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Practices and challenges of agile software development methodology
implementation: The case of Ethiopian airlines

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Sep 2021

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implementation: The case of Ethiopian airlines

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Sep 2021

Name and signature of Members of the Examining Board

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_____	Examiner	_____	_____
_____	Examiner	_____	_____

DEDICATION

This work is dedicated to My Lovely Mother who inspired me in every moment of my life! And to all my friends who were beside me during this difficult time and above all, to the Almighty God! Who always gives me the strength!

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First of all, thanks to the Almighty God for giving me the strength to start and finalize this study.

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DECLARATION

I declare that the research is my original work and has not been presented for a degree in
Any other university.

Date

This thesis has been submitted for examination with my approval as university advisor.

Advisor

ABSTRACT

The purpose of this research is to look at the practices and challenges of agile development methodology in Ethiopian airlines and come up with a proposed guide to address the identified challenges. The overall approach of this study was a case study in which data was collected and analyzed using a combination of quantitative and qualitative methodologies. A research guideline was developed based on a thorough literature analyses, and findings of an empirical data. The contents of the survey questionnaires and interview outlines were constructed based on the established research objectives, with some adaptations from available literature and new ones developed as needed.

The study's quantitative component included 72 respondents from Ethiopian airlines application development teams. Each with their own job title, role, and work experience. Interviews were also conducted to obtain data from five members of the airline's IT directors and managers in the qualitative study. Furthermore, document analysis was used as a secondary source of data in order to gather additional information and triangulate the findings. Using the SPSS software program, the quantitative data were analyzed using appropriate descriptive approaches. The qualitative data was examined with open coding approaches.

Findings revealed that Team work related practices were not properly experienced and team work related challenges were the most important predictors of agile development methodology implementation. Expert validation and descriptive approaches were utilized to assess the study's outcome (proposed guideline) in this study. As a result, expert validation was obtained through company mail and survey questionnaires. The proposed framework receives a 4.45 total rating, putting it in the "Agreement" category. Hence, the research process and result of this study is believed to be valid which indicates the usability and applicability of the output of the study. This study is expected to yield insights that will help Ethiopian airlines application developers so as to better understand and implement agile methodology. Finally, it is suggested that the proposed guideline be implemented by prioritizing the team work theme as a priority aim in order to sustain agile methodology implementation.

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LIST OF ACRONYMS

ABAP—Advanced business application program
AFRAA --African Airlines Association
APM — Agile project management
ASD — Agile software development
B2B — business to business
B2C — Business to customers
BI — Business intelligence
CIO — chief information officer
CSFS —critical success factors
DevOps --- development” and “operations
DSDM -- Dynamic Systems Development
Method
ET—Ethiopian airlines
Ethiopian—Ethiopian airiness
FDD-- feature driven development
FFS—Failure factors
IATA-- International Air Transport Association
IT—Information technology
ITMF—Information technology management
framework
SDLC— system development life cycle
SLA—Service level argument
SOP—Standard operating procedure
SPSS—Statistical Package for the Social Sciences
UI— User interface
US— User story
XP—Extreme programing

CHAPTER ONE

INTRODUCTION

1.1 Background

Individuals in today's environment place a higher value on punctuality than on other fundamentals. As a result, one way to save time in this aspect is to choose a fast transportation method. Airlines are one of the most efficient ways of transportation, functioning in a worldwide setting. The airline sector is both a cause and a symptom of rapid economic expansion. On the one hand, it is a development driver since it makes things easier. Transit within large countries or countries with inadequate infrastructure for other modes of transportation, such as land transport. On the other hand, it is a development indicator because its volume is directly proportional to the amount of economic activity as well as the population's well-being. It could also be a sign of the structure of economic growth as a more outward-looking economy be linked to higher levels of passenger or freight aviation traffic. Regarding the dynamic relationship between air transport demand and economic growth, (François & Pierre-Emmanuel, 2016) claimed that competitive air transportation has reasonable beneficial effects on economic growth, resulting in a direct and/or indirect link.

Ethiopian Airlines (Ethiopian) is Ethiopia's national airline. Ethiopian Airlines has grown into one of Africa's top carriers during the last seventy years, unrivaled in Africa for efficiency and operational performance, and has profited for almost all of its existence. The airline, which operates at the cutting edge of technology, has grown to become one of Ethiopia's most important companies and a veritable institution in Africa. It controls the majority of the Pan-African network, including daily and double-daily east-west flights across Africa. Ethiopian presently operates the newest and youngest fleet, serving 100 international and 21 domestic destinations.

The government of the Federal Democratic Republic of Ethiopia owns it wholly. ET was created on December 21, 1945, and its maiden trip to Cairo through Asmara took place on April 8, 1946. Ethiopian Airlines has been a member of the International Air Transport Association (IATA) since 1959 and the African Airlines Association (AFRAA) since 1968. In December 2011, Ethiopian joined the world's largest airline alliance (star alliance).

Ethiopian Airlines (Ethiopian) is the flag carrier of Ethiopia. During the past seventy plus years, Ethiopian has become one of the continent's leading carriers, unrivalled in Africa for efficiency and operational

Success, turning profits for almost all the years of its existence. Operating at the forefront of technology, the airline has also become one of Ethiopia's major industries and a veritable institution in Africa. It commands a lion's share of the pan African network including the daily and double daily east-west flight across the continent. Ethiopian currently serves 100 international and 21 domestic destinations operating the newest and youngest fleet. It is entirely owned by the Federal Democratic Republic of Ethiopia Government. ET was founded on 21 Dec 1945 and began its first flight to Cairo via Asmara on 8th April 1946. The airline has been a member of the IATA since 1959 and has been African Airlines Association (AFRAA) since 1968 and Ethiopian joined the largest alliance of airlines (star alliance) on December 2011. Beginning with its main hub at Bole International Airport, Ethiopian Airlines has aggressively grown its footprint or destinations in all parts of the globe, and now travels to more African locations than any other carrier. ET has been instrumental in boosting the country's economic development.

By initiating from its main hub at Bole international airport, today more than ever before, aggressively expanded its presence or destinations in all directions of the globe and flies to more destinations in Africa than any other carrier. ET has been playing a pivotal role in advancing economic development of the country. Ethiopian Airlines currently has around 128 aircraft, including new Airbus A350 and B787 dream liner aircraft, and transports 700-1000 passengers every day. Ethiopian Airlines has gained control of African airlines by purchasing a stake in them. Tchadia Airlines (49 percent), Air Malawi (49 percent), Asky Air (25.26 percent), Mozambique Air (99 percent), and Equatorial Guinea Airlines (99 percent) are among them (25 percent). (<https://corporate.ethiopianairlines.com>).

Most businesses and the software engineering profession have been altered by the rapid rise of the internet and digital economy. As a result, the classic Waterfall development process has been phased out in favor of the new Agile Development methodology. These new methodologies have been classified as being able to handle business need changes simply, being able to deliver solutions to clients quickly, and being able to deliver solutions on a continuous Iterative development and continuous code integration (Jeffrey A. , 2008). The most widely used agile methodologies include extreme programming (XP), Scrum, crystal techniques, and future driven development (FDD).

Extreme Programming (XP): is the most popular agile methodology that incorporate customers with development team onsite, this greatly help customers believe as full engagement of the team, pair programing, and designing test before developing code, frequent meetings. I.e. team meets every morning to share information and all team members stand the whole time in order to make the meeting on time and short (Verret, 2018), Scrum: is another popular Agile Development method that integrate sprint planning, sprint review and scrum meeting major activities. The sprint mostly ranges two to four weeks only. Future Driven Development (FDD): is a Clint – centric and pragmatic agile software development

method that include five iterative main activates. First, understanding and identifying the fundamentals of the built system. Second those fundamental built are grouped in to related items. Third, plane futures, forth, detail design modelling is done and finally build futures mean programing, testing and packaging of the whole system Subhas & Vinod et al.(2012).

Today's software development process faces obstacles as a result of rapid changes in the environment, confusing user requirements, and time constraints; as a result, software development firms are increasingly focused on the agile requirements in all projects they work on. (Lan &Kannan et al. 2009) Ethiopian Airlines is one of the companies that uses Agile Development. However, using agile approaches comes with its own set of obstacles.

1.2 Statement of the problem

Many companies are currently undergoing complex and frequently changing business environments in order to compete with other businesses. In order to adapt to such a dynamic environment, businesses must respond to new opportunities, a changing economic climate, a changing market, and freshly developed services and products. Information technology (IT) plays a critical role in helping organizations acquire competitive advantages in this regard. Many researchers were interested in software development in the early centuries. However, as time passes, the field will need to examine both customer and business demands, rather than relying just on technology, technical skill, and programming Widia &Puji et al. (2016).

For a long time, the subject of how best to structure software development in order to ensure speedy product delivery has been debated. These disputes demonstrate the complexities of software development and the challenges that businesses confront in improving their capacity to deliver solutions to clients quickly. According to research by Andro, Pael, et al around 63% of software development projects had failed in meeting the deadlines, budget, or quality standards. As a result of these ongoing challenges to productivity, an increasing number of software companies, have been seeking alternative methodology that will improve the efficiency of development and increase the speed of delivery of software products Adriano & Paulo et al. (2013).

In this connection, in order to improve the software development situation, developers and organizations should choose a proven software development methodology that determines the success of software projects in terms of achieving their objectives, as the current business environment requires quick responses. High client happiness, high quality product and service, and cost-effective software products (Oyong & Ekong, 2018). consequently, Traditional waterfall software development methodology which goes with compressive process flow and burdens suffers from various drawbacks it assumes that every requirement of the project can be identified before any design or coding occurs no longer survive (Widia, Puji , & Dana , 2016). In addition, Developers not focused on products or outputs Due to this reason

organization need quicker and simpler approach in software development became the basis of the rise of agile software development methods since it breakdown tasks to simplify and smaller units and modules.

Agile Software development methodology implementation critical success factors, have got much attention by both researchers and business practitioners. Conceivably, focus on factors influencing the successful adoption of agile methodologies in terms of team autonomy and diversity, self-discipline in individual team members, top level management support, top level management support, shared experiences among team members and utility of Documentation. Other Studies have analyzed social factors related to agile Software development, including organizational culture and Team characteristics. Still others have studied practitioners' perceptions of specific agile practices, mainly XP, Scrum or other single agile practices Adriano , Paulo , et. al, (2013).

However, although increasingly examined in the literatures, the concept of agile software development is still not sufficiently understood, especially regarding the outcomes of agile practices and how organization can fully implement and influence agile development methodology by identifying current challenges which hinders the adoption. Most Studies employ empirical, Systematic Literature Review, case study design or a literature based perspective with a few exceptions quantitative research based on large-scale surveys are (Adriano & Paulo et al. 2013) Furthermore, most of the available studies focus on Practices and Challenges in Using Agile Software Development Approaches in terms of Architectural design and Challenges such as Customer related, outside Forces, Developer related, Regulatory Compliance, Organization/management-related challenges, Hybrid of Waterfall and Agile process, Resistance and Development process related on a single agile methodology, generally on XP or scrum. The literature lacks studies that consider a broader spectrum of agile methodologies practices and challenges with both qualitative and quantitative research Kurup (2015).

