability to adopt appropriate methodology, Poor project planning and direction, Inadequate Communication, Ineffective management, Pitiable stakeholders handling, Unsupported executive management, and Careless behaviour. To overcome these challenges, agile software methodologies came into market and there is enough evidence in the market to say that agile methodologies are performing better than traditional. Agile projects are almost four times more likely to succeed than traditional. The success rate of sequential

Waterfall projects is 11% while the succes rate of agile projects is 39%. Researchers have already identified agile key factors in different dimensions but there is lack of prioritizing model of these factors which tells the importance of these factors. By knowing the ranking of CSFs will provide roadmap to adopt agile methodology for software development projects.

Chapter 2
Literature Review

2.1 Software Project

A software evolutionary procedure is a system that is utilized to architecture, arrange, and leadership the process of creating effective information systems. There are many programming shapes models and methods, for example waterfall, agile and spiral that are most appropriate contingent upon the tasks and associations' attributes[9]. Diverse models are utilized for venture accomplishment within product business. Agile methods have driven a significant part of the Software Development Lifecycles since the presence of the Agile Manifesto. An extensive variety of organizations actualize particular varieties of Agile so as to all the more adequately make programming and live up to client's wants speedier and superior to with the standard waterfall approach[10]. Plan-driven model (waterfall) and adaptive model (agile) are considered for software development. Plan-driven progression reflects the approach by the waterfall model where ventures within the change are organized out from the earliest begining point the undertaking culmination. The method that's considered as the birth place of the waterfall method or technique was depicted by Dr. W. Royce (1970) in his work "Managing the development of large software systems", in spite of the reality that he never utilized "waterfall", his strategy set the justification for this approach. This strategy is included seven clear advances which, once finished in a pre-characterized organize, should bring about a steady programming item. These steps are; Framework necessities, Software necessities, examination, arrange, coding, testing, and operations.

In the adaptive model, for modeling computer program system based on best hones. It is a collection of values and standards that can be associated to an agile software development venture. The Agile concept was put forward by a bunch of developers in 2001 and summarized in The Agile Manifesto, which has the taking principles as fundamental postulates: "Individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, and responding to change over following a plan". The comparison between traditional and agile development model as described [2] is given in Table2.1.

Table 2.1: Comparison between traditional and agile software development

Project parameter	Traditional software development	Agile software development
Development Group	Arrange situated, satisfactory aptitudes, access	Agile, knowledgeable, co-located and
	to outside knowledge, pre-defined	cooperative, self-modifying groups
Clients	Minimal commitment, not co-located	Devoted, well-read, co-located,
	And not authorized.	combined, representative and
		Authorized.
Necessities	Known beforehand, considerably steady	Largely emergent, rapid change
Skeleton	Designed for latest necessities.	Designed for latest and predictable
		Requirement
Size	Greater Groups	Minor groups
Refactoring	Costly	Cheap
Supreme Goal	Great assurance	Rapid value
Basic presumption.	Systems are completely specifiable,	High quality adaptive software
Management Manner	Command and control	Leadership and Cooperation.
Knowledge	Explicit	Tacit
Management		
Development Scheme	Linear or incremental (anticipatory)	Evolutionary – delivery model
		(iterative or adaptive models)
Conveyance	Formal	Informal
Anticipated	Mechanistic (bureaucratic with high	Organic (flexible and participative
Organizational	formalization) aimed at large	encouraging cooperative social action)
form/structure	Organizations	aimed at small and medium size
		Organizations
Quality control	Heavy planning and strict control, late,	Continuous control of requirements,
	heavy testing	design and solutions, continuous
		Testing
Organizational	Command and control	Leadership and collaborative
culture		
Market	Mature, stable	Dynamic/early markets
Measure of success	Conformance to plan	Business value delivered

There are lot of process models are being used in software industry to develop the system but two key models are considered more important and useful in software Industry which are plan driven (Traditional) and adaptive model (Agile). The comparison of among successful, challenged and failed project in Agile and Traditional is given in Table 2.2: basically it is giving an overview in three dimension along with comparison and that is being successful in which is agile grading from challenge, success and failed decendigly with less failures on the other hand in traditional it is

descending from challenge, failed to success where failures are much more as compare to the agile project[10].

Size	Method	Successful	Challenged	Failed
All size	Agile	39	52	9
	Traditional	11	60	29
Large	Agile	18	59	23
	Traditional	3	55	42
Medium	Agile	27	62	11
	Traditional	7	68	25
Small	Agile	58	38	4
	Traditional	44	45	11

Table 2.2: Resolution of software projects 2011-2015

Agile is a part of lightweight methodologies used to expand highly prospective software. Agile methods invariably depend on an iterative approach to software description development and transport; they are calculated to deliver working software rapidly to customers, who can suggest changed requirement and new to be involved in later iterations of the system [12]. According to the recent chaos report of Standish Group "The Standish Group is an International, Incorporation or Standish Group is an liberated international IT research counselling firm established in 1985, recognised from their researches about information systems with their implementation projects in the public as well as private sector. According to the recent chaos report of Standish Group[11], Table 2.3 shows the latest statistics about the successful, challenged or failed project (that is cost overruns, budget overruns or content deficiencies and the comparison is made from 2011 to 2015 in the above mentioned aspects of successful, challenged or failed to check the progress in these years to muster up the conclusions for further improvements where required.

Table 2.3: Standish group chaos report

	2011	2012	2013	2014	2015
Successful	29%	27%	31%	28%	29%
challenged	49%	56%	50%	55%	52%
Failed	22%	17%	19%	17%	19%

2.2 Critical Success Factor (CSF) of Agile Project

Critical success factor (CSF) is an essential term that is vital for an organization to accomplish its central goal. A CSF is a critical factor or action required for guaranteeing the success of an organization or company. The term was first used in the real world of data analysis and business analysis. Critical success factors are those couple of things that must go well to guarantee the success of a manager or a company. CSFs are factors that add to an outcome which should be done effectively to guarantee the achievement of a project.

Software engineers centre around various models that assist in the software industry for developing software projects like conventional and agile models. Plan-driven development reflects the methodology by a waterfall model where steps of the development are sorted out from the earliest starting point of the project. Adaptive model is utilized for modelling a software system based on best practices. It is an accumulation of qualities and rules that can be connected to an agile software development project [2]. There has not been any conventional examination of key success factors (KSF's) in the Agile methodology of developing a project. However, there are contextual analyses and research hypotheses on successes or failures/ issues in agile execution and agile software development. The review of both successes and failures in the literature will be helpful in recognizing the possible success factors in ASDP, as failures can provide for the comprehension of how to keep away from certain genuine peril that is critical to the accomplishment of a project. Researcher to identify Key factors and also mention different success factors belong to agile software development in following table 2.4.

Table 2.4: CSFs of Agile software development project

Dimensions	factors	Literature citation
Organizational	Strong executive support, Collocation of the entire group, Facility with agile-style work environment, Top management support, Leadership, Management commitment, Collocation of the whole team	[3][8][2][12][13] [14][15][16][17] [18] [19][20][21]
People	High ability with team members, Group members with great invitation, Managers well informed in Agile process, Good client relationship, Customer involvement, Training and Education	[3][8][2][13][14] [15][17][22] [18][19][23]
Process	Agile-oriented requirement management, Strong communication, Regular working schedule, Strong customer commitment, Project scope is well-defined, Good customer relationship , Regular delivery of software	[3][8][13][14][1 8] [19][7][24][21]
Project	Dynamic schedule, Projects with small team, Project complexity, Project nature	[3][8][2][14][15] [13][7][20]
Team	Project team skill with the task, Project team commitment, Internal project communication, Participation of project team, Project team commitment	[2][12][15][7][1 6][19][25]
Customer	Customer training , User support, User participation education, Client experience, Customer training and education	[12][2][15][7][2 0][23][26]

2.3 Challenging Factors of Project

There are some challenging factors to software project including: Incapability to adapt appropriate methodology, Contracting of technical lead who has not prepared the desired sort of a project before, Poor project planning and direction, Inadequate Communication, Ineffective management, Pitiable stakeholders handling, Unsupported executive management, Development of the project plan by working backwards from a drop-dead system complete date, and Careless behaviour towards data model are also some factors for software failures. There is long debate that why software project

fails[5][7]. Although there are many factors proposed by different studies that why projects are not successful, numerous studies argue that software projects fail due to inappropriate choice of software development mythologies. Many researchers ought to identify key challenges and factors that show software project failure rate. Software projects still face high failure percentages[8][9][10], especially in developing countries Also much issue arises in the software industry because of the lack of collaboration and communication among project stakeholders.

Many researchers [16][27] have pointed out following reasons why software project fails. Now the factors emphasized are Insufficient Communication, Unclear and inappropriate requirements, Poor project planning and direction, Ineffective management, Poor stakeholders handling, Never Reviewing Project Progress, Not Enough Time, Insufficient Budget, Not use of specific methodology, Unsupportive executive management, Careless behaviour towards data model, Poor Testing, Testing in the Production Environments, Lack of Quality Assurance, Not matching to Industry Standards, Inability to adapt and Poor methodology. Several companies are relying on software project development to attain information and communication improvement and innovations. Despite of the truth that software program industries are committing massive investments to their ventures, they're completing the requirements to deliver the projects on time, within the given price range but do not promise quality to their customers. A contemporary studies informed that nearly 65 percentage of software initiatives do not arise to their earmark desires and time , and usually do not meet their task goals[2].

A survey was carried out by the reputed Standish team in 2012 classified that only 39% of worldwide software program development initiatives were productively conveyed on time, on budget, and with required specification whilst almost 43% had been challenged, and 18% were failed (cancelled before their completion or product never used)software projects failures may be the reason of financial deficit to a business enterprise and yet jeopardize its endured existence[12].

There are a lot of studies on why software projects fail. Many researchers have recognized a lot of troubles and suggestions to highlights this problem [2][28]. However, a lot of factors have been discovered up till now that indicates why projects are not successful [29][30][31].It is found that software projects usually fail due to inappropriate choice of software development methodologies.

Diverse researchers' have by now distinguished the challenges and success factors which cooperate an imperative function in the development of software project. There is also a call for to suggest an appropriate development methodology which increase success rate of projects. The primary idea of the present research is to classify and analyze the key components that influence the determination of adopting Agile methodology for software development intended for a specific project. The discoveries of this analysis provide information concerning agile methodology is best to be used depending on the degree of each factor for a particular project.

2.4 Development Methodologies of Software Project

A software life cycle also called SDLC this life cycle is followed for almost every software development project it covers the phases like planning analysis design and implementation studies suggest to divide SDLC into chunks of light weight ,heavy weight and hybrid development methodology [14]. The classical heavy weight development covers steps like 1) Requirement gathering ,definition 2) Solution build up 3) Deployment there exist some HDM like water fall model ,prototyping model and spiral model etc smaller .when we are sure about requirements waterfall is used as model of development ,prototyping believes providing a useable form of software to client before actually deploying it for testing purpose spiral combines the design and prototyping phase .Heavyweight development methodology is also known as traditional methodology and it includes[32][33]:

- Waterfall model
- Iterative model
- Prototype model
- Spiral model
- Rational unified process (RUP).

Lightweight methodologies are also considered as agile methodologies these methodologies contain following attributes incremental, cooperative, adaptive and straightforward.Lightweight process or agile process models feature on agility for software development process. Literature review, suggest following agile methods.

- Extreme Programming (XP)
- Dynamic System Development Methodology (DSDM)
- Adaptive Software Development (ASD)
- Scrum
- Crystal
- Feature-Driven Development(FDD)

Extreme Programming (XP)

XP follows the concept of ever-changing user requirement it also focus on team work developers managers and even customers all work as a team. XP is one of the most emerging agile method it relies on communication and simple collaborative work. XP is popular because of its management activities.

Dynamic System Development Methodology (DSDM)

Dynamic System Development Methodology was introduced in 1990 it follows the concept of scrum and xp in multiple aspects but I is used where time restriction is the major concern in traditional methodologies the functionality is concrete or non-variant while time and assets are variable but in DSDM functionality changes while time is already decided.

Scrum

Scrum is a gradual and iterative framework where experts can use distinctive methods and strategies to build a complex project and product. It is specially intended to deal with fastly changing business assessments. Scrum may possibly a sprint; a time framed exertion for about fourteen days to about a month, in a sprint work is partitioned into parts and to be finished toward the finish of the sprint time. Scrum focus more on the methods of management than coding strategies, and it is utilized in small and large projects.

Crystal family

Crystal method is one of the most popular agile methods. This method was created to address the as often as possible changing project environment and characteristics. It involves the number of different methods from which to select the most satisfactory one for the project. The advantages of crystals family involves:

- Improve communication and collaboration
- Improve performance
- Provide faster result

Feature-Driven Development (FDD)

In 1997, this technique was introduced for a project of 15 month with the team of 50 people for Singapore bank the it was quickly adopted for a project of 18 month with the team of 250 people. There are 5 primary tasks in FDD that are performed iteratively:

- plan an overall structure
- Build a charactistics list
- Plan by charactistics
- Design by charactistics
- Enhance by charactistics

Hybrid methodology comprises of both agile and traditional and it involve:

- Rapid application development (RAD).