Traditional software development approaches, according to studies, are founded on a few assumptions, such as a good grasp of the requirements first (which is getting nearly impossible in the current dynamic environment situation). The size as well as complexity of business process is severely increasing in adjust with the continuously evolving software industry. Though, below are a few drawbacks of the waterfall model. Like Requirements need to be solid straight, customer may add or change requirement after the project progressed this may require system redesign, predicting or foreseeing all risks and problems before, bureaucratic nature of the methodology all this contribute for the failure of many software projects Kiran & Rama (2013). So based on above problems and the impact they may have on the quality of Software we delivered this research initiated to study what are the current practices and challenges of agile software development methodology in Ethiopian airlines.

The researcher by (Jouko, Kirsi , et.al, 2016) presents a case study on a government transport safety agency related to challenges with the adoption of agile methods in public organizations. Similarly, the study presented identified challenges in the adoption of agile methods in a governmental organization. Such as documentation, personnel education, experience and commitment, stakeholder communication and involvement, roles in an agile set-up, location of the agile teams, legislation, and complexity of SW architecture and system integration. Despite to this, authors (Gregory, P, L, Sharp, Taylor, KJ, & Deshpande, A, 2016) study on the challenges that process with other development challenge: engaging with agile practitioners' researched that due to the fact agile challenges are interlinked each other, treat in those challenges in context rather than individual is vital. There for, the study address both practices and challenges in context of team work, development process and customer engagement perspectives. In line with this, the above mentioned research recommended further study of agile methodology adoption would be studied both the practices of project management required for agile methods and challenges.

Currently, there are limited researches of agile implementation practices and challenges that are studied in Ethiopia context. Asegid (2019) conducted cross-sectional qualitative research of mainly descriptive type at private banks in Ethiopia. The study attempts to understand the current level of the adoption of the agile methodology at the case companies. Despite these studies, local research attempts did not address both practices and challenges of agile implementation issues in terms of customer involvement, team work and development process on Ethiopian context. More over use of methodologies like agile needs to be studied contextually as there may be different due to infrastructure or team's variation. Even though current software development methodology which Ethiopian adopted is agile; it is not a satisfactory to fully implement the process as well as benefited from it. Rather, it demands identifying current practices and challenges in the implementation journey.

In connection with above facts this research targets to identify practices and challenges of agile Software development methodology. Mainly focuses on current actual practices of use of agile methodology and identify both operational challenges and opportunities as well as proposing general guideline that helps Ethiopian IT Application Development sections get more understanding of Agile and also to produce Qualified Software products with short period of time.

This research explores and answers the following research questions:

RQ 1. What is the current level of awareness and operational practices of agile development methodology with in Ethiopian Airlines Software development teams?

RQ 2. What are the major challenges that currently hinders to fully implement agile Software development methodology within teams?

RQ 3. What appropriate guideline to address challenges related to agile development methodology could be developed?

1.3 objective of the study

1.3.1 General objective

The general objective of proposed study is to identify Practices and challenges of agile software development methodology implementation in Ethiopian airlines and propose an implementation guideline.

1.3.2 Specific Objective

In line with the research questions mentioned above the specific objective of this study are:

1. To identify current practices of Agile in software development process at Ethiopian airlines
2. To identify challenges while implementing agile software development methods.
3. To propose guideline for Ethiopian Development teams based on empirical data findings.

1.4 Significance of the study

This study is expected to benefit both researchers and Ethiopian airline development teams to get more understanding and knowledge of Agile Software development methodology current practices and challenges and opportunities through agile software development methodology implementation. The study will raise the awareness of Ethiopian airlines developer team members about this methodology and encourage them to explore further for better software development and delivery process with in short period of time. The research is expected to produce result that can help to improve System Development life time, facilitate better feed backing mechanize with system users and developers in Ethiopian airlines. This research also believed to propose guideline to Ethiopian System Development teams.

1.5 Scope and Limitation of the study

The scope of this study is limited to identify practices and challenges of agile software development methodology implementation, mainly focus on identifying current practice of Agile and determining both challenges and opportunities while implementing Agile Software development methodology. This research Focus Only Ethiopian airlines organization specifically information system Application

Development Department, agile software development methodology practices and challenges during the implementation.

1.6 organization of the study

This research report paper is organized in to five chapters. Chapter one which is the current chapter describes general background of the study and organization, the problem statement associated with research question, both general and specific objective, as well as significance, limitation and scope of the study are discussed. Chapter two is committed to discuss review of both empirical and theoretical literatures. Chapter three is about research methodology which incorporated research design and research type, data collection method, sampling method used and population of the study as well. Chapter four is focused on data analysis, data description and presentation. Chapter five which is the final one is summarize finding of the study with conclusion and recommendation. It also includes limitation and recommendation of the study for future study.

CHAPTER TWO

LITERATURE REVIEW

2.1 overview

In this chapter the operational practices and challenges of Agile Software development methodology is produced based on the availability of previous researches. In addition to this agile Development methodology implementation related literatures are reviewed to analyses existing research and to clearly show the research gap to rationalize significance of this study. With the purpose of literature to get understanding and theoretical back ground of Agile Software development methodology, researcher accessed different journals, conference papers and articles using the following key words. Agile software development, Agile Practices, Challenges in Agile Software Development, popular-agile-software development technologies, Factors that Significantly Impact Agile practices, benefits and challenges of agile method, Factors that Significantly Impact the Implementation of an Agile Software Development Methodology.

2.2 Agile Software development methodology

Before we go to the concept of agile software development methodology first it's better to know what is the origin and development of Agile in the field of information technology (IT). According to (Jenin), the concept agile software development comes from the project management decline, "Project management is the application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed customer's requirements and expectations from a project". Agile methodologies are a group of software development method that all are based on incremental and iterative development. There are four major characteristics that are main for all agile methodologies are: adaptive planning, iterative and incremental development, short and flexible response for change and highly promote communication. It's used to gain good quality software with in short period of time, high customer collaboration and less documentation, this methodology incorporates the following lightweight methods of families, such as Scrum, Extreme programming (XP), Adaptive Software Development (ASD), Feature Driven Development (FDD), and Dynamic Systems Development Method (DSDM), Crystal, Lean Software Development and others Gaurav & Pradeep (2012).

The Agile Manifesto defines Agrees for Agile software development in 2001 by setting up meeting and signed by the entire seventeen participants. The manifesto Declares: “We are revealing better ways of developing software by doing it and helping others to do it”. In addition to that some of the manifesto members set up agile alliance organization and capture below twelve princes of the manifesto Sonia & Amandeep (2013).

- Our highest priority is to satisfy the customer through early and continuous Delivery of valuable software.
- Welcome changing requirements, even late in development. Agile processes tackle change for the customer's competitive advantage.
- Deliver working software frequently, from a couple of weeks to a couple of months, with a reference to the shorter timescale.
- Business people and developers must work together daily throughout the project.
- Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
- The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
- Working software is the primary measure of progress.
- Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
- Continuous attention to technical excellence and good design enhances agility.
- Simplicity - the art of maximizing the amount of work not done is essential.
- The best architectures, requirements, and designs emerge from self-organizing teams.
- At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

FIGURE 1: PHASES OF AGILE METHODOLOGY (SONIA & AMANDEEP, 2013)



2.3 Popular Agile Methodologies

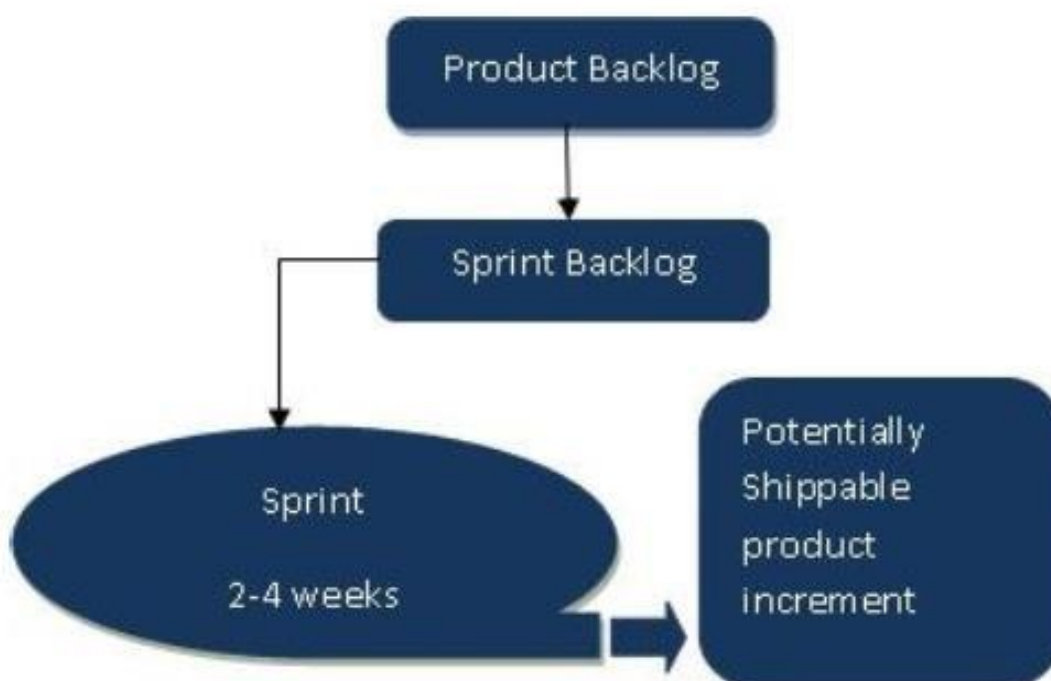
Agility enforce business organizations to act in advance for the changes happening in the environment to increase the benefits, and customer feedback and also welcomed and incorporated in to their products. According to (Gaurav & Pradeep , 2012) some of the popular agile methodologies are described below.

Extreme Programming (XP): Extreme programming (XP). Give more stressed on customer satisfaction rather than delivery time of product. Extreme Programming emphasizes team work and implements a simple and group work style of development. The XP (extreme programming) team not only included developers, managers and customers have equal part of team which work together and deliver high quality product. There are five principles of XP: Simplicity, communication, feedback, courage and quality work of team. But, Extreme Programming (XP) is not suitable for distributed teams because XP support collaborative code ownership which means no module is owned by a single person and that is the advantage of XP because it speeds up the development process and also helps in detecting errors and faults at coding phase which improve the effectiveness of software.

Scrum: Scrum is another popular agile method for the development of software. Scrum is different from other methods Due to the idea of practical experience rather than theories that is known as “empirical process control”. In Scrum, project is divided into compact work sections, known as sprints, which are typically one to four weeks in duration. At the end of each sprint, stakeholders and team

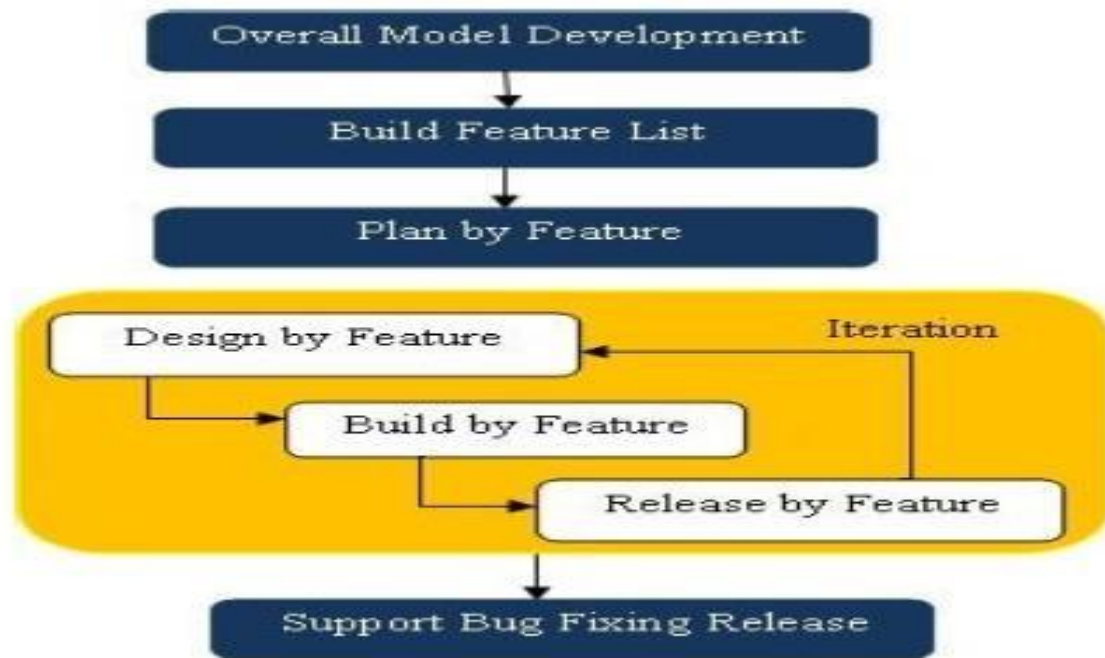
members meet to estimate the progress and make plan for its next steps Sonia & Amandeep (2013). There are three roles in Scrum, product owners who is responsible for communication on the product to development team and representing customers need on their requirements, Scrum master is responsible for facilitating of product owner and teams, team member are responsible for the actual work usually consisting of up to seven cross sectional members. In Scrum projects are divided in to different work sections called Sprint, which takes usually one to Four weeks' duration. All Finally each of Sprint, all stockholders and team members are meet in order to estimate of the project current progress and also plan for the next step.

Figure 2 : SCRUM METHODOLOGY (Sonia & Amandeep, 2013)



Feature Driven Development (FDD): SDD is client- centric, Architecture- centric agile method which includes five main activities that are performed iteratively. Firstly, the Overall model is developed. Secondly, a features list is developed; grouping of them into related sets. Third is plan by feature; it is the identification of class owners and the identification of feature set owners is done. Fourth is Design by Feature includes detailed modeling. Fifth and the final one is built by feature that includes programming, testing, and packaging of the system.

Figure 3: FDD Methodology (Sonia & Amandeep, 2013)

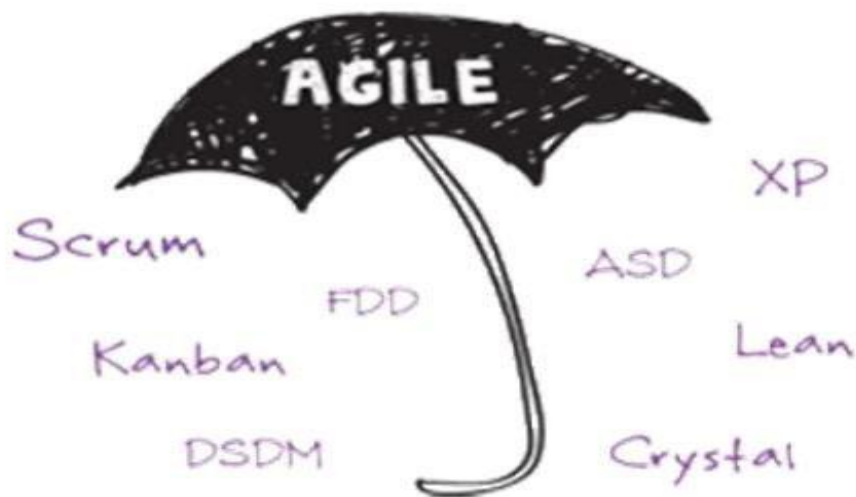


Crystal Method: Crystal method is an agile software development methodology developed by Alistair Cockburn in which people are highly emphasized in the software development process rather than tools and process. In crystal method small teams, not life critical and small projects are treated. Crystal Methods is a toolkit or collection of methodology elements that organizations combine into appropriate methodologies to suit individual projects Livermore (2008).

2.4. Practices of Agile Software development methodology

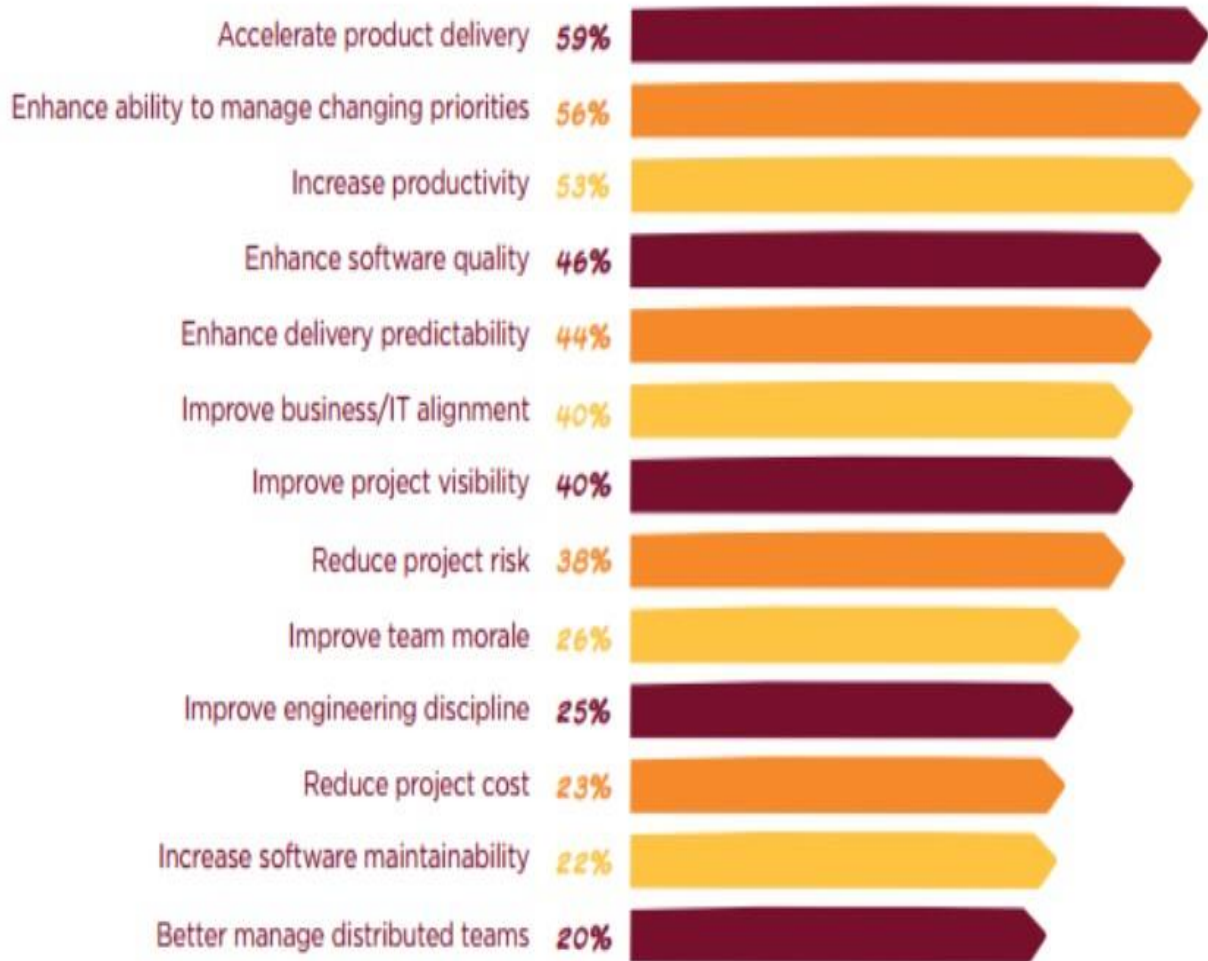
Many agile methods have arisen in recent years, and they are now used and implemented in a variety of industries. While these methodologies share many of the same agile principles, traits, and practices, each methodology has its own set of techniques and vocabulary. As agile popularity and acceptance in businesses has risen, so has the number of practices and techniques. Below Diagram shows many of the practices of agile methodology under agile umbrella Kurup (2015).

FIGURE 4: AGILE PRACTICES (Kurup, 2015)



According to (Kostić, 2017), the main objective of agile methodology is to deliver a working code as early and as efficiently as possible. So as to achieve this purpose, process is divided into iterations. Rather than setting of a final project goal, each Iteration has as an objective to produce the working code which is primarily respond to the Customer needs, and secondly to the needs of the final software. On the other hand, according to the researcher, in agile development method the analysis and Design models, as well as software Documentation do not have such an important Role in the development process. This is the Point which is most often getting criticism among the agile approach opponents. They pointed out that the result of the lack of proper Documentation and models, especially when they are a part of large, complex systems, is quite often an organization to a memory loss.

Figure 5: Reasons for choosing Agile in an organization (Kurup, 2015)



In today's business world agile practices have had a clear impact on the technology industry, by supporting increased communication among teams, increased quality and productivity in teams and their products when implemented successfully. However, adopting fully and using effectively this agile practices still presents a significant challenge to teams and organizations (Brendan , James, et al 2019) Listed below are some of the features where agile method is more advantageous than other methodologies:

- ✓ **Dynamic Requirements** - Due to the highly competition among different companies today, it is more than likely that the requirements might not be clear cut. Agile becomes the potential solution, as the process is defined to Show a working model to the client so as to understand and confirm.
- ✓ **Iterative Nature** - The initiatives during the agile manifesto which are iterative in nature also fall into the best fit category, as Agile itself is iterative in nature. Most of the product development efforts fall into this category. The delivery is done in the form of small increments eventually.

- ✓ **Active User Involvement** – For software projects with these factors, agile is positively recommended. User and product owners play a significant role in developing the final outcome of the project.
- ✓ **Skilled, Equivalent Team** -As agile methodology focuses on delivering the required changes in a fast and efficient manner, it is demanding to have a skilled team. And if that team remains unchanged for the entire project duration, it's an environment where agile can succeed on.
- ✓ **Acceptable cost of failure** – This factor is almost a pre requisite to agile project management. Working on an iterative model, there should be some space planned to accommodate failures.

2.5. Challenges of Agile Software development methodology

The challenges of agile practices in different project and organizations that motivate the adoption level of agile practices are studied in the following perspective (Lan & Kannan et al. (2009).

Development process-related challenges

Agile methods value a working system over documents No formal architecture design is included in a typical agile approach or methodology. Agile methods such as XP advocate continuously refactoring code to Improve code quality and system architecture. However, lack of architectural scalability can raise a serious concern for relatively large projects. Without a formal design phase, many design problems may be missed for example, agile development teams may make lost architectural mistakes due to inadequate attention paid to architectural design.

Customer-related challenges

Agile methods such as XP depend on inputs from on-site customers Rather than predefined requirements documents. The main point is not how to minimize changes in a project but how to better handle inevitable changes throughout the life cycle of the product. Agile methods respond to this expectation by adopting strategies designed to reduce the cost of change throughout a project. By closely working with on-site customers, the team can obtain immediate feedback and information. However, customers' insufficient knowledge of the requirements due to the complexity and size of the system pretenses significant challenges, these challenges are even more pronounced when customers are not available or not willing to release to the final project.