2.5 Software Industry of Pakistan

In Pakistani software industry projects may partially or completely fails due to less focus on following appropriate project development methodologies and ignorance in improving success key factors. Studies show there are three main reasons for project failures in software industry these issues are a poor approach to manage the project no proper risk assessment no strict following of software engineering practices and lack of funds that's why there is still need of to provide this industry a well-structured framework to get successful in their projects. In Pakistan, the software industry is in its initial stages when we compare it with international industry despite the financial crisis

this industry has groomed so much this growth can be improved by analyzing the success factor and overcoming the failure issues. According to the Ministry of Science and Technology, software experts rose about 50% and amounted a total of 48.5million USD.

According to the Global Information Technology report, by the World Economic Forum, Pakistan was ranked 111th among 144 countries. If we look at the report issued by the Ministry of Science and Technology in 2016 about the failure of software projects in Pakistan, we will realize that these failures are bringing loss to the economy and if these failures are prevented, the software industry will boom more and the economy of Pakistan will improve manifold[34]. Pakistan Software Expert Board (PSEB) under software and Telecommunication Ministry listed the leading software exporting companies in Pakistan [34] as;

- Netsol Technologies Inc.
- System Limited
- S and P Global Pakistan
- Teradata
- TRG Pakistan
- Medical Transcription Billing Co.
- Ovex Technologies
- I2C Pakistan

2.6 Multi Criteria Decision Analysis

Decision Making is the act of choosing between two or more activities of task. In any case, it must always be recollected that there may not continuously be a 'correct' choice among the accessible options. There may have a stronger choice that had not been considered, or the proper information may not have been accessible at the time. Multiple criteria assessment problems composed of a limited number of alternatives, declared known in the starting of the solution process. MCDA is a sub discipline of research that specified evaluates multiple clashing criteria in decision making. [35]. Different method of MCDA:

- Analytic Hierarchy Process (AHP)
- Novel Approach to Imprecise Assessment and Decision Environments (NAIADE)
- Multi-Attribute Utility Theory (MAUT)
- Multi-Objective Programming (MOP)

2.7 Summary

This chapter discusses the literature review. The CSFs of agile software development are identified from literature. The CSFs are those factors which plays an importat role to make a software project successful. In Pakistani software industry projects may partially or completely fails due to less focus on project development methodologies and ignoring key success factors. There are two key models which are considered more important and useful in Pakistan software industry and these two kay models are plan driven (Traditional) and adaptive model (Agile).

Chapter 3
Research Methodology

3.1 Introduction

This chapter describes the research methodlgy of the research. Mixed method research will be used to achieve the objectives of study to investigate the critical success factors of Software projects. The study will initiate the investigation by reviewing the recent literature in detail and analyze to identify and conclude the items that are relevant to software projects. After that, to validate the extracted quality factors, a Delphi survey approach will be use which will involve software engineers. Delphi helps decision makers to find the decision that best suits their goal and their understanding of the problem. SPSS (Statistical Package for the Social Sciences) Windows software program will be used to analyze survey response to get quantitative data. Following different steps to analyze and collect data in Delphi study:

Step 1: Select a Facilitator
Step 2: Distinguish Your Experts
Step 3: Characterize the Problem
Step 4: Round One Question
Step 5: Round Two Questions
Step 6: Round Three Questions
Step 7: Concluded your Findings

This study will apply AHP technique to prioritize the CSF factors of in software development methodologies in step 6 for round 3 questions. The analytic hierarchy process (AHP) is a technique that can be used for organizing and analyzing the complex decisions that are based on mathematics and psychology. It was developed by Thomas L. Saaty in the 1970s.The AHP helps decision makers to find the decision that best suits their goal and their understanding of the problem[36]. The graphical illustration of this research methodology is as following figure 3.1:

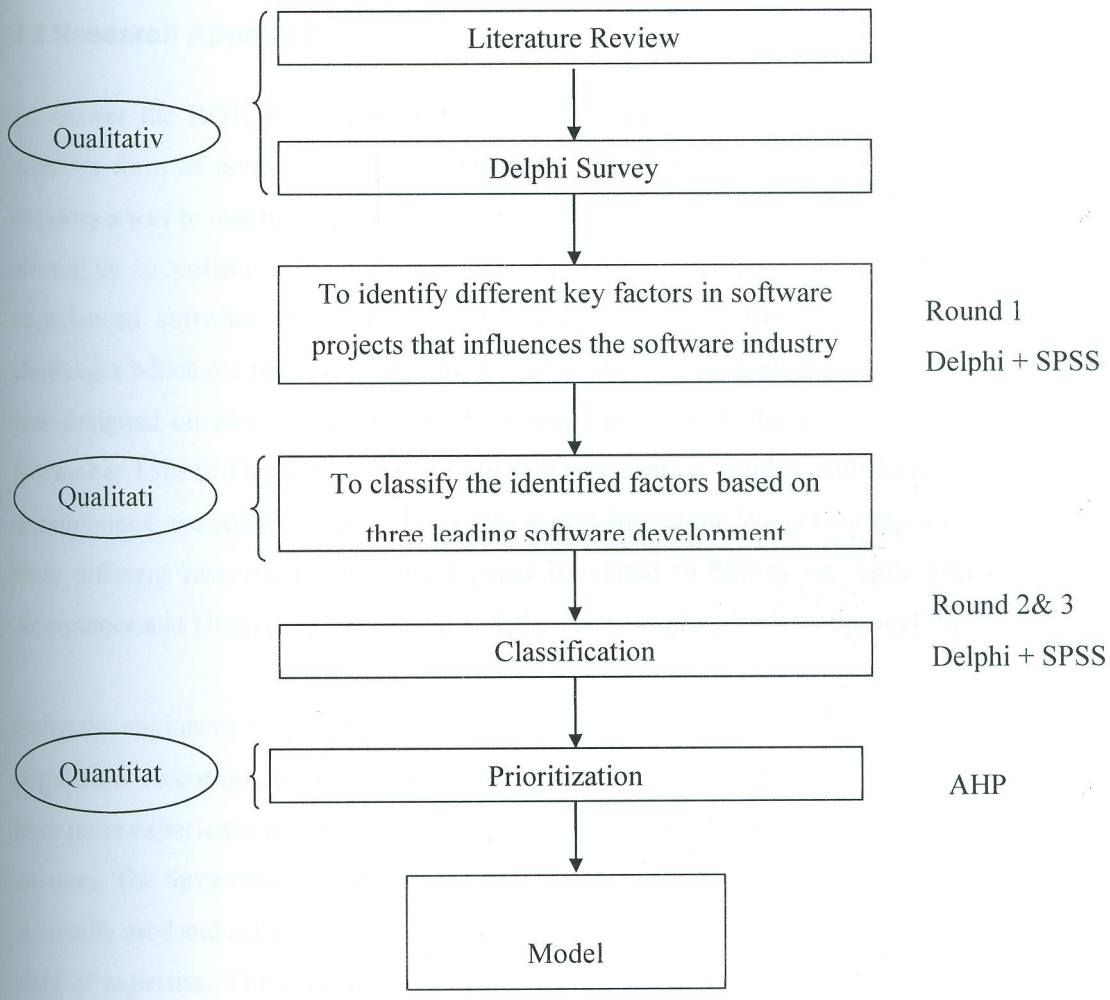


Figure 3.1: Graphical Representation of Research Methodology

3.2 Research Approach

To answer the RQ1, RQ2, and RQ3, the Delphi approach using AHP which is an effective form of investigation to gather data from a wider population. The approach provides a way to measure a population's characteristics, opinions and needs [37]. It also allows us to collect data from a wider population. We collected opinions from experienced software engineers of agile development to identify the factors and challenges which are related to software projects in Pakistan industry. The questionnaire was designed on November 2018 and was made available to target population from November 15th to December 30th. In order to test content validity and readability of questionnaire, we conducted a test before the survey invitation. We get our questionnaire from different research papers. First paper is related to Survey on Agile Methods Acceptance and Usage[38] and second is Agile Adoption Experiences Survey[39].

Software engineers (Agile Expert) on Agile software development are our target population. According to the aim and objectives of this thesis, software engineers who have more experience about Agile development, can provide more helpful and effective answers. The three rounds of the Delphi research are as following. The Delphi method is broadly used and acknowledge for gathering information from respondents within their field of expertise. The method is outlined as a gather communication handles which points to achieve a conclusion on a particular real-world issue. The Delphi process has been used in different areas of study such as program plan, policy determination, resource utilization and needs estimation to develop a full range of choices, examine evaluation, opinions, as well as correlate judgments on a problem spanning a wide range of developments. Delphi helps decision-makers to find the decision that best suits their goal and their understanding of the problem.

3.2.1 Round 1:

To answer Research Question1, the Delphi method is used. It also allows us to collect data from a wider population. In the first round, collect identify different key factors of software projects that influence the software industry using questionnaire way. First data was collected from literature to start the first round.

The following resources are used to gather data:

- Google Scholar: https://scholar.google.com.pk/
- IEEE Xplore: https://ieeexplore.ieee.org/
- Science Direct: https://www.sciencedirect.com/

The survey could be conducted in two ways: 1) questionnaire 2) interview. The interview method is simple, self-evident and the interviewer coordinates a conversation aimed at obtaining desired information[8]. However, we didn't choose this method, because when we contacted the people to conduct the interview, some of them don't like face to face communication and some respondents have no time for interview. Taking into account these issues, the respondents suggest us to send a questionnaire to them. Thus, we choose the online questionnaire to collect data. As compared to interview, the respondents can fill it out at their own convenience. The survey questionnaires are sent to those respondents have rich experience (software engineers) on Agile software development.

3.2.2 Round 2:

As explained in the description of a Delphi study, responses of the first round of open-ended questions were analyzed and categorized into Likert-scaled questions. The purpose is to determine that which factors are most or least important and how to classify the identified factors based on leading agile methodology for software development project. Due to our survey questions are open-ended and subjective; the answers of software engineers were analyzed using qualitative analysis. Qualitative analysis has come into widely use in analyzing text data. In our case, the text data is obtained from open-ended survey questions. The results of survey questionnaire were analysed using descriptive statistics. The descriptive statistics is used to describe the basic features of the data in this study. This method provides simple summaries about the sample and the measures. Some measures that are commonly used to describe a data set are measures of central tendency which includes the mean, median and mode.

3.2.3 Round 3: Analytical Hierarchy Process (AHP)

After completing the Round 2, the researcher had preceded to the Delphi method's Round 3. This activity is performed through AHP method. AHP is a method of MCDA. Saaty (1980) developed a strong and helpful technique for decision-making. This technique is called Analytical Hierarchy Process (AHP) and is based on a hierarchical structure. The aim of the final-round Delphi survey is to attempt the priorities and to give weightings to the list of criteria, which were selected from the previous two rounds. To prioritize the factors influencing academic integrity, the results of the second round Delphi survey were arranged in the format of AHP pair-wise comparisons.

The AHP method has following steps to resolve the problem:

- Define Goal or Problem
- Identify Criteria and Sub-Criteria
- Hierarchy Model for Analysis
- Gathered Information and Data
- Judgment Pair-wise Comparison
- Consistency Test
- Global and Local Weight
- Final Ranking of Dimensions and Factors

Step 1: Define Goal or Problem

The first step in AHP is to deal with the structure of the problem and the structure of the problem is to enhancement of CSFs of Agile software development project.

Step 2: Identify Criteria and Sub-Criteria

The next step is to identify the criteria and sub-criteria of CSFs of agile project in expert choice for applying AHP in which individual enter data of criteria and sub-criteria collected from the agile expert and detailed discussion in chapter 4.

Step 3: Hierarchy Model for Analysis

The next step is explained the hierarchy model of CSFs of Agile project in chapter 4.

Step 4: Gathered Information and Data

The AHP questionnaire will be designed in chapter 4 and distributed to most senior's experts who have more than or equal to 5 years of agile experience, have qualification equal to MS/Ph.D and are capable of well decision making.

Step 5: Judgment Pair-wise Comparison

A pair-wise comparison of each factor which data are collected from the agile expert will be explained in chapter 4.

Step 6: Consistency Test

The consistency test is measured in MS Excel software. The consistency ratio should not be bigger than the acceptable consistency rate of 0.10.

Step 7: Global and Local Weight

Expert choice software is used to calculate the local and global weight of the main dimension and each factor will be explained in chapter 4.

Step 8: Final Ranking of Dimensions and Factors

The ranking of the main dimensions and factors will be discussed in chapter 4.

Respondents will be explained the meaning of the integer scores 1-9 and they will also be explained how these scores need to be considered while making the pairwise comparisons between any two factors. Table 3.1 shows the scale for pairwise comparison. Finally, the researcher went through a weighting process dependent upon the expert's ratings and calculated the weight of each factor using both Microsoft Office Excel (spreadsheet) software and AHP software. The study followed Saaty (1990) guidelines. The following Table 3.1 describes the AHP scale values.

Table 3.1 Scale for pair-wise comparison

Scale	Definition	Explanation
1	Equally Important	Two elements equally contribute to the objective
3	Moderately Important	Experience and judgment slightly favour one element over another
5	Highly Important	Experience and judgment strongly favour one element over another
7	Very Highly Important	One element is favoured very strongly over another, its dominance is demonstrated in practice
9	Extremely Important	The evidence of favouring one element over another is of the highest possible order of affirmation
Note: 2,4,6,8 can be used to express intermediate values.		

A questionnaire is designed in the form of a pair-wise comparison based on the hierarchical structure. According to the feedback from the experts, only those factors will be selected from previous rounds, which have a mean value greater or equal to 3.50. As a result, some factors are eliminated from three dimensions. The AHP questionnaire is designed based on extracted factors and distributed to most senior's experts who have more than or equal to 5 years of agile experience and have qualification equal to MS/Ph.D and are capable of well decision making. The characteristics profile of the target population is described in the following Table 3.2.

Table 3.2: Characteristics of the Target Population

Gender	**Male**
Qualification	MS/PHD
Experience	>=5 years
Area	Software Engineers(Agile Expert)

3.3 Summary

This chapter discusses research methodology of the research. Mixed method research will be used to achieve the objectives of study and to investigate the critical success factors of software projects. First of all CSFs will be identified and then to validate the extracted quality factors, a Delphi survey approach will be used which will involve software engineers. According to the aim and objectives of this thesis, software engineers

who have more experience about Agile development, can provide more helpful and effective answers. Software engineers (Agile Expert) on Agile software development are our target population. SPSS (Statistical Package for the Social Sciences) software will be used to analyse the survey responses and to get quantitative data. AHP technique will be used to prioritize the CSFs of software development project.

Chapter 4

Result and Discussion

4.1 Introduction

This chapter discusses the findings of research. Analysis of data collection, final findings and the results produced through AHP are also discussed here. Expert Choice Software is used to analyse the results. We conducted a survey using online questionnaire to collect the opinions form experienced software engineers. The detail data of each aspect is described in the following section. As we described in chapter 3, we used Delphi methods to collect necessary data.

4.2 Success Rate to Adopt Agile in Pakistan industry

The Agile conception was introduced by a gaggle of developers in 2001 and reviewed within the Agile manifesto, that has the subsequent principles as main bases: "Individuals and interactions over processes and tools, working software system over comprehensive documentation, client collaboration over contract negotiation, and responding to vary over following a plan". Success rate of agile project in Pakistan industry in figure 4.1:

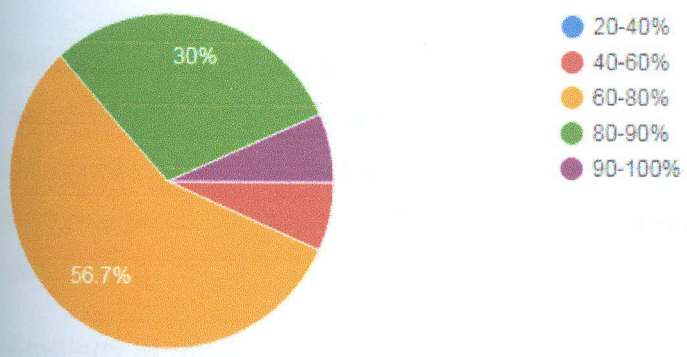


Figure 4.1: Agile success rate in Pakistan industry

In general, developing in keeping with any of the Agile methodologies includes a powerful specialize in the industry desires, study collaboration systems, a settlement with quality, and therefore the performance of reiterative developments that are totally useful and are finally conferred to the various business purposes, together with the client, so as to be improved over time[10].

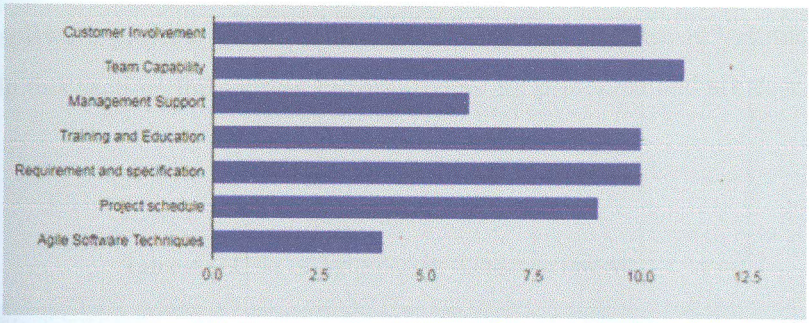


Figure 4.2 Adopting difficult factors in software project

There are some factors to be considered as the most difficult to adopt in a software project which is collected through a survey in Pakistan industry that is represented in figure 4.2.

4.3 Findings of Study using the Delphi Method

As described in Table 4.1, we finally identified factors from software engineers (Agile Experts) to support our research. In this thesis, we just focused on CSFs for Agile software development. The details of each paper are presented in the following sections. Section 4.4.1 provides information about identifying factors to collect from different software engineers (Agile Expert).

4.4 Overview of Findings

To find the answers of research questions of this study, the key CSFs of Agile project are identified in extensive literature review as mentioned in Chapter 3. Then the identified CSFs of Agile project are prioritized using AHP software. Furthermore, a model is proposed to enhance the CSFs of Agile project and this model is discussed in Chapter 4.

4.5 Findings of Study

The core purpose of the round 1 was to identify the major factors of Agile software development project that contributes to the success of software project in Pakistan industry. AHP was particularly used in the last round to prioritize each factor based on expert's contribution. Findings for each round are discussed in the following section.

4.5.1 Findings of Round 1

The round 1 of this study results into extraction of 17 important CSFs. These CSFs, which were extracted from literature and agile experts, can play an important role to the

success of software projects in Pakistan. The finding of this phase is summarized in Chapter 4. In this section, the success factors studies are presented and are described in Table 4.1.

Table 4.1: CSFs of Agile project (Literature review)

S.NO	Critical Success Factors	Literature citation
1	Management Support	[17][28][22][18][40][41]
2	Project objective	[42][18][13]
3	Project Schedule	[42][18][13][41]
4	Culture	[43][22][18][40]
5	Communication	[17][28][22][18][15][13][43][41]
6	Leadership	[42][43]
7	Risk Management	[17][28][18][15][41]
8	Customer Involvement	[3][15][13][43]
9	Team Capability	[3][18]
10	Training and Education	[44]
11	Requirement and specification	[42][18][15]
12	Agile software technique	[3]
13	Delivery strategy	[3]
14	Project management process	[3]

4.1.1 Management Support

Management support is also additional significant for the successful outcome of the project. Management support has the control over the role of project manager and his specialist to control assets[17].

4.1.2 Project Objective

Project objectives serve as a turning point for the complete group and everybody included will have a clear course of work[17].

4.1.3 Project Schedule

Project schedule should portray time and assets required as well as advance examination framework. Project possibility plays basic portion in achieving overall project success[17].

4.1.4 Culture

To be agile is a cultural thing. If the culture is not right, then the organization cannot be agile[45].

4.1.5 Communication

Communication is also very important for effective observing and control[17][22].

4.1.6 Leadership

Project manager's leadership capacities to motivate project group increments by large commitment level and hence productivity and success[17].

4.1.7 Risk Management

Risk management is the identification, assessment, and prioritization of risks taken by coordinated and economical application of assets to minimize and control the probability or affect of unfortunate events or to maximize the realization of opportunities[12].

4.1.8 Customer Involvement

The Agile Manifesto advocates customer's collaboration as one of the critical requirements for effective software development [45][46].

4.1.9 Team Capability

Proposed study suggests the experienced and expert should necessarily be part of team for achieving success[45][46].

4.1.10 Training and Education

An imperative concern that has been raised within the past writing is how much preparing is required for effecively implementing agile strategies in an organization[45].

4.1.11 Requirement and specification

The software requirement & specification document lists sufficient and necessary requirements for the project development and also describe the features & behaviour of the system[18].

4.1.12 Agile software technique

Agile software technique assists teams in responding to the unpredictability of constructing software[46].

4.1.13 Delivery strategy

Delivery strategy is related to regular delivery of software and appropriate for the context of the project[46][47].

4.1.14 Project management process

This process starts after the approval by the client, is based on the contract, and is focused on the initial values of the method and the general management of a project[3][47].

Table 4.2: Critical Success factors of Agile project (Agile Expert)

Software Engineers (Agile Expert)	Critical Success Factors
SE1	Communication, Leadership, Agile Software Techniques, Requirement and specification, Project Management Process
SE2	Communication, Risk management, Leadership
SE3	Management support, Risk management, Culture, Customer Involvement, Leadership
SE4	Management support, Communication, Culture, Customer Involvement, Team Capability, Quality
SE5	Management support, Productivity
SE6	Management support, Culture, Customer Involvement, Team Capability, Agile Software Techniques, Delivery Strategy, Project Management Process
SE7	Communication, Risk management, Customer Involvement, Training and Education, Agile Software Techniques. Quality, Project Management Process
SE8	Communication, Risk management, Culture, Training and Education, Leadership, Productivity
SE9	Risk management, Training and Education. Agile Software Techniques, Delivery Strategy
SE10	Management support, Communication, Customer Involvement, Training and Education
SE11	Communication, Customer Involvement, Agile Software Techniques, Productivity
SE12	Management support, Culture, Productivity
SE13	Quality, Productivity
SE14	Management support, Performance
SE15	Management support, Communication, Culture, Training and Education, Leadership, Agile Software Techniques, Quality
SE16	Training and Education, Leadership, Agile Software Techniques
SE17	Management support, Risk management

SE18	Management support, Communication, Customer Involvement, Training and Education, Leadership, Agile Software Techniques, Quality , Project Management Process
SE19	Management support, Team Capability, Quality , Productivity
SE20	Management support, Team Capability, Quality , Productivity
SE21	Management support, Communication, Risk management, Team Capability. Training and Education, Leadership, Agile Software Techniques, Delivery Strategy, Project Management Process
SE22	Risk management, Customer Involvement, Team Capability, Leadership, Productivity , Project Management Process
SE23	Communication, Culture, Project Management Process, Team Capability, Leadership
SE24	Management support, Culture , Project Management Process, Team Capability, Training and Education, Leadership
SE25	Culture , Quality , Project Management Process, Team Capability
SE26	Management support, Communication, Quality, Project Management Process, Customer Involvement
SE27	Management support, Communication, Customer Involvement, Delivery Strategy
SE28	Culture , Agile Software Techniques, Delivery Strategy, Team Capability
SE29	Risk management, Delivery Strategy, Quality, Productivity , Project Management Process
SE30	Leadership, Communication
SE31	Management support, Communication, Culture, Customer Involvement, Team Capability, Quality, Requirement and specification
SE32	Management support, Culture, Customer Involvement, Team Capability, Agile Software Techniques, Delivery Strategy, Project Management Process
SE33	Communication, Risk management, Customer Involvement, Training and Education, Agile Software Techniques, Quality , Project Management Process
SE34	Communication, Risk management, Culture, Training and Education, Leadership, Productivity
SE35	Risk management, Training and Education, Agile Software Techniques, Delivery Strategy, Infrastructure
SE36	Management support, Communication, Customer Involvement, Training and Education, Requirement and specification
SE37	Communication, Customer Involvement, Agile Software Techniques, Productivity, Partnership
SE38	Management support, Risk management, Requirement and specification, Performance

SE39	Management support, Communication, Customer Involvement, Training and Education, Leadership, Agile Software Techniques, Quality , Project Management Process
SE40	Management support, Communication, Risk management, Team Capability, Training and Education, Leadership, Agile Software Techniques, Delivery Strategy, Project Management Process
SE41	Management support, Communication, Culture, Customer Involvement, Team Capability, Quality, Performance
SE42	Management support, Culture, Customer Involvement, Team Capability, *Agile Software Techniques, Delivery Strategy, Project Management Process, Infrastructure*
SE43	*Communication, Risk management, Customer Involvement, Training and Education, Agile Software Techniques, Quality , Project Management* Process
SE44	Communication, Risk management, Culture, Training and Education, Leadership, Productivity, Performance, Infrastructure
SE45	Risk management, Training and Education, Agile Software Techniques, Delivery Strategy, Requirement and specification
SE46	Management support, Communication, Customer Involvement, Training and Education, Requirement and specification
SE47	Communication, Customer Involvement, Agile Software Techniques, Productivity, Requirement and specification
SE48	Management support, Risk management, Partnership, Infrastructure
SE49	Management support, Communication, Customer Involvement, Training and Education, Leadership, Agile Software Techniques, Quality , Project Management Process
SE50	Management support, Communication, Risk management, Team Capability, Training and Education, Leadership, Agile Software Techniques, Delivery Strategy, Project Management Process
SE51	Risk management, Delivery Strategy, Quality, Productivity , Project Management Process
SE52	Leadership , Communication, Partnership, Infrastructure, Requirement and specification

After factors attraction, from the systemic literature review the survey questionnaire is designed in Google survey form. An email describing the purpose of this study with Round 1 instrument was sent to agile experts. The experts were also asked to confirm their cooperation as a part of the three rounds of Delphi method. The experts were allotted six weeks to complete the questionnaires. A survey was conducted about the questionnaire by agile experts and distributed (online) to respondents. The respondents

are experts in software development projects. Data was collected in November 2018, from 144 total members and we obtained 52 potential respondents. In this section, success factors are mentioned which are identified from different software engineers (Agile Expert) of Agile project table 4.2. After getting responses, we performed further selection to process only questionnaires from respondents who have acquired working experience in software development projects and have an educational background in IT, computer engineering, or similar education as they are reasonably reliable and trustworthy as experts in this study.