Developer-related challenges

Agile methods usually depend on tacit knowledge embodied in development teams. All team members collocate in the same room. Stand-up meetings among team members usually take place daily. Critical decisions may be left undocumented. There is a lack of formal history of the project for team members to trace and understand the evolution of the system. Communication strategies

adopted by agile methods work well for small, highly cohesive teams. However, their use in large, complex projects may result in several challenges. Informal communication may not be effective when dealing with a large number of stakeholders and vast amounts of information or requirements.

Organization/management-related challenges

Agile methods recommend decentralized decision making. Every team member is informed on the progress of the project and is empowered to make decisions on his/ her own. Agile methods work well in organizations that have a uniform organizational structure. However, in organizations that are used to deep hierarchical and centralized decision-making structure, they may conflict with the organizational culture and diversity causing resistance between top management and team members.

Despite the several advantages of Agile and the fact that the agile trend or practices is still on, today there are some challenges of implementing agile in organization. Most organizations cannot totally ignore the agile practices, but the implementation of agile methodologies is likely to present several difficulties for those saturated in traditional systems development. Some of the known disadvantages of agile development are as follows Godfred & Joyce et al. (2019).

- I. **This dynamic methodology is not suitable for processes that require a complex decision making:** Since the initial plan is not Define well, the final product can be completely different than that was initially defined.
- II. **Insufficient experience with agile methods:** agile seems simple but it requires skill and experience so as to implement successfully. This is what many project management practitioners fail to understand. In terms of skills and experience of the team, as compared to traditional method Agile is rated low.
- III. **Little understanding of the wider organizational change needed:** Adopting Agile requires a complete shift from and sometimes the curtailment of the status quo, and this is understanding is not too clear to managers • Philosophy or culture of the company in contradiction with agile principles: Any form of culture of an organization in contradiction to the Agile culture will not augur well for the thriving of
- IV. **Less foreseeability:** Developers are unable to quantify the full extent of required efforts for some software deliverables. This is principally true for larger products at the start of the development life cycle, and eventually leads to frustrations.
- V. **More Time and Dedication:** all stakeholders such as Testers, clients and developers must communicate with each other on an ongoing basis. This includes countless face-to-face discussions because they are the best way to communicate. Everyone engaged in the project must cooperate closely. Customers need to be accessed and engaged in each of the stages. This may guarantee

that the item meets the expectations of the customer, but it is difficult and time consuming. This requires more time and energy from all involved.

- VI. **Greater Developer and Customer Demands:** These principles involve close cooperation and comprehensive participation of users. Although it is an engaging and rewarding mechanism, it requires a great dedication to guarantee achievement throughout the project. Customers must be trained to assist in product development. Any absence of customer involvement will affect the quality and achievement of the software.
- VII. **Lack of documentation required:** Because software requirements are clarified just in time for development, there is lack of or less comprehensive documentation. This leads to miss understanding and problem on the information of certain characteristics on which how they need to conduct when new employees join the teams.
- VIII. **Technology (Tools and Techniques):** This challenge is related to suitability of current technology infrastructure and instruments, it's so difficult and nearly impossible for an organization to change configuration, technology, tool and method to new one especially when the current methodology using are working perfectly. This is the major challenge that most organizations find it difficult to adopt agile.

2.6 Related Works

Godfred & Joyce et al. (2019) have been studied the characteristics, benefits and challenges of agile IT project management: a literature based perspective by reviewing of literature of peer reviewed papers collected mainly from Google Scholar. In this study, Agile and traditional method of IT project management are compared and both advantages and disadvantages are also discussed based on the three points, team work, collaboration, and self-organization. Generally, this study was aimed to give more understanding on the concept of agile IT project management, to help IT project management specialists realize both benefits of agile IT project management over other methods, and to give practical suggestions on how to successfully implement agile IT project management in an enterprise.

According to the researcher, Agility is defined as, “moving quickly and easily”, whereas agile project management is a conceptual software engineering framework in which software is constructed within a comparatively brief duration of time and has several repetitions that result in stable software release. The authors in this research characterize or differentiate Agile and traditional methodology using the following areas: development model, focus of the project, the

management of the project, customer’s involvement, technology view, developers view, product future, documentation and testing.

Table 1: comparison between Agile and traditional method (Godfred & Joyce et al. 2019)

Categories	Agile method	Traditional method
Development model	iterative	Traditional(sequential)
Focus	people	process
management	facilitating	controlling
Customer	On- site involved	Requirement and phase final
Developers	collaborative	Work individually
technology	Object oriented	any
product	Most important first	All included
testing	iterative	End of phase
documentation	Only when needed	full
Design process	Rule driven	Not formal rule, iterative
goal	Adaptation, flexibility and responsiveness	optimization
Problem solving process	Learning through experimentation and introspection, constantly reframing the problem and its solution	Selection of the best means to accomplish a given end through well planned Formalized activities
Type of learning	Double loop/Generative	Single loop/Adaptive
Key characteristics	Collaboration, communication, exploration and creativity	Control, Direction and formalize innovation
View of the environment	Stable	Difficult to predict
Rationality	substantial	Technical/Functional
Knowledge management	explicit	Tacit
communication	informal	formal
Customer roll	Critical	Important

Development model	Evolutionary delivery model	Life cycle, waterfall, spiral model
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Additionally, the study discussed challenges and disadvantages of traditional method and benefit of agile to overcome the challenges, some of them are listed below: Management principle leads to scheduling problem, often resistance to change due to sequential nature, Requirement definition is labor intensive, Testing is always the end of the product, the plan does not consider dynamic change of user requirement, Process management is based on the volume of the requirement, Huge and slow. In contrast to that researcher Listed out Advantages over traditional method, agile enable us to make modification after original schedule phase, adding features at any stage is simple, project priority is checked at the end of the spirit and give people to motivate and cooperate. Even though agile methodology has many advantages, authors mentioned out some challenges for implementing this methodology today.

- Initially No predefined project plan
- Due Its dynamic nature requires complex decision making
- Insufficient experience with agile method
- More time and dedication
- Grater developer and customer demand
- Lack of proper documentation

Finally, the study conclude that agile methods are gaining and enjoying more popularity among industry players due to the overpowering benefits over the traditional methods. Regardless of this, traditional methods continue to be the easy choice of many industries when it comes to IT projects and systems development because change is a difficult thing, and moreover a change that has to do with a total re-orientation and the development of new skills altogether. Researcher recommended the question “why do we want to go agile?”, “why they need to be agile “and “what kind of agile projects they need to be” as future research.

Verret (2018) Researched Challenges and best practices of agile methodology implementation. The objective of the study was to scientifically review scholarly Articles in order to describe,

Demonstrate, guide, and analyze the efficiency of agile processes with regard to project success, to understand how agile methodologies applied precisely to Information technology (IT) projects for better understanding and successfully deployed in an organization, and how agile methods may be maintained to achieve greater project Stakeholder engagement and higher levels of project success. The researchers used advanced search function of the Google Scholar, UO Library system search engine to filter latest literatures as a research strategy. Once they collected samples of three or four journal articles researchers recorded on to Zoter.

The study analyzed both critical success factors (CSFS) and failure factors (FFS) which were identified with different scholarly Articles about Agile methodology practices. After a review of the literature the authors identified 39 CSFS categorized with in five main dimensions, namely people, organization, technical, project and process. On the other hand, researchers identified 19 FFS which were categorized in four dimensions, such as People, organization, technical and process. Multi-national web survey was employed to collect real-world data about the most selected twelve CSFs of agile methodology. Based on These twelve CSFs authors created the twelve hypotheses of the study and covered four success dimensions: quality, scope, time, and cost.

Articles, researches and case studies described in this research was represented a broad Range of analyses, experience, styles, and scale. The most Common success factors identified in the research were listed below:

- Strong communication amongst all interested parties is highly important
- Communication is better face-to-face, and teams are better when co-located
- Investment in training and coaching pays bonuses
- . Management must understand agile methods if they are to support these methods
- Empowered individuals and teams are engaged; success with agile depends upon.
- Utilize an agile approach to deploy agile methodologies in an iterative and prioritized fashion, measuring success one piece at a time rather than all at once.

Beside that the following are some of the most frequently cited challenges identified by the researchers:

- Organizational inertia is a powerful force,
- clear strategies to overcome inertia must be developed
- Expectations of all involved parties are not aligned. Clients, project managers, executive management, IT teams, and all others involved in an agile initiative must have clear understandings

of their roles in an agile development environment and what to expect, and what not to expect, from others.

- Mistaking minimal documentation for insufficient requirements. This review study was serve as a guide for both project managers, program managers, PMO leaders, team managers, and other stakeholders living upon the implementation of agile methods in their organizations.

A study by (Burman, 2015) analyzed practice of hybrid methodologies from two different firms and places the results in the Information Technology Management framework (ITMF) that help to answer formulated research question. Researcher use multiple case study to answer below two research questions:” How are hybrid agile methodologies enacted in practice in mature agile teams and why are they enacted in such a way?” Authors in this study stated that traditionally methodology had issues relating Theory with practice and among the reason researcher’s showcases are the lack of adoption of methodologies, lack of empirically and theoretically connected research and lack of customization methodologies. The study differentiates methodology and method, methodology is defined as: “A systems development methodology is a recommended means to achieve the development, or part of the development, of information systems based on a set of rationales and an underlying philosophy that support, justifies and makes coherent such a recommendation for a particular context. The recommended means usually includes the identification of phases, procedures, tasks, rules techniques, guidelines, documentation and tools. They might also include recommendations concerning the management and organization of the approach and the identification and training of the participants” Whereas method is defined as: “a collection of Techniques approaching the use of a tool”.

The researcher used Qualitative data through semi structured interviews. Moreover, past literature studies, journal articles. And researcher used Snowball sampling techniques to represent the entire population. Accordingly, the researcher utilized the data gathered from the case studies and designed ITMF (Information technology management framework), “ITMF is a framework created to allow an organization to gather Information from multiple projects that are using different methodologies and frame it within a common framework lifecycle”. Which helps to increase accuracy of the study and gives the sample a wider depth in correlation to the interview samples. Authors used ITMF to give common ground and concept with in several methodologies and easily understanding.

The study identified five structure of ITMF which represents the overall lifecycles. Request stage: defines general objectives and goals of the project and motivates the need for change.

Define stage: define the requirements and specification and plans the execution of the project together with the project stakeholders. This stage produces a common position between the stakeholders of the software engineering project and the delivery areas, which could be in several forms ranging from requirement documents to storyboard cards or a prototype.

Build stage: the construction of the delivery areas through procurement of resources needed for the project as well as the development and internal tests of the deliveries. In many methodologies this stage would go under the implementation concept.

Deployment stage: is the integration of the deliverable into the business level where testing will be done within the environment where it will be eventually run. For instance, this stage would fit within the testing stage and verification within the SDLC methodology.

Run stage: the transition from completed requirements by the project owners to business ownership of the deliverable. It also contains the support given after the project have delivered and closed its teams.

Finally, researcher presented the result by dividing in to two separate categories which are Enactment in practice and Rationality behind the methodologies mainly focus on External factors are like customer interaction. Researcher concluded that the challenges for practicing between hybrid methodology and agile methodology are commonly external. Although researcher evidenced that a waterfall state of mind among development is a Force of habit that greatly affects development process. And also agile adoption need for a greater understanding of the arrangement between the external actors and software development in order to understand how agility is enacted in practice. The traditional boundary or gap between IT and the business mentioned as a factor for the practices.