Table 4.3: Percentage of CSFs of Agile project

S.no	Factors	Frequency	Percentage
1	Communication	29	55.7
2	Leadership	19	36.5
3	Agile software techniques	22	42.3
4	Requirements and specification	8	15.3
5	Project management process	19	36.5
6	Risk management	20	38.4
7	Management support	28	53.8
8	Culture	16	30.7
9	Customer involvement	22	42.3
10	Team capability	16	30.7
11	Quality	17	32.6
12	Productivity	14	29.6
13	Delivery strategy	13	25
14	Training and education	21	40.3
15	Infrastructure	5	9.61
16	Performance	4	7.69
17	Partnership	3	5.76

Table 4.3 shows the percentage of each factor which is collected through questionnaires survey from the agile expert . All the Factors are carrying a frequency with the percentage in this table which is descending from Communication 29 frequency and 55.7% weight at the top communication is the first and foremost to focus upon. Now Management support with frequency 28 and 53.8% weightage, Agile software techniques 22 and 42.3% weightage is almost equally important, Customer involvement frequency 22 and 42.3% weightage is carrying equal importance to the software techniques, Training and education frequency 21 and 40.3% weightage, Risk management frequency 20 and 38.4% weightage, Leadership frequency 19 and 36.5% weightage, Project management

process frequency 19 and 36.5% weightage is carrying equal percentage to the leaders ship means there are correlating to each other should impact each other in a sense of scale where one lowering will impact the other to lower and vice versa, Quality frequency 17 and 32.6% weightage, Culture frequency 16 and 30.7% weightage, Team capability frequency 16 and 30.7% weightage with culture frequency means culture is important to create team capability if the culture is good team will be more capable, Productivity frequency 14 and 29.6% weightage, Delivery strategy frequency 13 and 25% weightage, Requirements and specification 8 and 15.3% weightage, , Infrastructure frequency 5 and 9.61% weightage, Performance frequency 4 and 7.69% weightage, Partnership frequency 3 and 5.76% weightage. Graphical Representation of Percentage of CSFs of Agile project in figure 4.3.

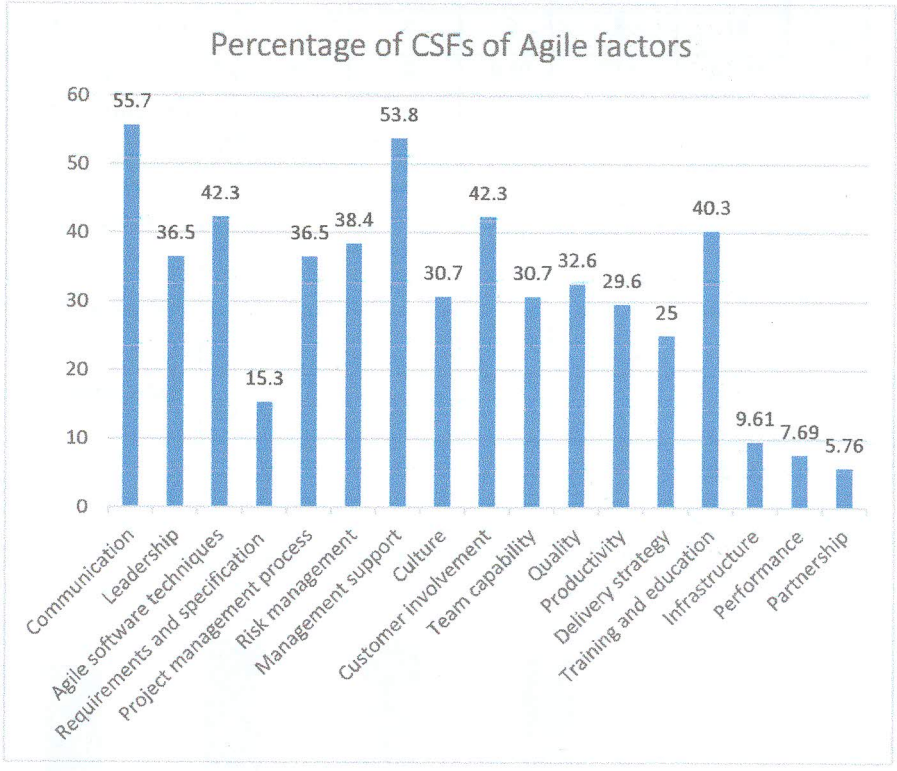


Figure 4.3: Graphical Representation of Percentage of CSFs of Agile project

4.5.2 Findings of Round 2

After data collection from Agile experts, SPSS software is used to analyse the obtained data. SPSS software is widely used by market researchers, survey companies, marketing organization and education researchers for statistical analysis of data. The analysis of this data yields the following results.

Table 4.4: Data Analysis of Organization success factors

Dimension	factors		Level of importance					Mean of Factor	Standard deviation
			Not important	Slightly important	Neutral	Moderately important	Very important		
Organization Success factors	Risk Management	N	0	0	5	15	9	4.13	.693
		%	0	0	17.2	51.7	31.03		
	Management support	N	0	0	2	8	18	4.51	.687
		%	0	0	6.89	27.5	62.09		
	Communication	N	0	0	0	15	14	4.48	.508
		%	0	0	0	51.7	48.2		
	Culture	N	0	1	6	7	15	4.24	0.912
		%	0	3.44	20.6	24.1	51.7		
	Infrastructure	N	2	19	8	0	0	2.20	0.559
		%	6.89	65.5	27.5	0	0		
	Partnership	N	15	14	0	0	0	1.48	0.508
		%	51.7	48.2	0	0	0		

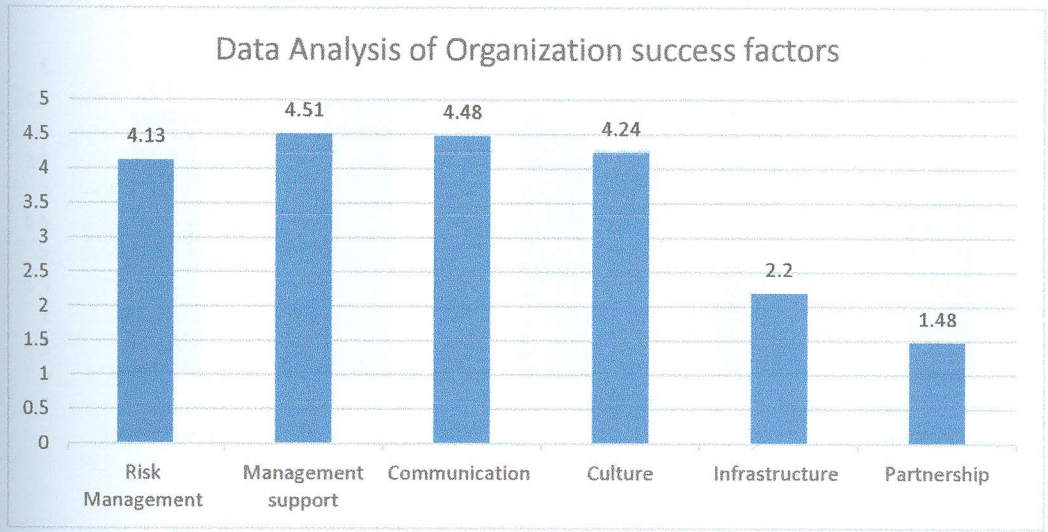


Figure 4.4: Graphical Representation of Organization success factors

Organizational factor includes variables such as Risk management, Management support, Communication, Culture, Infrastructure and partnership. Graphical Representation of Organization success factors in figure 4.4. The table 4.4 shows that the **Management support** sub factor is most important and its mean value is 4.51. The sub factor **Partnership** has least mean value and it is 1.48.

Table 4.5: Data Analysis of People success factors

Dimension	Factors		Level of importance					Mean of Factor	Standard deviation
			Not important	Slightly important	Neutral	Moderately important	Very important		
People success factors	Customer Involvement	N	0	0	3	13	13	4.34	.669
		%	0	0	10.3	44.8	44.8		
	Leadership	N	0	0	0	14	15	4.51	.508
		%	0	0	0	48.2	51.7		
	Team Capability	N	0	1	4	11	13	4.24	.803
		%	0	3.44	13.7	37.9	44.8		
	Training & Education	N	0	0	1	12	16	4.51	.574
		%	0	0	3.44	41.3	55.1		
	Requirement & Specification	N	0	2	12	14	1	3.48	.687
		%	0	6.89	41.3	48.2	3.44		

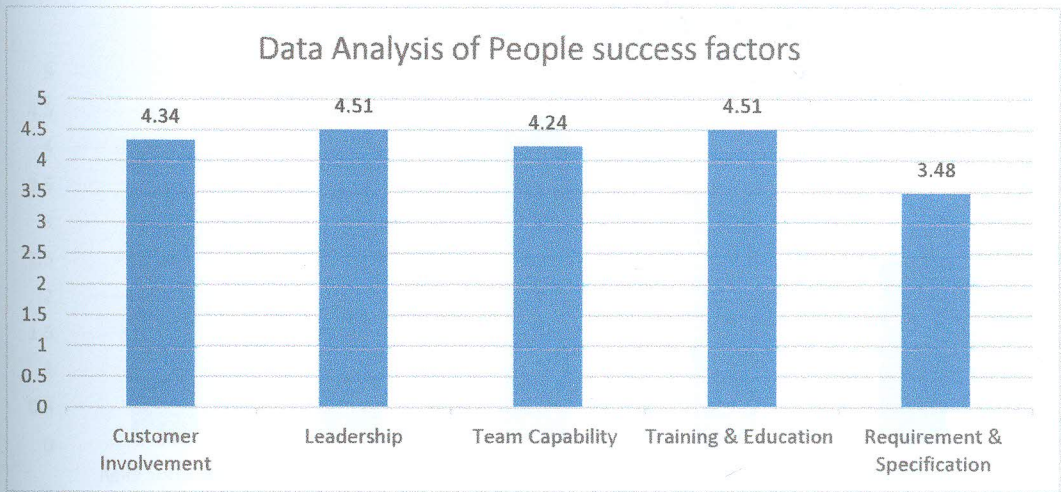


Figure 4.5: Graphical Representation of People success factors

People factor includes variables such as Customer Involvement, Leadership, Team Capability, Training and Education and Requirement & specification. Graphical Representation of People success factors in figure 4.5. The table 4.5 shows that **Leadership and Training & Education** sub factor is most important and its mean value is 4.51. The sub factor **Requirement & specification** has least mean value and it is 3.48.

Table 4.6: Data Analysis of Technical success factors

Dimension	Factors		Level of importance					Mean of Factor	Standard deviation
			Not important	Slightly important	Neutral	Moderately important	Very important		
Technical success factors	Agile Software Technique	N	0	3	5	6	15	4.13	1.05
		%	0	10.3	17.2	20.6	51.7		
	Delivery Strategy	N	0	0	6	12	11	4.17	0.75
		%	0	0	20.6	41.3	37.9		
	Productivity	N	0	0	1	14	14	4.44	0.572
		%	0	0	3.44	48.2	48.2		
	Quality	N	0	0	0	19	10	3.51	0.949
		%	0	0	0	65.5	34.4		
	Performance	N	0	16	12	1	0	2.48	0.574
		%	0	55.1	41.3	3.44	0		

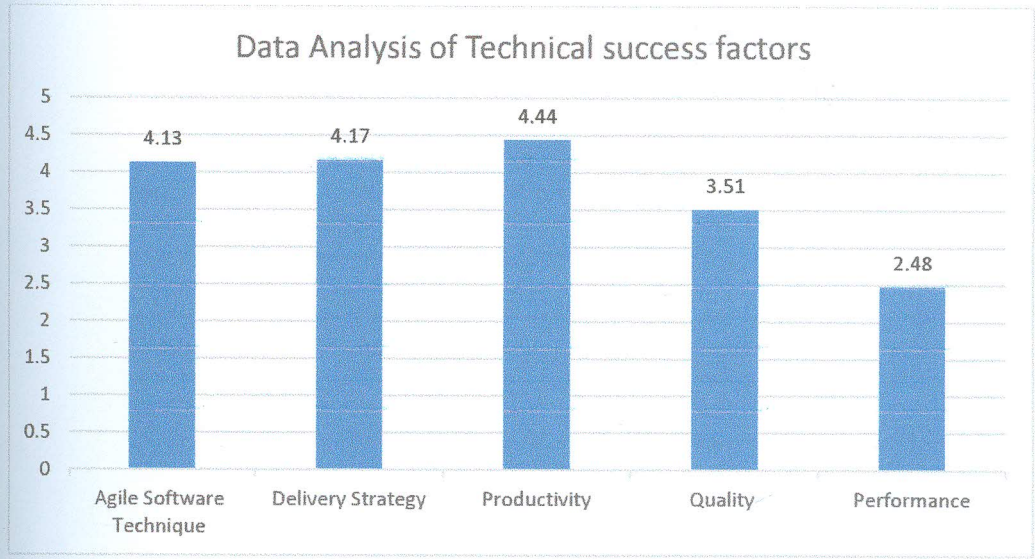


Figure 4.6: Graphical Representation of Technical success factors

Technical context includes variables such as Agile Software Techniques, Delivery Strategy, Quality, Productivity and Performance. In the software industry all around the world, experience can be accompanied by previous obtained technical knowledge [48]. Graphical Representation of Technical success factors in figure 4.6. The table 4.6 shows that the **Productivity** sub factor is most important and its mean value is 4.44. The sub factor **Performance** has least mean value and it is 2.48.

Table 4.7 SPSS Data Analysis

Dimension	Factors		Level of importance					Mean of Factor	Standard deviation
			Not important	Slightly important	Neutral	Moderately important	Very important		
Organization Success factors	Risk Management	N	0	0	5	15	9	4.13	.693
		%	0	0	17.2	51.7	31.03		
	Management support	N	0	0	2	8	18	4.51	.687
		%	0	0	6.89	27.5	62.09		
	Communication	N	0	0	0	15	14	4.48	.508
		%	0	0	0	51.7	48.2		
	Culture	N	0	1	6	7	15	4.24	0.912
		%	0	3.44	20.6	24.1	51.7		
	Infrastructure	N	2	19	8	0	0	2.20	0.559
		%	6.89	65.5	27.5	0	0		
	Partnership	N	15	14	0	0	0	1.48	0.508
		%	51.7	48.2	0	0	0		
People success factors	Customer Involvement	N	0	0	3	13	13	4.34	.669
		%	0	0	10.3	44.8	44.8		
	Leadership	N	0	0	0	14	15	4.51	.508
		%	0	0	0	48.2	51.7		
	Team Capability	N	0	1	4	11	13	4.24	.803
		%	0	3.44	13.7	37.9	44.8		
	Training & Education	N	0	0	1	12	16	4.51	.574
		%	0	0	3.44	41.3	55.1		
	Requirement & Specification	N	0	2	12	14	1	3.48	.687
		%	0	6.89	41.3	48.2	3.44		
Technical success factors	Agile Software Technique	N	0	3	5	6	15	4.13	1.05
		%	0	10.3	17.2	20.6	51.7		
	Delivery Strategy	N	0	0	6	12	11	4.17	0.75
		%	0	0	20.6	41.3	37.9		
	Productivity	N	0	0	1	14	14	4.44	0.572
		%	0	0	3.44	48.2	48.2		
	Quality	N	0	0	0	19	10	3.51	0.949
		%	0	0	0	65.5	34.4		
	Performance	N	0	16	12	1	0	2.48	0.574
		%	0	55.1	41.3	3.44	0		

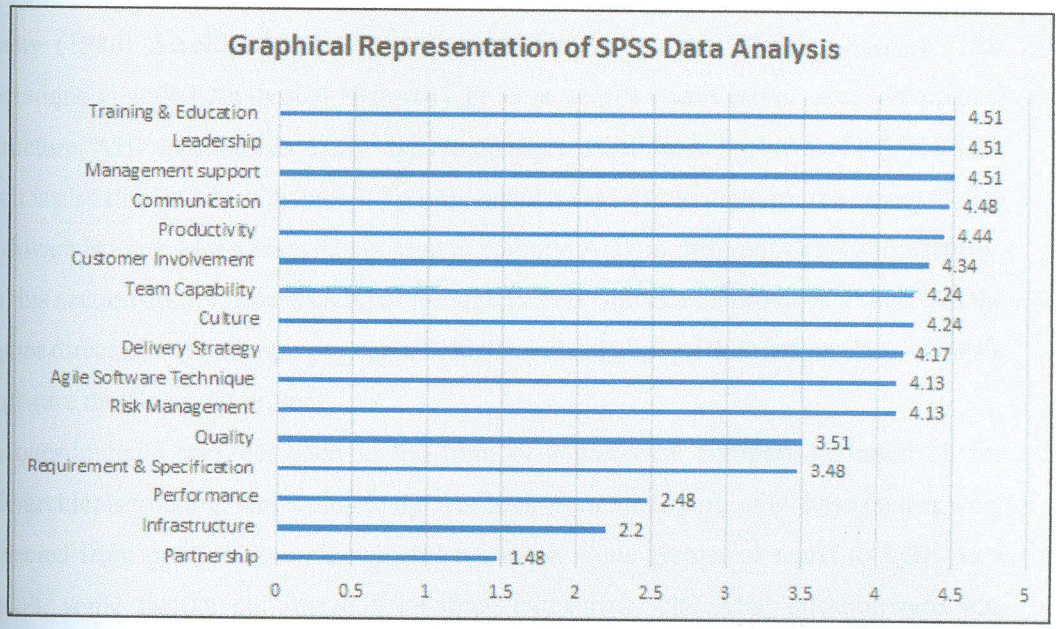


Figure 4.7: Graphical Representation of SPSS Data Analysis

Table 4.7 shows that SPSS data analysis in which "Organizational" dimension includes variables such as Risk management, Management support, Communication, Culture, Infrastructure, and partnership. "People" dimension includes variables such as Customer Involvement, Leadership, Team Capability, Training and Education and Requirement & specification. "Technical" context includes variables such as Agile Software Techniques, Delivery Strategy, Quality, Productivity, and Performance. Graphical Representation of SPSS Data Analysis in figure 4.7. ***Training & Education*** is a sub-factor of "***People***" dimension which has the highest mean value is ***4.51***. Similar, ***Leadership*** and ***Communication*** both are sub-factors of "***People***" and "***Organization***" dimensions which have mean value is ***4.51***. The ***Partnership*** has the lowest mean values is ***1.48***. Table 4.7 is the collective table of all previous tables where all the aspects have been discussed specifically and for the mutual comparison below table has been compiled to have a bird's eye view for all the previous discussions at once. Where SPSS techniques have been utilized to cater to their importance and summed up in a singleton table.

4.5.3 Findings of Round 3

Saaty (1980) developed a strong and helpful technique for decision-making. This technique is called Analytical Hierarchy Process (AHP) and is based on a hierarchical structure. AHP method has many steps to measure the defined problem of this research as it is also discussed in Chapter 3. To implement the AHP and its steps, the expert choice software is used. Many researchers used to compile AHP in different fields successfully. In this section author described AHP through Expert Choice and provides a sketch of the major directions of software project in Pakistan industry in which focus on CSFs of Agile software development project.

A questionnaire was designed in the form of a pair-wise comparison based on the hierarchical structure. According to the feedback from the expert, only those factors were selected from previous rounds, which have mean value greater or equal to 3.50. As a result, some factors eliminated from three categories. The AHP questionnaire was designed based on extracted factors and distributed to most senior's experts among the same group who have more than or equal to 5 years of agile experience, have qualification equal to MS/Ph. D and are capable of well decision making.

4.5.4 AHP Result Analysis

As discussed in Chapter 3, AHP method has several steps to measure the defined problem. These steps of AHP are incorporated by Expert Choice tool. Many researchers used to compile AHP in different fields successfully. In this section author described AHP through Expert Choice and provides a sketch of the major directions in development of the CSFs of Agile software development project.

The steps of AHP along with results are as follow

1. Define Goal or Problem

The first step in AHP is to deal with the structure of the problem and the structure of the problem is to enhancement of CSFs of Agile project.

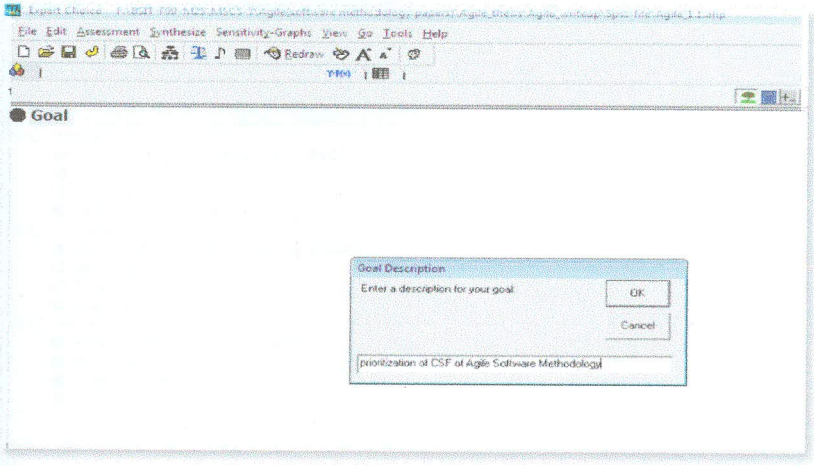


Figure 4.8: Name of Goal Description

2. Identify Criteria and Sub-Criteria

The next step is to identify the criteria and sub-criteria of CSFs of agile in expert choice for applying AHP in which individual enter data of criteria and sub-criteria collected from agile expert.