Papadopoulo (2014) have studied the practice for moving from traditional to agile software development methodologies on large and distributed projects by conducting case study analysis with in two software and service companies namely, Telematicum Inc. and smart client. In this study proved that agile development methodology has better than traditional methodology with regard to product quality, customer perception, for better communication and collaboration among the teams and customer satisfaction. Besides that, Geographical distribution teams and software development process in terms of Agile and traditional methodology were discussed. As per the researcher traditional method helps for easy translation to distributed system due to its clear organized structure and in-depth documentation, whereas moving to large distributed team is not straightforward in agile methodology. Despite the above the study mentioned that the motivation using Agile methodologies for large and geographically distributed projects have same benefits

like achieving customer satisfaction, providing quality software, better flexibility and responsiveness.

The researcher identified four organizational factors in order to balance organizational structure and agile methodology relationship. I.e. organizational design, decision making, collaboration and coordination and agile culture. Agile culture which as practiced in small and collected members should be changed when we used Agile on distributed projects. Multi team- backlog, multiple meeting, organizational agility and scaling up infrastructure are discussed to scale agile practice. Author described the results of traditional and agile development methodology for the two selected case study company on the following main categories: Quality improvement, Enhancement or change request, Employ satisfaction and Customer satisfaction.

Finally, researcher find out that adopting the agile framework on large, distributed projects improves quality, allows for requirement changes and additions throughout the project and improves the employee satisfaction while building the final product. Implementing agile framework to develop a new product and the positive effects of the agile practices were discovered by comparing the activities of a specific agile feature development team with the Activities of a team that performed similar activities during the same time period with the usage of traditional development methodologies. Conversely, the case study also verified that adopting the agile framework is not sequential and straightforward due to that companies, especially large ones which was practicing traditional processes need to carefully plan this activity, need to avoid common problems observed when attempting to adopt the agile methodologies. In addition, Building the agile culture and accepting the practices requires time during which activities need to be closely monitored in order to identify additional project specific problems and to initiate actions to resolve the problem. As per author suggestion the result of the study should be fitted to agile guiding principles that match the actual project needs and develop the necessary individual skills and for the successful implementation.

Table 2 : Summary of Related Works

Author (year)	Topic/title	Purpose /objective	Methodology	Key findings	Remarks
Kannan & Peng, et al, (2009)	A framework for adopting agile development methodology	To investigate how agile software development methodologies adapted for use in different contexts	Qualitative Research Design using multiple Case-study methodology used. Semi structured Interview as	Agile approaches are adapted and appropriated based on the project, organizational, and development context.	Challenges and practices are not explicitly identified. The research did not

			primary data sources		identify any future work.
(Hajjdiab & Taleb, 2011)	Adopting Agile software development: issues and challenges	Presents a case study for agile adoption in a government entity in the United Arab Emirates, as well as a comparison and analysis of the results with other published case studies in this sector.	Single Case study used	Discovered the difficulties faced by agile teams during the adoption phase and compared findings with other software engineering studies.	Single case study may not be enough, the research did suggest and solution.
Adriano & Paulo, et al, (2013)	Agile practices to accelerate the delivery of software	To investigate the perspectives of software professionals on the impact of agile practices on the delivery of software products.	Quantitative Research Design using expert sampling and snowball, sampling.	Customer satisfaction is the most important factor influencing professionals' perceptions of the use of agile practices to meet software project deadlines.	Focus on perception than actual factors, data collection approach is only quantitative.
Widia & Puji, et al, (2016)	Challenges in agile software development	The study aims to conduct a thorough literature review in order to determine the challenges associated with agile development methodology	A systematic Literature review used for locating, evaluative papers relevant for RQS	Team management and distributed team, requirement prioritization, documentation, changing requirement, organization, process, and progress monitoring and feedback are the most significance challenges of agile among the 30 identified challenges from literature.	Only on challenges and the context is not different. The research did not identify any future work.
Joyce & Henry, et al, (2019)	Understanding characteristics, benefits and challenges of agile IT project management	To bring out the understanding of the concept of agile IT project management; what it is and what it is not.	It is solely a survey of peer-reviewed literature, primarily from Google Scholar.	Agile was found to better from traditional approaches in terms of advantages, but its adoption is difficult due to a variety of obstacles, the most important is found to be corporate culture and project team empowerment.	Not supported by empirical data. It is not also contextualized to a domain.

2.7. Summery

This research purpose is to help the reader understand different aspects modeled by the researcher on agile practices and challenges on software development and project. This is significant because the paper give understanding, reviewed more research and discussion is conducted in related empirical data findings, agile methodology development and the way Ethiopian currently practices challenges they faced.

Currently, there are scarce research attempts made on agile methodology implementation in the context of Ethiopia. Accordingly, the above mentioned local research attempts to identify most frequently used software development methodology and also identify the adoption level of agile in the selected private bank using qualitative approach. In addition most studies researched on agile practices and challenges implementation were based on scholarly articles which is not supported by empirical data. Thus, this should be further studied. More over studying agile development methodologies contextually is important because business nature and environment different from one organization from others. Besides, the researcher also recommended conducting a comprehensive empirical study to further understand operational practices and challenges of agile implementation adoption.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Overview

This chapter presents the methodology that support to achieve the objective of the study. First, the general research approach is defined. Then, the method of the research presented. Next, data source, population and sampling of the study, sampling techniques, sample size, data collection techniques, and data collection Approaches are discussed. Finally, data analysis and presentation method along with Data validation methods are organized.

3.2 Research Approach

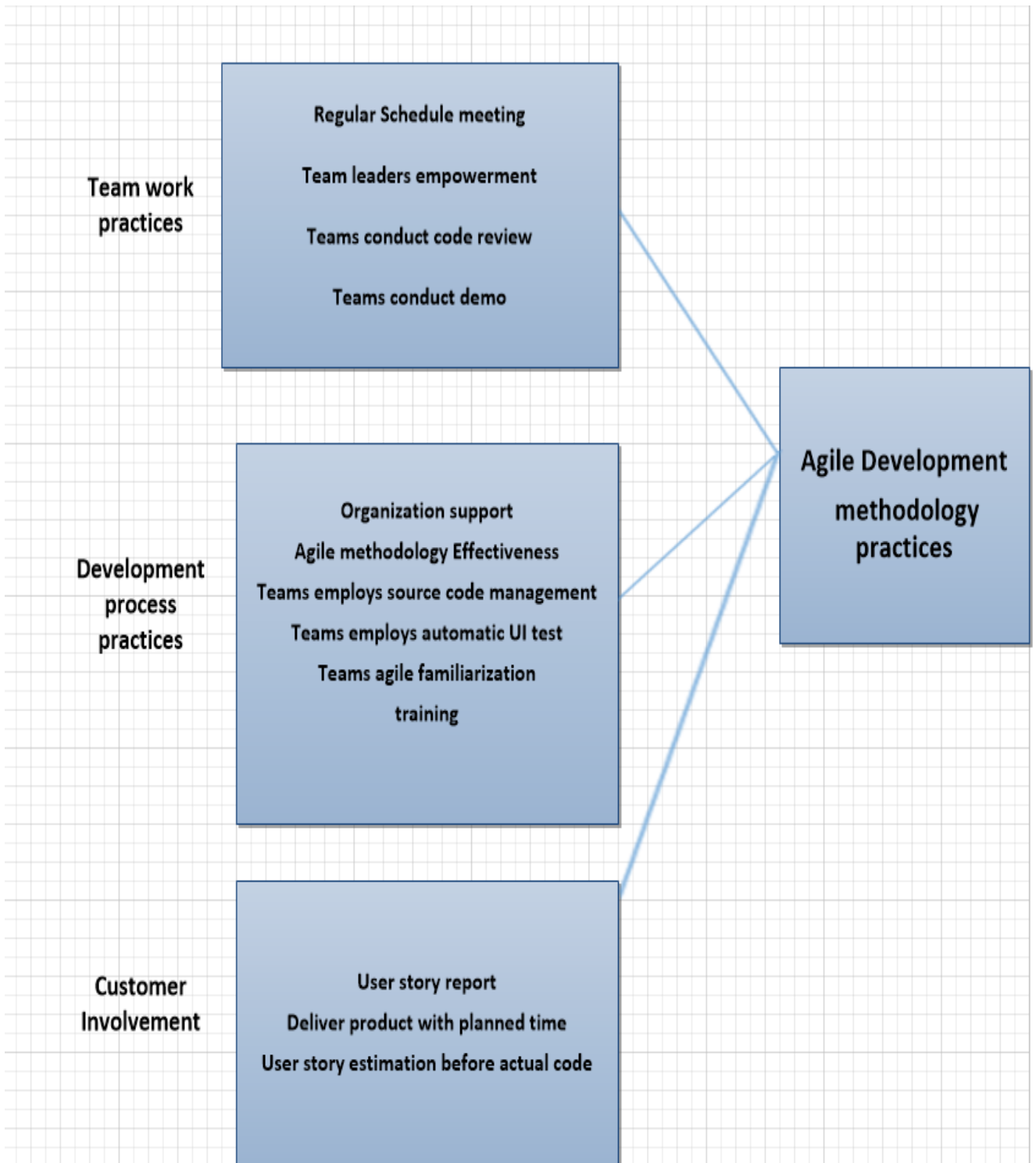
For the purpose of answering the research questions and achieving the research objectives a descriptive case study with a combination of both Qualitative and quantitative data collection and data analysis method used as research approach, to identify and explore agile software methodology practices and challenges of Ethiopian airline software development teams. This approach is considered appropriate for a number of reasons. First the case study allows an investigation to keep in mind the holistic and meaningful characteristics of real-life events like organizational and managerial processes. Second case study has the ability to deal with a full variety of evidence, Documents, interviews, and observations. Third case study is valued as a research method for its ability to examine a phenomenon in its real-life context. Forth, the case of our study was selected because the studied company had been experimenting with agile approaches for the last five years and has been moved from Waterfall (plan driven) methodology to agile software development methodology. In addition to this, a great value of this method comes from its strength for manipulating the “richness” of the condition which permits deeper understanding of the subject (Yin).

In this research, Single case study is used since only Ethiopian Airlines is considered as a case company to study agile practices and challenges during implementation. Ethiopian Airlines is selected for the case study because ET implemented agile software development methodology and, the researcher has working for about 6 years in the organization with system development and operational Application Support Section. Therefore, the experience of the researcher in the organization can positively add to the success of the research because researcher able to incorporating the day-to-day Activity with the real business process of the organization.

Qualitative approach is also used to explore attitudes, behavior and experiences through interviews to get an in-depth opinion about the study. In addition to this, qualitative approach allows the researcher to constrict meaning out of meanings experience and also allows to gain detailed description of the phenomenon DANIEL (2016). Qualitative research aims to get the hidden meanings attributed to a particular experience in various situations. Qualitative document analysis is used as a secondary source of data to gain more information and support the findings reached by questionnaires and interview of the representatives. Quantitative approach used to reach more people with optimized time than qualitative approach. Hence, it provides the potential to use large sample of participants with the aim of generalizing findings to incorporate the whole population.