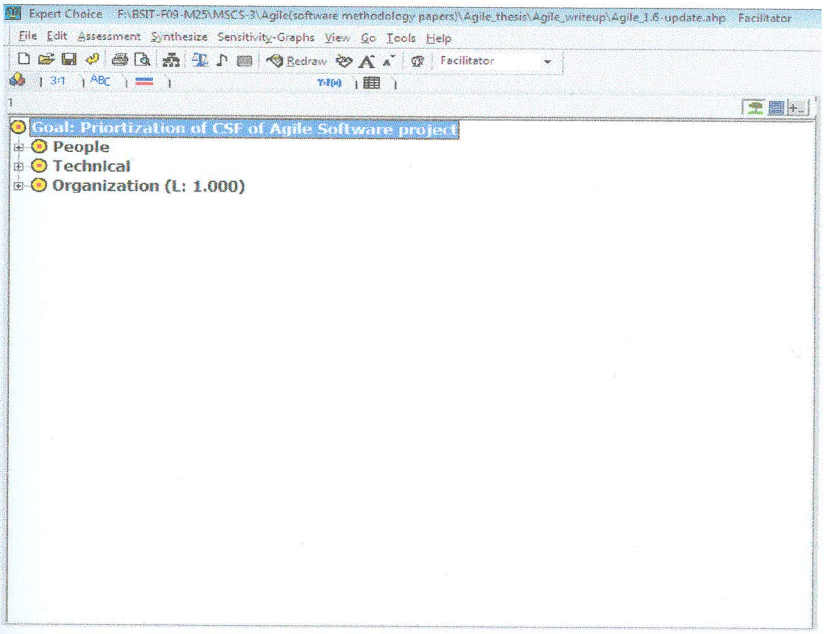


Figure 4.9: Entering Main dimension of Agile project

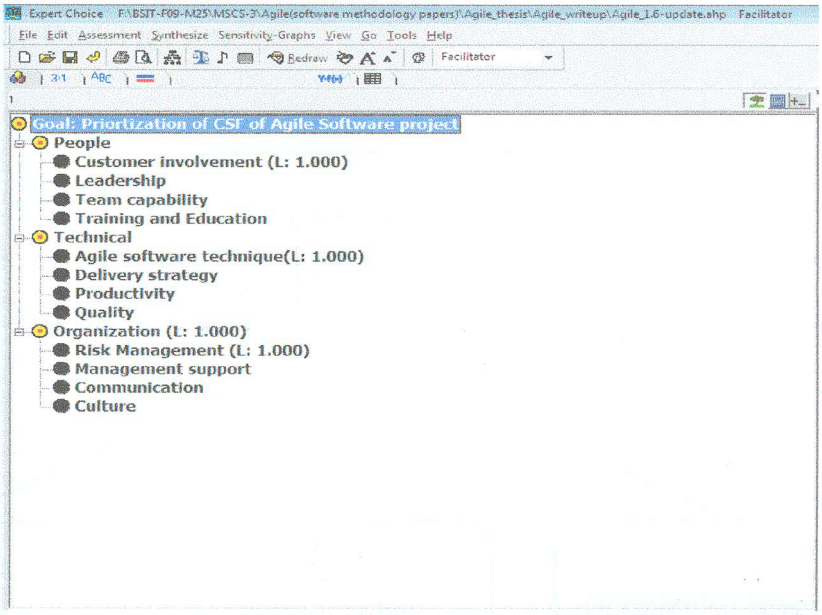


Figure 4.10: Entering CSFs of Agile project

3. Hierarchy Model for Analysis

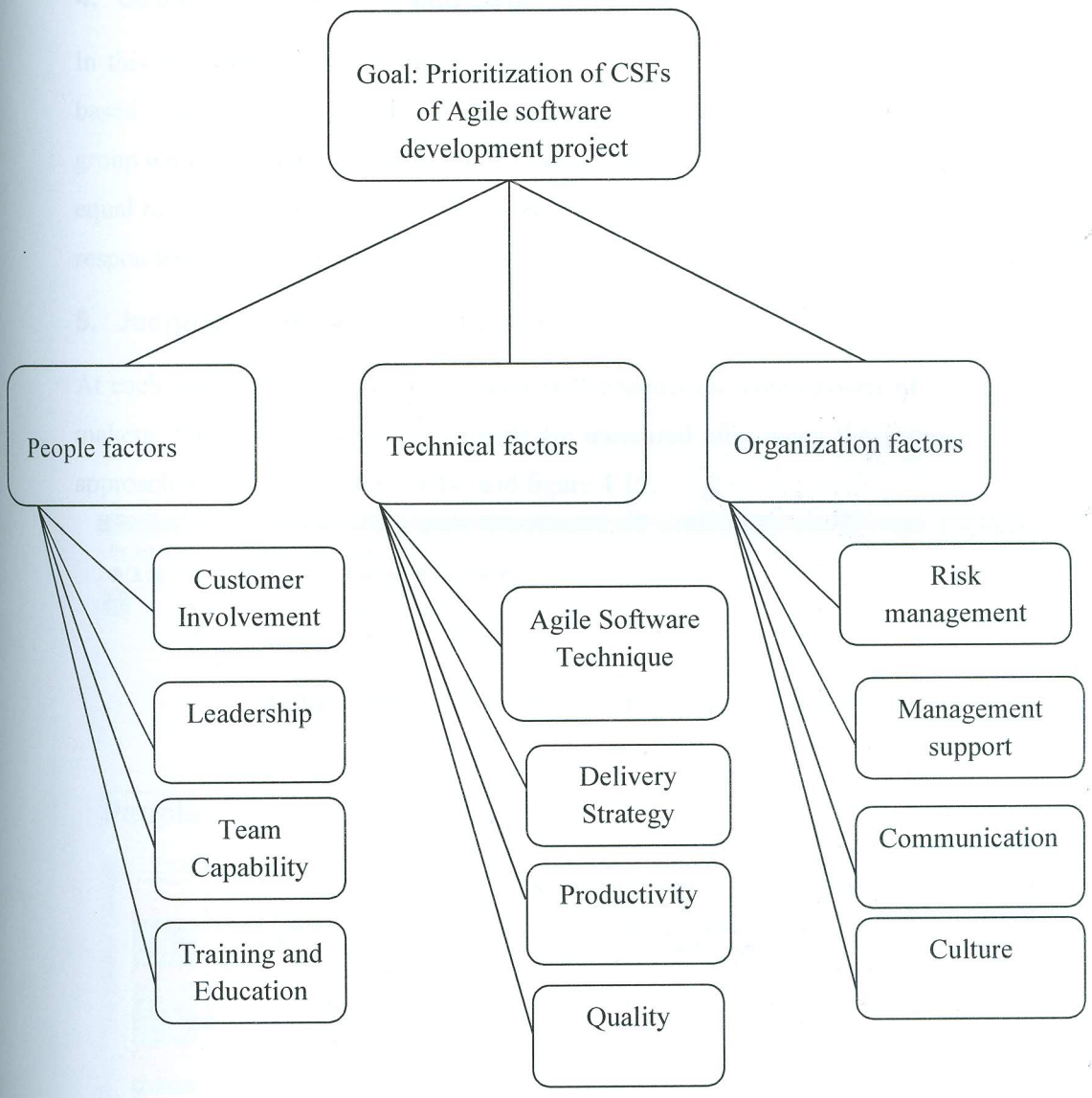


Figure 4.11: Hierarchy Model of CSFs of Agile project

The Hierarchy Model of CSFs of Agile project is designed during the implementation of AHP As, the researcher has extracted 12 factors in three dimensions in previous two rounds of Delphi, which contribute in "A Study to identify, Classify and prioritize CSFs of Agile software development project: Software Engineer's perspective".

Ratings models save time in making pairwise comparisons. Standards of performance are established for each criterion and the alternatives are rated one at a time on each criterion using its standards. Relative models: In a relative model such as the CSFs of

Agile model all nodes are pairwise compared against each other to establish priorities requiring n(n-1)/2 comparisons.

4. Gathered Information and Data

In this step, data and information is collected. The AHP questionnaire was designed based on extracted factors and distributed to most senior's experts among the same group who have more than or equal to 5 years of agile experience and have qualification equal to MS/PhD and are capable of well decision making.We finally got 20 potential respondents for further analysis.

5. Judgment Pair-wise Comparison

At each node of the hierarchy, a matrix will conduct the comparisons of the decision makers. These results from participants are measured after using the geometric mean approach in figure 4.12, 4.13, 4.14, and figure 4.15.

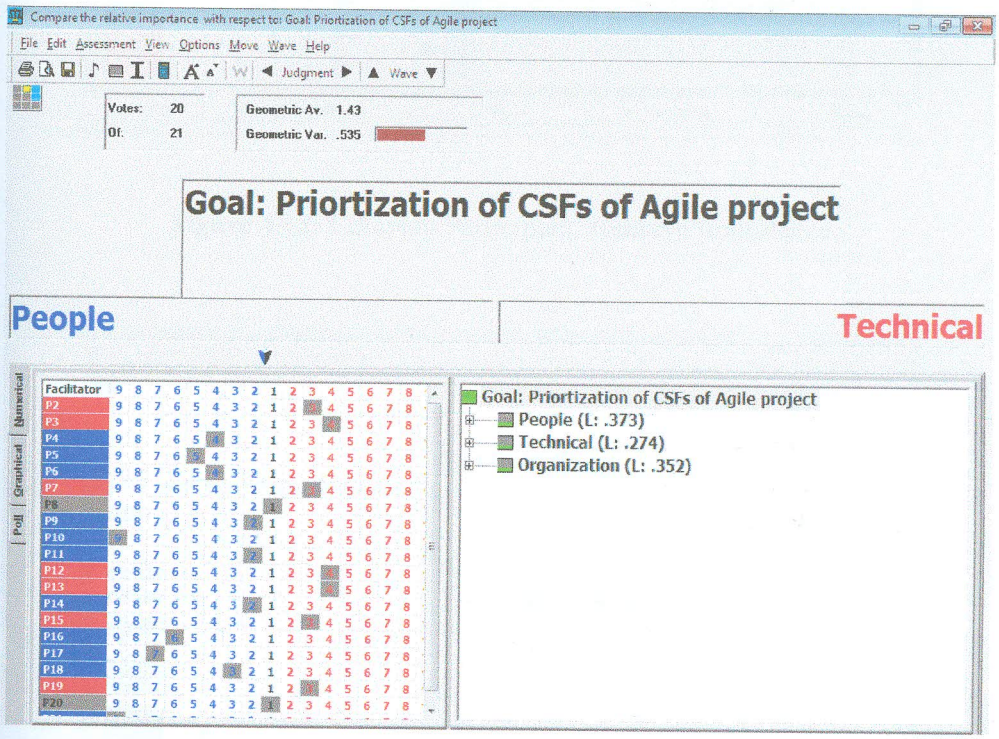


Figure 4.12: Compare Participant' Relative Importance

The above Figure 4.12 shows the relative importance of People and Technical Agile factors. Poeple Agile factor is shown in blue colour and Technical Agile factor is shown red colour. The respondents assigned weight values are also showing in the figure.

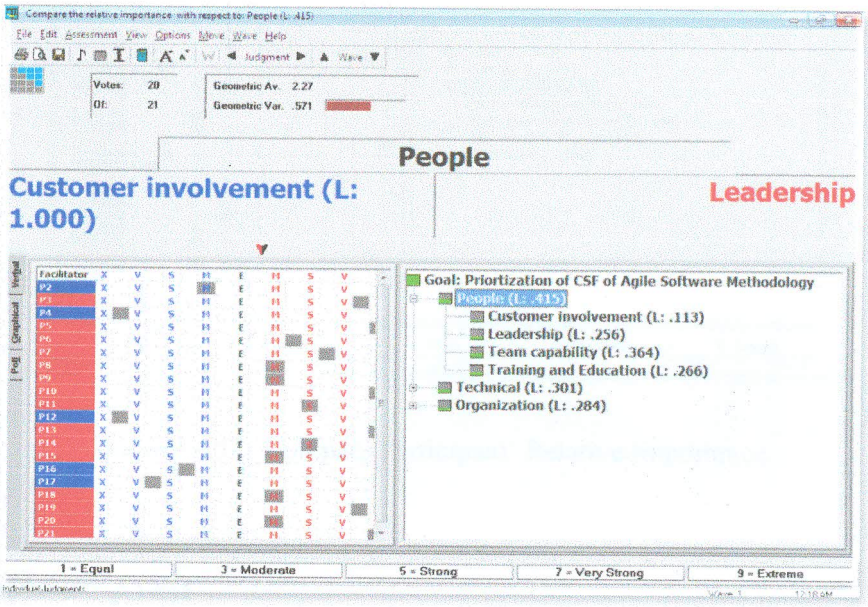


Figure 4.13: Compare Participant' Relative Importance

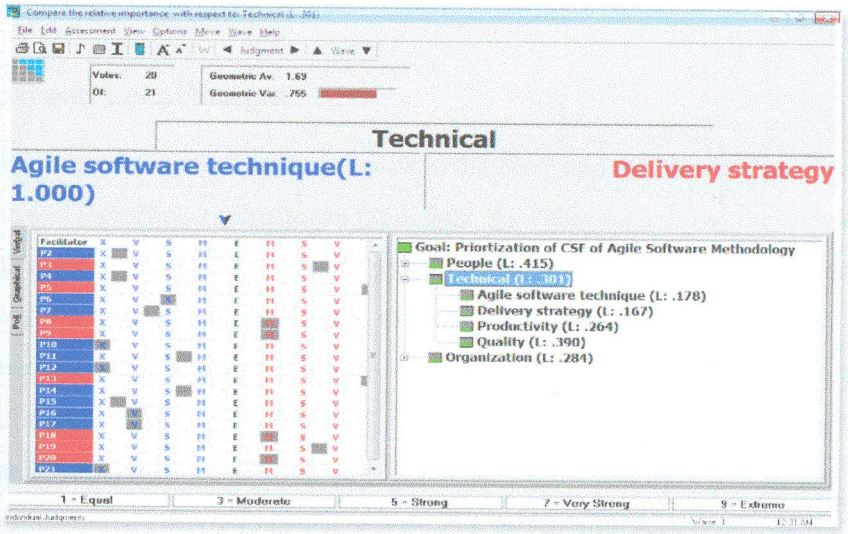


Figure 4.14: Compare Participant' Relative Importance

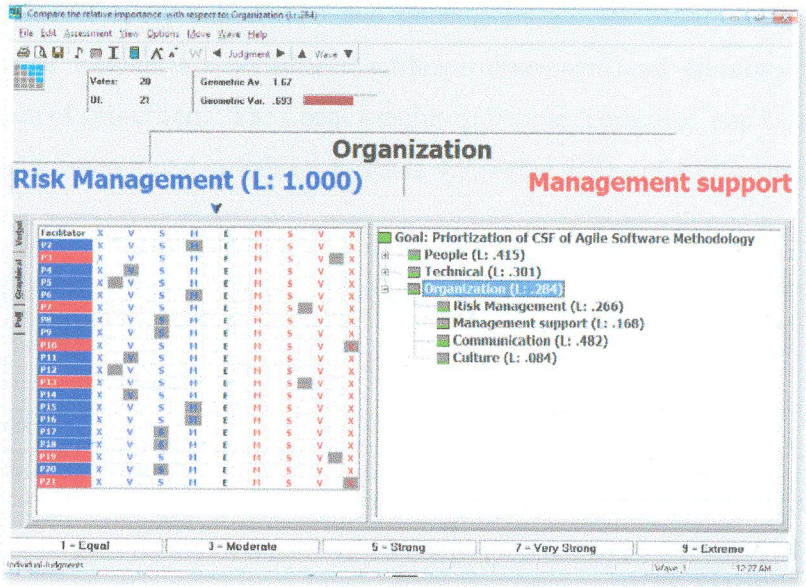


Figure 4.15: Compare Participant' Relative Importance

6. Consistency Test

The consistency test is performed in Expert Choice and online to fulfils the Saaty[49] criteria. The survey responses which have consistency more than 10% are excluded. So, twenty (20) responses are excluded out of forty (40).

7. Global and Local Weight

In this step, Expert choice software calculated the local and global weights of each main dimension and factors according to the input data. As Table 4.12 shows the weights which are globally prioritize of CSFs of Agile project. After prioritizing the key success factors by proposing a model for adopt agile factors that influence the success of software development projects shown in Figure 4.21. Expert choice has calculated the local priorities of each factors of Agile project and then finally generates the global weights that produced the outcomes of this study. The results show that the CSFs factors criterion is the highest ranked criteria to evaluate the CSFs of Agile project.

Local weights of every sub criteria and dimensions are discussed in the following section. Local weights are considered within a dimension and are considered as a measurement of sub-criteria. The Local weights of People, Technical, and Organization' sub-criteria are mentioned in Table 4.8, Table 4.9, Table 4.10 and 4.11 respectively.

Table 4.8: AHP Local Weights and Rank of People factors

Factors	Weights (Local)	Rank (Local)
Team capability	0.364	1
Training and Education	0.266	2
Leadership	0.256	3
Customer involvement	0.113	4

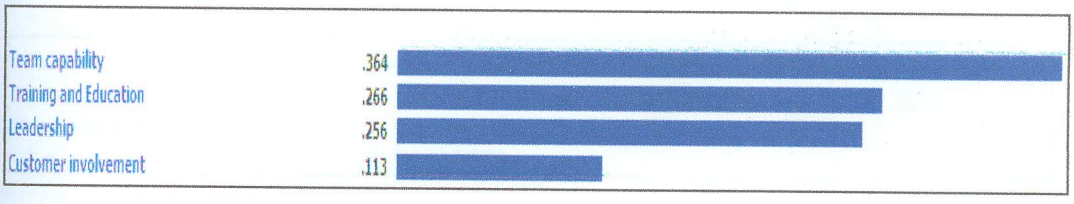


Figure 4.16 Prioritization of CSFs of People factors

The local weight and local rank of People CSFs is shown in table 4.8. The CSF *Team Capability* is most important with local weight 0.364 and *Customer Involvement* is least important with local weight 0.113. Graphical representation of the Rank of People factors is shown in figure 4.16.

Table 4.9: AHP Local Weights and Rank of Technical factors

Factors	Weights (Local)	Rank (Local)
Quality	0.390	1
Productivity	0.264	2
Agile software technique	0.178	3
Delivery strategy	0.167	4

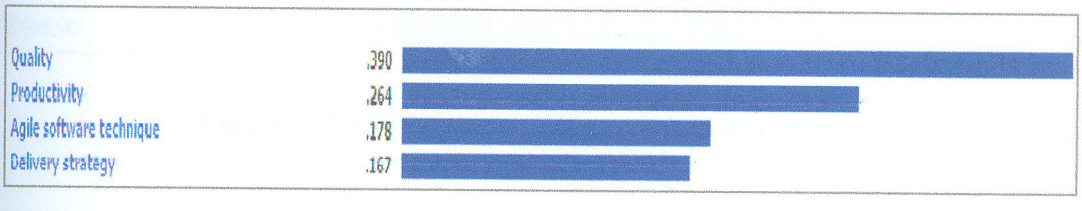


Figure 4.17 Prioritization of CSFs of Technical factors

The local weight and local rank of Technical CSFs is shown in table 4.9. The CSFs *Quality* is most important with local weight 0.390 and *Delivery Strategy* is least important with local weight 0.167. Graphical representation of the Rank of Technical factors is shown in figure 4.17.

Table 4.10: AHP Local Weights and Rank of Organization factors

Factors	Weights (Local)	Rank (Local)
Communication	0.482	1
Risk management	0.266	2
Management support	0.168	3
Culture	0.084	4

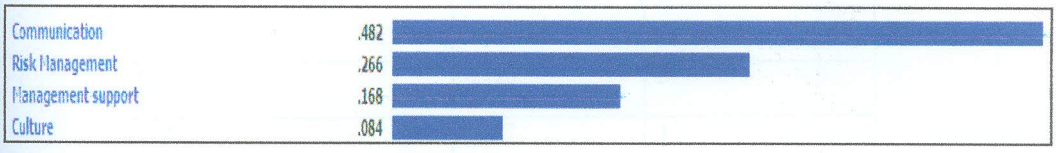


Figure 4.18 Prioritization of CSFs of Organization factors

The local weight and local rank of Organization CSF's is shown in table 4.10. The CSFs *communication* is most important with local weight 0.390 and *culture* is least important with local weight 0.167. Graphical representation of the Rank of Organization factors is shown in figure 4.18.

Table 4.11: AHP Global Weights and Rank of Dimension

Dimensions	Weights (Global)	Rank (Global)
People	0.415	1
Technical	0.301	2
Organization	0.284	3

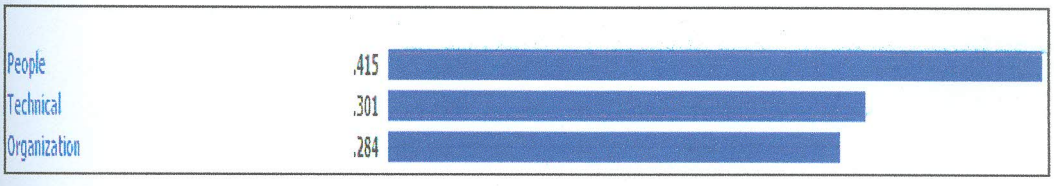


Figure 4.19 Prioritization of CSFs of Main dimension

The global weight and global ranking of main dimensions are shown in Table 4.11. The CSFs of the main dimension "People" dimension has the highest rank due to his highest weight 0.415 and "Organization" dimension has the last rank due to his less weight 0.284. Graphical representation of the Rank (Global) of the main dimension is shown in figure 4.19.

8. Final Ranking of Dimensions and Factors

Table 4.12: Ranking factors (Global) of Agile success project

Factors	Weights	Rank (Global)
Team Capability	0.166	1
Training and Education	0.121	2
Quality	0.120	3
Leadership	0.117	4
Communication	0.114	5
Productivity	0.082	6
Risk manageemnt	0.061	7
Agile software technique	0.055	8
Customer Involvement	0.052	9
Delivery strategy	0.052	10
Management support	0.040	11
Culture	0.020	12

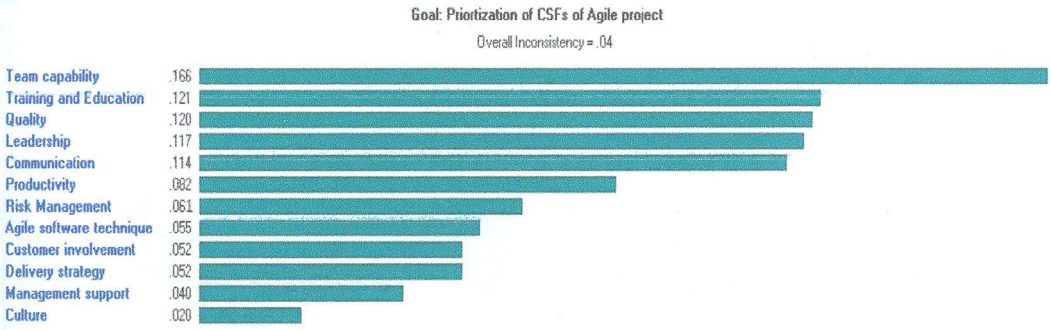


Figure 4.20: Success factors of Agile project in Pakistan

By using the Expert Choice software, the ranking of main dimensions and factors is calculated. Ranking of the main-dimensions People, Technical and Organization are described in Table 4.11. Global priority in Table 4.12 shows the ranking of each CSFs of Agile project in regards to software development success. We could get top twelve CSFs (globally) as follows: communication, quality, Team capability, Training and Education, risk management, productivity, leadership, agile software technique, management support, delivery strategy, customer involvement, culture. Success factors of Agile project in Pakistan shown in figure 4.19. The software industry is in its growing stage in Pakistan. Figure 4.20: shown graphical representation of Agile project factors (global) to move software development project success in Pakistan industry. ***Team capability*** factor is display on top due to its highest weight ***0.166*** (global) to other factors and part of major dimension is called "***organization***". ***Culture*** factor is display on the bottom due to its lowest weight ***0.020*** (global) to other factors and part of major dimension is called "***organization***".

4.6 Overall Weight and Ranking

Table 4.13: Overall Weight and Ranking

Dimensions	Global weight with contribution %	Global Rankin of Factors	Sub-Factors	Local weight with contributio n%	Local Ranking of Sub Factors	Global Ranking of Sub Factors
People	0.415 (41.5%)	1	Team capability	0.364 (36.4%)	1	1
			Training and Education	0.266 (26.6%)	2	2
			Leadership	0.256 (25.6%)	3	4
			Customer involvement	0.113 (11.3%)	4	9
Technical	0.301 (30.1%)	2	Quality	0.390 (39%)	1	3
			Productivity	0.264 (26.4)	2	6
			Agile software technique	0.178 (17.8%)	3	8
			Delivery strategy	0.167 (16.7)	4	10
Organization	0.284 (28.4%)	3	Communication	0.482 (48.2%)	1	5
			Risk management	0.266 (26.6%)	2	7
			Management support	0.168 (16.8%)	3	11
			Culture	0.084 (8.4%)	4	12

Table 4.13 illustrates the weight of and contribution level of main factors and sub factors. The most contributing main factors are ***People*** with 41.5 percent contribution. The most contributing sub agile factor of ***people*** is "Team capability" and its local contribution is 36.4 percent. Similarly, the second (2^{nd}) most contributing main factors are ***technical*** with 30.1 percent contribution level. The most contributing sub agile factor of ***Technical*** is "Quality" and its contribution is 39 percent. The third (3^{rd}) most contributing main factors are ***Organization*** with 28.4 percent contribution. The most contributing sub agile factor of ***Organization*** is "Communication" and its contribution is 48.2 percent.

As the objective of this study was to develop a hierarchical model that can be used to evaluate the factors of Agile project for the software development. Thus, we can conclude a hierarchal model to evaluate factors of an Agile project for the software development as shown in **Figure 4.21.**

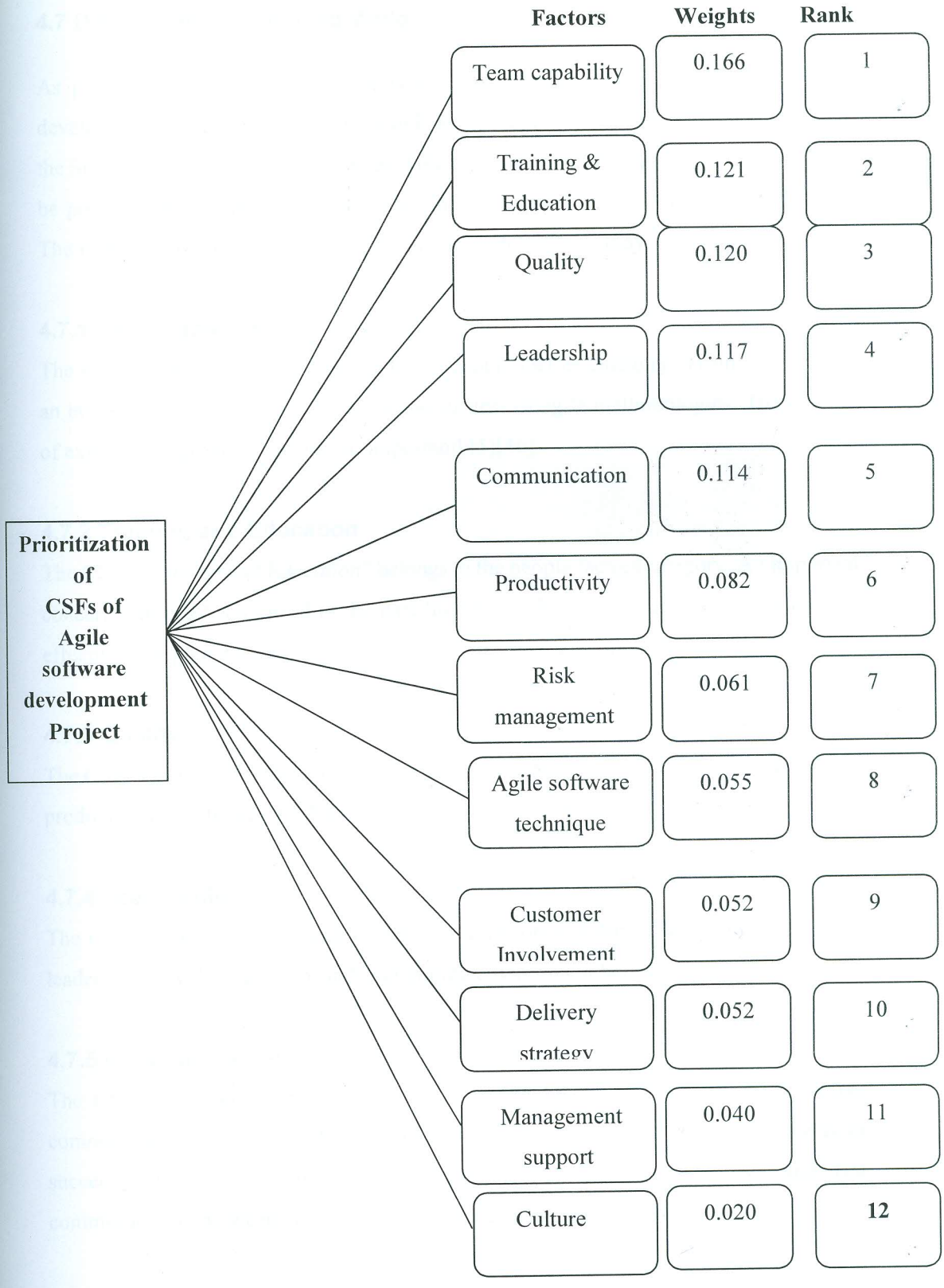


Figure 4.21: Proposed Model of Agile project

4.7 Discussion of Proposed Model

As per the results of this study, it is necessary to change the concept of software development projects success criteria in Pakistan. This result is in line with the study of the Standish Group (2013) that indicated the increase in software project success rate can be predicted by the increasing awareness of the importance of CSFs of Agile project. The following section discusses the proposed model of this study.

4.7.1 Team capability

The CSF "*Team capability*" belongs to the people factors category. Team capability is an important factor that is capable for the success of agile methodologies. The number of experts in a group is considered important[45][46].

4.7.2 Training and Education

The CSF "*Training and Education*" belongs to the people factors category. An important concern that has been raised in the past literature is how much training is required for effectively implementing agile methodologies in an organization[45].

4.7.3 Quality

The CSF "*Quality*" belongs to the technical factors category. Quality refers to whether a product works, whether it fulfils the project stakeholders' needs[4].

4.7.4 Leadership

The CSF "*Leadership*" belongs to the people factors category. The work of an Agile leader is to develop harmony and cooperating environment between team members[12].

4.7.5 Communication

The CSF "*Communication*" belongs to the organization factors category. Effective communication is distinguished as one of the important factors for agile projects to succeed. One of the important requirements for agility is effective and fast communication between engineers, clients and management[12][45].

4.7.6 Productivity

The CSF "*Productivity*" belongs to the technical factors category. Productivity describes various measures of the efficiency of production.