3.3 Research Model

The research model is illustrated in figure 6 as a result of the extensive literature review. The model depicts the three main themes that influence agile development methodology implementation and practices: team work, Development process, and customer involvement. Relevant concepts are identified for each of the themes. With a few modifications, the model was based on three research projects. According to (Lan, Kannan , et. Al, 2009) there are four key variables that influence agile development methodology implementation: Development process related, Developer related, Organization/management relate and Customer related. according to (Gregory, P, L, Sharp, et. Al, 2016), (Cho, 2018) there were proposed Six key themes that affect agile software development methodology implementation, origination, culture, team work, sustainably and value .



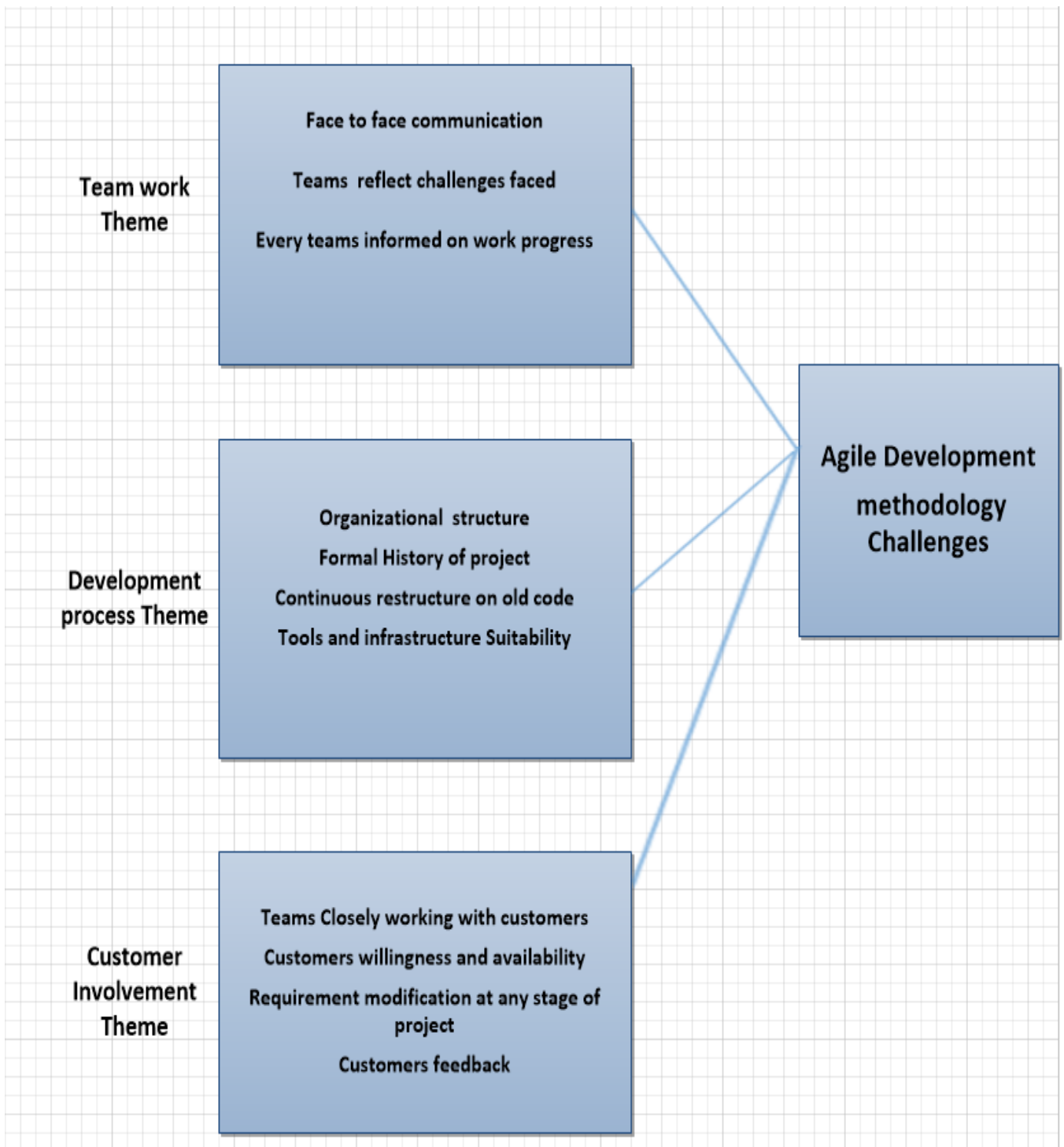


Figure 6: Research Model (adapted from: Lan, Kannan, et. Al, 2009; Gregory, P, L, Sharp, et. Al, 2016, Cho, 2018)

3.4 Data Source and Study population

This proposed research involves single case study on Ethiopian Airlines IT Application development sections. The population of this proposed study is Ethiopian Airlines B2B Application Development teams, B2C Application Development teams, operational application support and development teams, direct sales and service Application development teams, in-house application Development and support teams, mobile application development teams, team leaders, managers and directors of all above listed departments.

In connection with this, for quantitative data the total number of Ethiopian airlines application developers are considered as respondents of the questioners using census method in order to get more information from informant teams. For qualitative data managers and directors for each section are selected and interviewed using purposive sampling technique and this will help to gain deeper insight about the study. The sample size for the qualitative study initially determined to be six from managers and directors for each sections. Later on according to (Patricia & Lawrence, 2015) When choosing a study design, researchers should choose one that specifies how data saturation is achieved. When there is enough information to duplicate the study, when the ability to get more new information has been achieved, and when further coding is no longer viable data saturation has been reached., as a result the data was saturated after five (two directors and 3 managers) selected key informants are interviewed. As per Phone discussion with Selected IT department team leaders we have summarized total number of respondents with below table.

Table 3: Number of respondents of Ethiopian System developer's

Department	Number of respondents
Abab Developer's	10
C # developer's	25
Core Developer's	7
PI Developer's	8
Sale and Serve developer's	12
Operational Developers	9
In-house application and support	10
Total	81

3.5 Data collection method

The methods used for collecting the required data were undertaken with questionnaire, interview and document analysis. Here below the detailed description for each of the methods.

3.5.1 Questionnaire

The data collection tool was mainly developed from a combination of different literatures that are applicable to meet objective of this research. The study used both open ended and 5-point Likert scale questionnaires in order to get data from Ethiopian Application development teams of Ethiopian Airlines on agile practices and challenges during implementation. Consequently, the scales were ranging from 1= strongly disagree to 5=strongly agree.

The questions used in the questionnaire were adapted from the following two sources given below. The first source uses Likert scale questioners for software developers to identify practices and challenges of agile is adopted from (Asegid , 2019) and the second source uses open ended questions for interview with modification of contents based on research question addressed for managers and directors to identify the challenges that the team has come across while implementing agile and operational practices too are adopted from Elsa (2015).

To develop and customize questionnaires construed from above literatures the following process undertaken. First, the questionnaire items were selected from above mentioned literatures that are relevant to meet the research objective. Customizations to some of the questions and adding new items in order to reflect the objective of the study. Moreover, some questions developed as a new based on the reviewed literatures. Second, each questions divided in to three broad themes namely, Demographic related questions, Practices related questions and challenges related questions. Third, practices related and challenges related themes further categorized in to themes, i.e. Practices in terms of teamwork, practices in terms of development process and customer involvement related and challenges in terms of team work, challenges in terms of development process and challenges in terms of customer's involvement as well, this themes also used by the researcher for analysis purpose. Forth, the questionnaires were pilot tested by eight operational application development and B2B Application development teams. Questionnaire items used for the survey are attached in Appendix 1.

The objective of the pilot study is to test whether the questionnaires' provide accurate information and to see the language used helps to simplifying jargon words and grammatical wording of several items. In addition, this pilot study greatly help to test the general layout and sequence of

questions. After all some modification for the sequence and wording are done depending on feedback given from pilot participants.

3.5.2 Interview

Interviews are considered to be appropriate for looking for opinions, experiences and advantaged information from respondents in key positions since the interviewer can get the possibility avoid incorrect or incomplete answers by explaining the questions to the interviewee. (Yin). In this study, semi-structured interview conducted which are derived from the literature and consultation of experts in the field of Ethiopian Software development and from outside Ethiopian who use agile for their software development method.

The researcher has started the interview by first categorizing items it to three themes: Introductory part, practices related and challenges related and then contacting the selected respondent's managers and directors briefly stating the objective of the study and also sending the interview outline using Ethiopian airlines mail address. And then using company phone to adjust continent time and schedule Microsoft team meetings, this is due to the fact of covid 19 pandemic and fortunately help researcher to record the session and read again and again for better understanding. The interview has been taken place by a brief introduction regarding the objective of the study and why the researcher motivated to study about agile practices and challenges and also expected benefits of the proposed study. The researcher record information from interviews by taking hand written notes and Microsoft teams record with each interviewee's idea. Then the interview data were consequently being listened, proofread, explained and organized with in five paged report. This help the analysis easy that was been performed after data collection. Questioner outlines used for interview are referenced in Appendix 2.

3.5.3 Document Analysis

Document analysis is one of the source used in this study as a secondary data collection method used to strengthen the analysis by referring different documents of Ethiopian Airlines (ET). Among Ethiopian documents that were analyzed includes: Ethiopian Airlines portals for below specific sections, IT Application design and delivery, Digital Application Development and IT service management and Ethiopian airlines website are analyzed to get more information about current practices as standard document and a procedures mistake proofing document about previous work. And also the researcher analyzed Ethiopian airlines website to get general or background information about the study area. (Ethiopian, head application desing and delivery, 2021) And (Ethiopian, overview, 2021).

3.6 Data Analysis

After the data is collected from different data source which is described above areas of data sources, it is edited, organized, aggregated and analyzed using statistical software mainly SPSS based on appropriate statistical methods and tools. Descriptive statistics methods such as frequency distribution, mean calculation, percentages, tabular and graphical representations are used to summarize the collected data. Qualitative data is analyzed through thematic analysis which is by organizing and preparing the data in to themes, sorting and arranging the data into different types according to the sources of information then those organized data read it again and again to avoided jargon and those arranged data coded, categorized per themes. Software tool called open code is used in qualitative data analysis which shown both practices and challenges of agile implementation methodology.

The analysis discovered practices and challenges that are under study; are examining the level of operational practices as well as challenges during implementation depending on the output of the analysis and existing literatures, and general guideline about implementation process is proposed depending on the findings of empirical data. Based on the finding of the quantitative and qualitative analysis, a standard implementation guideline is designed that can address the identified agile challenges to represent team work, development process, and customer involvement dimensions of the proposed solutions in order to improve the utilization of the agile methodology and realize fast delivery of software products.

The use of a well-executed approach to evaluate the quality, and acceptability of a research result is seen as a critical feature of the IS research process. A Guideline must be thoroughly examined in terms of functionality, completeness, usability, organizational fit, and other relevant quality qualities before being used for its intended purpose (Hevner, 2004) According to Hevner, and this guideline can be evaluated using observational, analytical, experimental, testing, expert validation, and descriptive methods. These evaluation procedures may be acceptable depending on the type of study. In this work, the proposed Guideline is examined utilizing expert validation and descriptive approaches and survey questions were done as a result.

3.7 Validity and Reliability

According to (Nahid, 2003) Data validation is defined as “a process which ensures the correspondence of the final data with a number of quality characteristics”. And its purpose is to ensure a certain level of quality using the following dimensions: relevance, accuracy, timeliness

and punctuality, accessibility and clarity, comparability, coherence, completeness. In addition, Triangulation method are important methodological subject in qualitative approaches to evaluate or control bias and establishing valid suggestions. Since the questionnaire items for quantitative data are adopted from literature it's statistically tested and ensure the validity of the data.