4.7.7 Risk management

The 5th CSF in twelve CSFs, namely the "Risk management" belongs to the organization factors category. Risk management is the identification, assessement, and prioritization of risks taken by coordinated and economical application of assets to minimize and control the probability or affect of unfortunate events or to maximize the realization of opportunities[12].

4.7.8 Agile software technique

The CSF "*Agile software technique*" belongs to the technical factors category. This technique assists teams in responding to the unpredictability of constructing software[45].

4.7.9 Customer Involvement

The "*Customer Involvement*" CSF belongs to the people factors y. The Agile Manifesto advocates clients collaboration as one of the important requirements for successful software development [45][46].

4.7.10 Delivery strategy

The CSF "*Delivery Strategy*" belongs to the technical factors category. Delivery strategy is related to regular delivery of software and appropriate for the context of the project[46].

4.7.11 Management support

The CSF "*Management support*" belongs to the organization factors category. Management support is designed to support the management of an organization[12].

4.7.12 Culture

The last CSF "Culture" belongs to the *Organization Factors*. To be agile is a cultural thing. If the culture is not right, then the organization cannot be agile[45].

4.8 Summary

In this chapter results and findings are discussed. The core purpose of the round 1 was to identify the major factors of Agile software development project that contributes to the success of software project in Pakistan industry. . We got 52 responses from software engineers (Agile experts) and collected those factors that are close to our research. To find the answers of research questions of this study, the key CSFs of Agile projects are identified in extensive literature review and agile expert's opinion. The core purpose of the round 2 was to classify the major factors of Agile software development project and only those factors are selected which have mean value equal or greater than 3.50. Furthermore, a model is proposed to adopt agile factors that influence the success of software development projects.

Chapter 5
Conclusion and future work

In this chapter we are going to discuss conclusion and future work. This chapter also discusses recommendations based of final conclusions.

5.1 Conclusion

Research Objective 1:

Critical success factors are proved to be mandatory to the success of Agile project. Systematic literature review was conducted to collect CSFs of Agile software development project in existing research and some other factors were collected from Agile expert. The survey based on the questionnaire was performed to identify 17 CSFs and in-depth study of each factor. The respondents come from Pakistan industry, and they have enough experience on Agile project. Thus they can provide the effective answers for our research.

Research Objective 2:

A Delphi study, responses of the first round of open-ended questions were analyzed and categorized into a list of filtered survey questions. The purpose is to determine which factors are most or least important and classify the identified factors with agile expert opinions. Due to our survey questions; the answers of software engineers were analyzed using quantitative analysis. Table 4.7 shows that SPSS data analysis in which "Organizational" dimension includes variables such as Risk management, Management support, Communication, Culture, Infrastructure, and partnership. "People" dimension includes variables such as Customer Involvement, Leadership, Team Capability, Training and Education and Requirement & specification. "Technical" context includes variables such as Agile Software Techniques, Delivery Strategy, Quality, Productivity, and Performance.

Research Objective 3:

The top twelve CSFs of Agile software development project in Pakistan are acquired as follows:

1. Team Capability
2. Training and Education
3. Quality
4. Leadership
5. Communication
6. Productivity
7. Risk management
8. Agile software technique
9. Customer Involvement
10. Delivery strategy
11. Management support
12. Culture

The most critical CSF category of Agile factors, and the most critical project success criteria in determining software development projects success in Pakistan is business goal fulfilled.

Strive for continuous improvement of all processes is one of the vital components of the success in the modern, ever-changing world. In IT project, it first led to the transition from strict and "heavy" project management methodologies towards those that are flexible and lightweight. This transition was accelerating during past several years, making agile a new dominant methodology in the information technology sector.

5.2 Limitations of Study

Limitations are basically making some boundaries and policies that are integrated into the research to limited the research toward some specific areas which are going to govern the research like inclusion-exclusion criteria about age like 30 to 45 years old experts are considered only. Any forum of discussion out the mentioned scoped and limited policies are not answerable if questioned upon the research. For example, our research is not accountable for the flaws in agile and the people who are not experts of agile and also not explaining the highlights of the agile project other than agile and the factors not considered to be included in research also. And after a detailed discussion on the factors,

they are ranked and our scope of the study is not covering the excluded factors other than ranked 12 factors. There are some limitations to this as well.

- One of the major drawbacks of being lemmatization is about that the study is that the CSFs is the domain only that need to be discussed only.
- Aspects we are discussing are only biased and biasing toward succession only not in the terms of demerits as that could also be carrying a probability that it should have some demerits as well so research would not be liable to define any demerits as not the constitutional part of the research.
- Another limitation was studied's sampling type. Convenient sampling has been used for the purpose, due to the sensitivity of the topic as it was related to personality and distress, instead of random type.
- One of the delimitations is only agile project engineers who are agile experts are taken for the opinions for the sake of analysis, reason for that is we want to work in the domain of critical succession only and it is not to emphasize upon the margin of lacking in the reliability in analyzing factors and that can be done from the experts only.
- We are going to have the observed and experienced opinions only and that can be done only if we are taking the experts who are already carrying the opinions which are already scrutinized and that can be done with highly qualified like MS or Ph.D. only because they already have been through a sort of the research. Opinions related to lower qualified are not entitled.
- Another factor that is the experience we are not going to consider people less than 5 years as that is the solid experience and that is equal to or greater than 5 years only. Because the opinion of the Experienced experts would be preferable as they have the practical knowledge of success factor as they have gone through them in their official environment in the sense of evolution.

5.3 Recommendation

The result of our study suggests that it is significantly important to change the concept of agile project project development success criteria. The following section discusses the proposed recommendation.

"Team capability" is CSF from people dimension here team refers to the team who have the responsibility to carry out the agile development model. The proposed study suggests the experienced and expert should necessarily be part of the team for achieving success. "Training and Education" is a factor from people category. An important concern that has been raised in the past literature is how much training is required for effectively implementing agile methodologies in an organization. "Quality" is considered to be one of most important critical success factors according to proposed model while following the agile project for agile project management Quality means that either the product is working fine and it entertains the user requirements or not. The CSF "Leadership" belongs to the people factors category. The work of an agile leader is to develop harmony and cooperating environment between team members. The CSF "Communication" has a place within the organization factors class. Effective communication is recognized as one of the essential variables for agile methodologies to succeed. One of the critical prerequisites for the agile approach is the quick and powerful communication between engineers, clients, and managers. The CSF "Productivity" belongs to the technical factors category. Productivity describes various measures of the efficiency of production. "Risk management" is from the organization factors category. Risk management is the identification, assessement, and prioritization of risks taken by coordinated and economical application of assets to minimize and control the probability or affect of unfortunate events or to maximize the realization of opportunities.

"Agile software technique" belongs to the technical factors category. This technique assists teams in responding to the unpredictability of constructing an agile project. "Management support" is a factor under organization factor Management support and is designed to support the management of an organization. "Customer Involvement" is the most important aspect of agile manifesto and it is related to people dimension which encourages developing a team to engage the customer with them for developing the agile project which fulfills customer requirements. "Delivery Strategy" is a part of the technical category which discusses the strategy for delivering the project to the customer in deliverables according to the context of the project. The planned delivery strategy is important for successful project development and user satisfaction. "Management support" is a factor under organization factor Management support and is designed to support the management of an organization. "Culture" is a CSF from the organization dimension. This factor should also be considered according to the proposed model if the culture of an organization is not good it will be a hurdle in achieving success in agile

project development. It is finally considered that below should be recommendations that need to be implemented for improvements at the domestic and international level for the betterment in the domain of agile CSFs.

- First and foremost thing that needs to be catered for the betterment is to recommend the smooth and reliable team capability of the agile project. It is the most important factor that needs to be considered more for improvement when and where required. 0.166 is the weight of the team capability and hence ranked at first place in the 12 factors so should be considered a top priority for future endeavor.
- Training and Education is the most important factor because it is time-saving in the utilization of the agile project and understanding can cause in saving us from a lot of issues not to arise. So to avoid any hazel and issues training is mandatory for the concern agile project and it is recommended that there should be a need to training institutes.
- Quality is equally important in the aspects of the agile betterment so it should be considered the most as a lot of organizations are making their revenue enhanced by the quality of the agile project's. It is obvious that if the quality is poor than there might be issues arises and causes a lot of financial issues and loses toward the company so the quality cannot be compromised.
- A very strong recommendation is to cater the risk in the agile project and work on the policies and restrictions integrated in such a way that risk factor should be almost zero or negligible in using agile.
- An agile project should be designed in such a way that a proportion of the effectiveness of an individual employee and framework of agile contributions to helpful yields. Efficiency should be processed by partitioning the normal yield per period by the complete expenses brought about or assets (capital, vitality, material, faculty) devoured which makes agile productive.
- Agile software technique should be developed in such a way that it should backings teams in answer back to the irregularity of constructing an agile project technique.
- Agile Customer thinking does not deliver unlimited measures of substance that the colleagues need to examine. So it is most important to organize experts to manage a group's abilities, work rhythm and correspondence. What's more, finds a fit between what the group needs to learn, the constraints and chances of the lithe procedure.

- There are a lot of factors that are important but one of the most important is the agile project should be designed to support the Management of the organization I such a way that they are capable of reviewing all the employees and should have all rights to restrict their working and make a check and balance along with monitoring as well.
- Every organization is carrying an organogram that should be followed in accordance with the hierarchy of the company these are the strategies that must be designed toward the agile.
- Customer requirements and needs could be one of the most important factors that can never ever be avoided so it is said that a customer is a pillar upon which the company or an organization is standing. So it should be considered the most at all, that what are the points constructed from the customers given algorithms to be implemented in the agile project.
- Last but not least is the culture of the agile project that needs to be considered and should be focused as well. To be agile is a cultural thing. If the culture is not right, then the organization cannot be agile.

5.4 Future work

Other group aggregation of AHP method such as FGD could be utilized for similar research. FGD will involve the same experts in all stages (the variables evaluation stage, pairwise comparison stage, and ranking analysis stage); hence, result with the same level of satisfaction of the experts is more likely to be achieved. Next, to evaluate the rigor of our CSFs, future work also needs to be conducted to examine the significance of these twelve CSFs in one or more software development project in Pakistan. To assess the extent to which these CSFs hold, further work needs to be conducted to analyze the CSFs ranking on each stage of software development life cycle. Similarly, the result of this study could be also further examined if it is also applicable to specialized area of software development projects, such as ERP, CRM, agile methodology, etc. Likewise, to generalize these CSFs, further research is required to evaluate these CSFs of software development projects towards Asian countries and/or different industries such as telecommunication, banking and constructi

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APPENDICES

APPENDICES A

A Survey on CSFs of Agile Methodology

* Required

What is your name? *

Your answer

Please mention your work email ID *

Your answer

Which Organization you work for? *

Your answer

1. Which of the following best describes your current occupation? *

- ○ Software Development Professional
- ○ Agile Professional
- ○ Management Occupations
- ○ Specified IT Professional
- ○ Software Testing Professional
- ○ Software Maintenance Professional
- ○ Production Occupations

- ◯ Sales and Related Occupations
- ◯ Other:

2. How long you have been using Agile Methods? *

- ◯ <1 years
- ◯ 1-3 years
- ◯ 3-5 years
- ◯ 5-10 years
- ◯ >10 year

3. Which Agile method you used/like most? *

- ☐ XP (Extreme Programming)
- ☐ SCRUM
- ☐ Kanban
- ☐ Feature Driven Development
- ☐ Crystal Clear
- ☐ Other:

4. What is the overall success rate of your Agile Projects? *

- ◯ 20-40%
- ◯ 40-60%
- ◯ 60-80%
- ◯ 80-90%
- ◯ 90-100%

5. What were your key reasons to start agile? *

- ☐ Quality
- ☐ Productivity
- ☐ Predictability
- ☐ Team health

6. What are the key challenges and factors that show software project failure rate for your organization? *

- ☐ Insufficient Communication
- ☐ Unclear and inappropriate requirements
- ☐ Poor project planning and direction
- ☐ Ineffective management
- ☐ Poor stakeholders handling
- ☐ Never Reviewing Project Progress
- ☐ Not Enough Time
- ☐ Insufficient Budget
- ☐ Unsupportive executive management
- ☐ Not use of specific methodology
- ☐ Inadequate testing

7. Which aspects do you consider as the most difficult to adopt? *

7. Which aspects do you consider as the most difficult to adopt? *

- [ ] Customer Involvement
- [ ] Team Capability
- [ ] Management Support
- [ ] Training and Education
- [ ] Requirement and specification
- [ ] Project schedule
- [ ] Agile Software Techniques
- [ ] Other:

8. Which of the following factors importance for your organizations? *

- ( ) Organization factors
- ( ) Project factors
- ( ) Process factors
- ( ) Technical factors
- ( ) People factors

9. What are key success factors to adopt agile methodology that influences the Pakistan industry in terms of success? *

- [ ] Management support
- [ ] Communication
- [ ] Risk management

9. What are key success factors to adopt agile methodology that influences the Pakistan industry in terms of success? *

- [ ] Management support
- [ ] Communication
- [ ] Risk management
- [ ] Culture
- [ ] Customer Involvement
- [ ] Team Capability
- [ ] Training and Education
- [ ] Leadership
- [ ] Agile Software Techniques
- [ ] Delivery Strategy
- [ ] Project objective
- [ ] Project schedule
- [ ] Requirement and specification
- [ ] Project Management Process
- [ ] Other:

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