In this study, to ensure the reliability and validity of the questionnaire items pilot study have been conducted prior to distributing the questionnaire to the actual participants which was helped to ensure whether the instruments are free of ambiguity and irrelevant items. Pilot study is also valuable for controlling bias in data interpretation prior to disseminating the survey to the actual full-scale group and the technique of triangulation would be employed. This involved examining evidences from multiple data sources and using it to build a coherent explanation of concepts or themes. On the other hand, the member checking technique were used by taking the analysis result for a case study back to the participants' in order to determine if they feel they are accurate.

CHAPTER FOUR

RESULTS AND DISCUSION

4.1 Overview

In this chapter, data obtained from various sources are presented, analyzed and discussed according to the specific objectives of the study. The first section Includes of quantitative data presentation, analysis and discussion and the second part comprises of the qualitative data analysis and discussion. In the first section, Demographic related part of the respondents, such as educational background, current roll or position in software development and their service year or experience are presented, analyzed and discussed. Furthermore, the finding of both practices and challenges of agile with in three theme in terms of Team work, development process and customer engagement are presented, analyzed and discussed. In the next section, qualitative analysis and discussion is presented based on the data obtained through the interview which was conducted based on the interview questionnaires.

4.2 Data Presentation

In this study a total of 72 survey responses was received from the total of 81 respondents who received an invitation to participate in the survey. Responses were received from Ethiopian BI developers, c# developers, abap developers, operational developers, in-house application developers, and web developers which are currently follow agile development process for their software products. The survey instrument was employed online with Google form for a month.

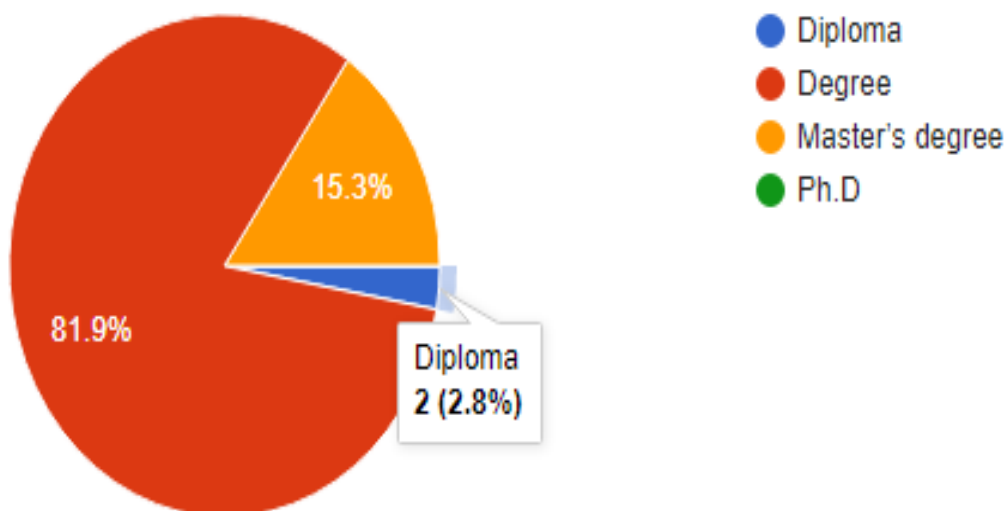
4.3 Demographic Findings

The survey questionnaires gathered demographic related data which may help the researcher to inference on agile practices and challenges among the software developers. The demographic data is relating to educational background, total number of work experience and current roles in the software development process. In this section of the chapter, the characteristics of the respondents are first discussed.

4.3.1 Distribution of Respondents by Level of education

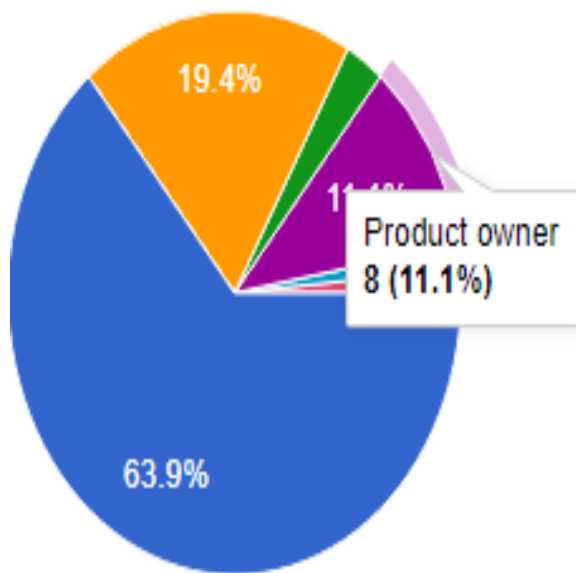
The distribution of the respondents with respect to their current level of education is represented in Figure 6. Accordingly, more than half of the respondents (N =59) having undergraduate Degree which constitute close to 81.9% of the total respondents. The next highest category of respondents (N= 11) is having master's degree and constitute 15.3% of the sample. Some are having diploma (N = 2) account for 2.8% of the total respondents. This indicates that the survey incorporates employees with different levels of education to ensure the representation of the sample.

Figure 7: Current education label of the respondents (Source: survey, 2021)



4.3.2 Distribution of Respondents by Job position

The data relating to the distribution of the respondents by their current job position in Ethiopian characteristics are shown in Figure 7. Accordingly, around 63.9% of the respondents were Software developers, 19.4% of the sample were software team leaders, around 11.1% of were product owners, 2.8% were scrum masters and 1.4% BI Analyst This implies good representation of each of the position of Ethiopian IT Developers participated and also help to explore the impact of the position of an employee on agile implementation.



- Software Developer
- Software Tester
- Software team leader
- Scrum master
- Product owner
- BI Analyst
- IT Manager

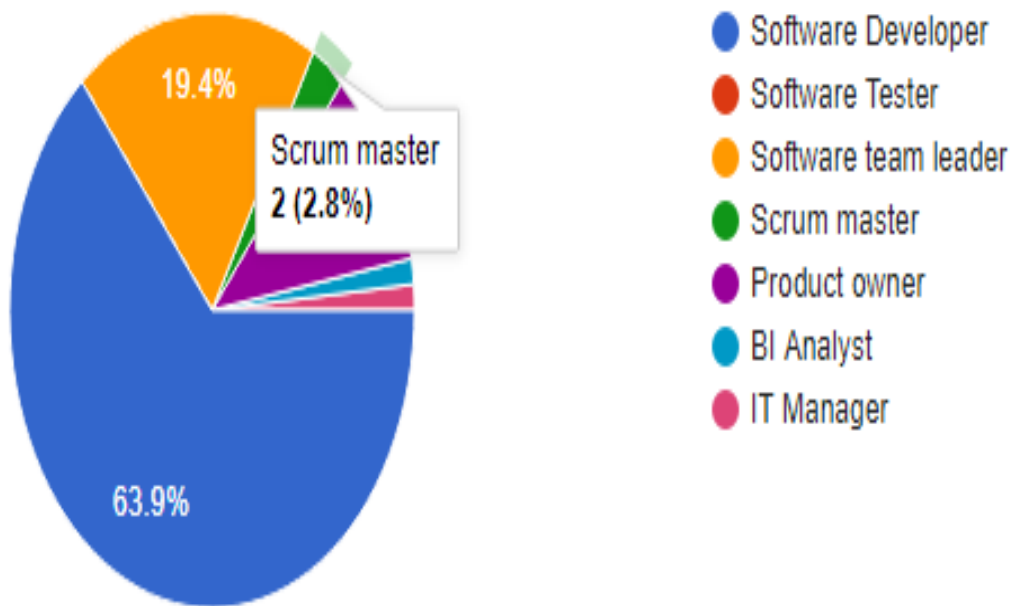


FIGURE 8 : CURRENT JOB POSITION OF THE RESPONDENTS (SOURCE: SURVEY, 2021)

4.3.3 Distribution of Respondents by Service Year

Distribution of respondents by their years of experience is an important determinant factor in explaining how the employee practices agile in an organization. This helps, to investigate whether agile implementation practices are impacted by the experience of the employees in the organization. Their work experience of the respondents in the organization is summarized in Figure 8 as can be seen below. Which is around 61.2% of the respondents are with service year between six and ten, from which close to 29.9% are with an experience between two and five years. And 4.5% of the respondents are between eleven to fifteen years of experience. Employes having service years less than two also counts 4.5% of the total sample. This indicates the survey incorporated respondents with both experience and little or no experience in the organization to understand challenges Ethiopian faced from the start of agile process. This leads the representativeness of the sample considered in the research also helpful to investigate impacts of service year on agile implementation practices.

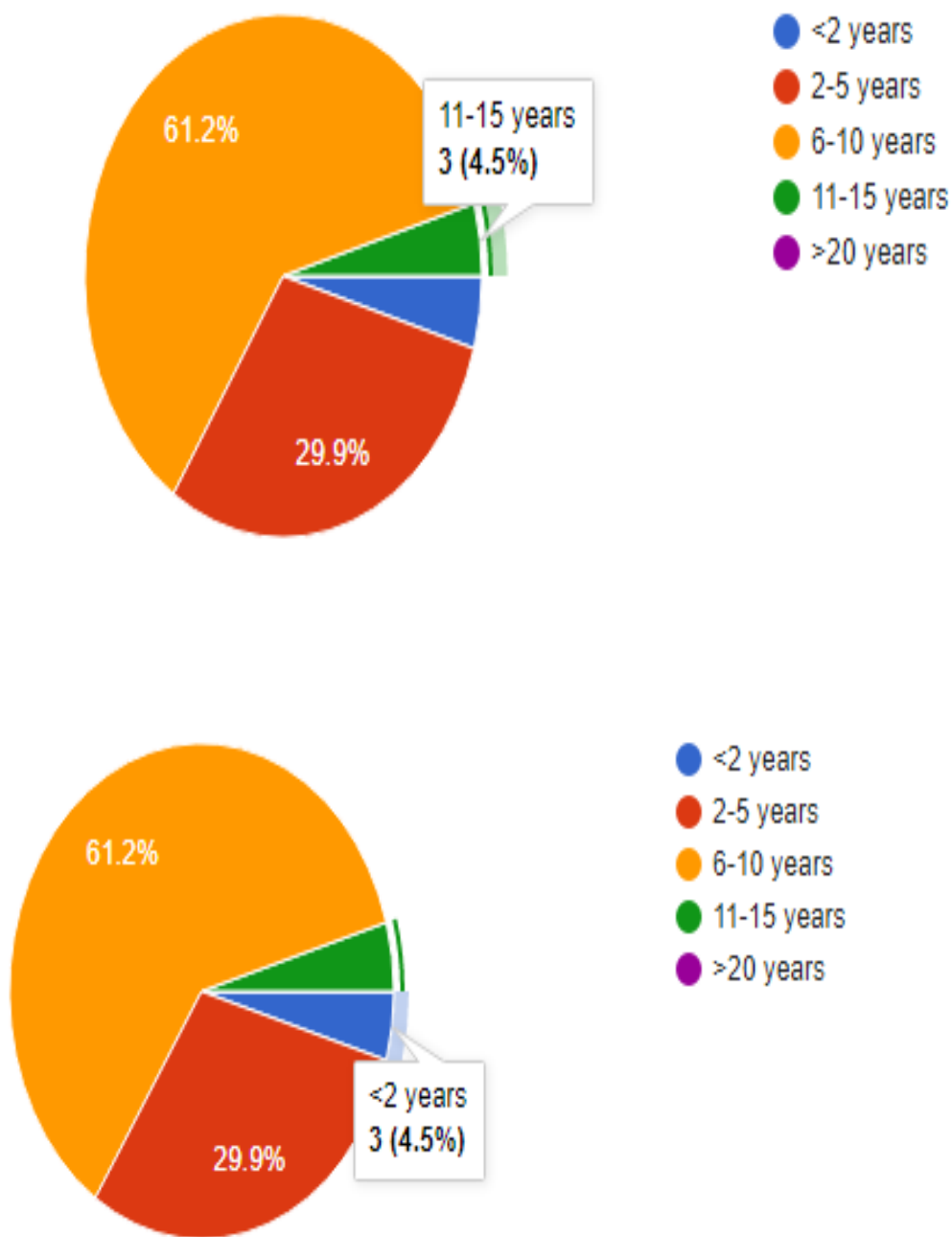


Figure 9 : Experience of respondents working in Ethiopian (Source: survey, 2021)

4.4 Agile Practices

4.4.1 Practices related Findings: Team work

Scholars has been argued that the basic principles of agile methodology encompass on, effectiveness of people working together with friendliness, and focus on teamwork (Pekka & Outi et al. 2002) indicated in the research Analysis part, there are three paradigms that are investigated

in relation agile software development methodology practices. These are team work, Customers involvement or engagement and development process. Team work related agile practices includes Team’s regular schedule meeting, team leader’s empowerment, and teams prepare demo with in customers, team’s regular code review before deployment and team size effect for agile implementation. The practices of agile methodology implementation in the context of team work theme constructs summarized in table 4 and also further discussed in the subsequent paragraphs.

Table 4: Team work agile practices (Percentage distribution and Mean)

Agile practices in terms of team work	Strongly disagree	disagree	neutral	agree	strongly agree	Mean
Agile teams regular schedule meeting	23.6	16.6	25.0	23.6	11.2	2.82
Agile team leaders empowerment	8.3	6.9	15.3	41.7	27.8	3.74
Always demo work progress for the teams	11.1	16.7	18.0	33.4	20.8	3.36
Agile appropriate per size	18.1	13.8	23.6	16.7	27.7	3.22
Agile team conduct code review	13.9	9.7	20.8	40.3	15.3	3.33

It is well acknowledged that effective communication between agile teams is the primary practices for quality software products, agile process recognizes the important role of team’s communications in the software development process and also provides an excellent means of communication M. Pikkarainen & J. Haikara et al. (2008). Researchers study on the importance of team practices when adopting agile methodology, such as pair-programming, test-driven development and improving communication through practices like daily stand-ups meeting and achieving a regular that would allow them to frequently check their work against their clients’ expectations Brendan & James et al. (2019). The aggregate mean (mean of the mean) result for the agile team work is found to be 3.294, which is rated in the agreement category.

Among the agile teamwork related variables addressed in the questionnaires, team size appropriateness for agile methodology implementation practices and regular schedule meeting among agile teams have the lowest mean value. This indicates that majority of the respondents

disagreed to current size of teams for agile implementation and regular meetings among them in Ethiopian Airlines IT Development. Regular demos for the work progress of the teams is one important factor that determines the agile teamwork practices. In this regard, only 33.3% of the respondents replied that we they demo one's team work progress to others for latest update and experience sharing with in agile teams. Hence, working to train more, promote and create self-organized agile team is the responsibility of Ethiopian airlines IT development top managements and who are currently promoting agile as a process.

Agile teams Conducting Code Reviews on a developer's work before deployed to the production environment is another important attribute that regulates team work practices in agile implementation. According to the survey, the practices of code review is agreed only by 40.3% of the respondents which is below half of the total respondents. Practices of reviewing code before actual go live may reduce system maintenance cost and time also for smooth product transformation and handover to operational teams and system users as well. On the other hand, agile team leaders are empowered to eliminate obstacles that are faced by agile team members during the cycle plays a major role in order to facilitate team work with in agile teams. 41.7% of the respondents are agreed for the team leader's empowerment in agile practices and this also less than half of the total respondent of the survey as well. Hence, having regular schedule meeting among agile teams, progress update, the total teams size with in each sections are identified for improvement as teamwork related agile practices.

4.4.2 Practices related Findings: Customers engagement/involvement

Greater developer and customer demands principles encompass the close cooperation and comprehensive participation of customers in software project. There also an engaging and rewarding mechanism, excessive commitment to achieve project success. Any absence of customer involvement will affect the quality and achievement of the software, thus agile teams must aware, train and participate customers as a team to assist in the full product development process Godfred & Joyce et al. (2019). Customer's engagement theme consists of team leaders report on work progress, Deliver software products with in planed time and budget, estimation of user story before actual work start. Now practices of agile methodology-implementation in the context of customer's engagement theme is analyzed and discussed in the below subsequent paragraphs. Further, table 5 summarized the rating of agile practices of customer involvement.

Table 5 : Customer involvement agile practices (Percentage distribution and Mean)

Agile practices in terms of Customers engagement	Strongly disagree	disagree	neutral	agree	strongly agree	Mean
user story estimated before actual code	12.5	12.5	26.3	29.1	19.4	3.31
Deliver product with in planned time	8.3	13.8	27.7	33	16.6	3.36
teams report on the work progress of their respective user stories	6	8.2	15.7	41.6	27.7	3.75

So as to assess customer involvement practices of agile software methodology, respondents were asked for their view with respect to team's product delivery time with respect to planed delivery date, teams progress report based on respective user story and estimation of user story before actual coding started have The overall mean value of (3.47) has higher rating than teamwork practices construct (3.294). This implies that, since customer engagement is the primary principles in agile process the team should practice more and more in order to benefit agile packages.

User story estimation before actual coding is an important factor to have clear business requirement and proper customer communication in agile development process. According to the survey below half of the total respondents (29.1%) are agreed directing for user story (requirement specification) checked prior to the actual work done, which have The lowest mean result (3.31) among the customer engagement theme variables. Delivering software products with planned time and budget, updating the work progress (sprint) of each user story has been considered as drivers to facilitate good communication skill and increase customer satisfaction with in products. About (33%) and (41.6%) of the respondent are agreed which is mean result of (3.36) and (3.75) respectively. This indicates that Ethiopian IT developers may focus on customer's user story to avoid rework, huge change management, qualified software products and meet business requirement within planned time.

4.4.3 Practices related Findings: Development process

Authors including (Livermore, 2008), (Brendan & James et al. 2019) emphasize that organizations committed on allocation of necessary resource for training for successful agile implementation, the needs to understand, values and aware agile principles, ensure agile teams to attend conferences

and journals, Agile coaching and championing. This help to prepare the development staff to use the agile SDM. Agile development process theme consists of agile Familiarity, training, organizational Support, effectiveness of agile usage, using source code management system and automatic UI test. The practices of agile methodology implementation in the context of Development process theme constructs is analyzed and discussed below. Agile Development process related challenges is summarized in table 6.

Table 6 : Development process agile practices (Percentage distribution and Mean)

Agile practices in terms of Development process	Strongly disagree	disagree	neutral	agree	strongly agree	mean
Familiarity of teams on agile methodology	2.8	1.9	16.6	25.0	54.1	4.26
organizational Support for agile process	8.3	13.8	27.7	33.0	16.6	3.36
effectiveness and productivity of using agile	11.0	2.8	0.0	20.9	58.3	4.12
Teams training participation on agile	45.8	8.4	12.5	18.0	15.2	2.42
teams employee source code management system	2.7	5.5	7.0	16.6	68.1	4.42
teams employ automated UI tests	32.0	11.1	19.4	20.8	16.7	2.79

Based on the survey result, training is one of the low rated from all development process theme Constructs. Taking former or informal agile training was not accepted by most of the Respondents (45.8%). As the training is the important determinate for agile implantation success, full adoption as well as taller to the environment most of the respondents (32%) disagreed on teams using automatic UI test due to lack of knowledge and skill. Thus Training can help users to be aware agile methodology principles and using all the functionalities. If the training is aligned with the practices, it's possible to create certified agile teams and can able to taller agile easily to Ethiopian business environment.

The aggregate mean (mean of the mean) result for the development process construct is found to be (3.56), which is rated in the „agreement“ category. This implies, the agile teams are familiar on agile development process and discussed the effectiveness and productivity of using agile in the development process on which only (2.8%) and (11.0%) of the respondents are disagree on agile development process familiarity and agile importance in development process respectively. However, Ethiopian should not underestimate training as most respondents argued the necessity of it for new entrants as well as full adopting and having some understanding among the teams, in addition to this, practicing automatic user interface testing UI within the team should checked and revisited.

Acceding to Empirical data findings presented above on practicing regular schedule meting among teams and checking team size with in scrum or agile teams from teamwork constrict, customer’s user story to avoid rework, huge change management, qualified software products and meet business requirement within planned time from customer engagement construct and Taking former or informal agile on teams and employing automatic User Interface tests from development process construct needs to be emphasized.

4.5 Agile Challenges

4.5.1 Challenges Related Findings: Team work

The main benefits of conducting stand-ups and meetings were facilitating open communication and getting open feedbacks from every member of the Teams. Locating everyone in the same room, at the same time, discussing the same Project would allow everyone to stay informed and discuss their current work progress (Brendan & James et al. (2019). Agile challenges in terms of Teamwork theme consists of teams face to face communication, having latest project update with in a team discussion of challenges faced and how they handled at the end of the project. Accordingly, rating of the agile challenges of team work construct is summarized in table 7 and also further discussed in the subsequent paragraphs.

Table 7 : Team work agile challenges (Percentage distribution and Mean)

Agile challenges in terms of team work	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean
Agile teams have face to face communication	33.3	26.3	16.7	18.0	5.6	2.36
Every team members have latest project update	23.6	25.1	16.7	25.0	9.7	2.72
at the end teams discuss challenges faced during development	19.4	36.1	30.6	6.9	6.9	2.54

Generally, agile challenges regarding teamwork construct rating of the respondents placed to disagreement; the aggregate mean (mean of the mean) result is 2.54. A total of only 18.0% of respondents indicated that there is face to face communication with in agile teams. This face to face communications and meetings may represent each sprint update within the teams in the same token, only 9.7% of the respondents agreed to having latest project status update and teams discuss and updated on the challenges faced during the agile process at the end of the product which is about (6.9%) of the respondents are agreed, help each agile teams to practice knowledge sharing and increasing productivity in the next project. Based on empirically investigated findings, team work is the primary challenges area that needs to be focused and stressed in order to improve agile development practices in Ethiopian airlines development process.

4.5.2 Challenges Related Findings: Customers engagement/involvement

It. is not possible to fully collect Business requirements at the beginning of the software development cycle, therefore continuous customer or stakeholder involvement is very critical to deliver a product that is actually valuable to the customer Kurup (2015). Agile development process challenges theme in terms of customer engagement consists of agile teams working together and gather feedback from them, willingness of customers for release of final products and agile team’s capability to handle changes comes from customer at any phase of project. The challenges of agile methodology implementation in the context of customer’s theme constructs is analyzed and discussed below. Accordingly, the percentage distribution and mean result of the respondents’ rating is depicted in table 8.

Table 8 : Customer involvement agile challenges (Percentage distribution and Mean)

Agile challenges in terms of customer engagement	Strongly disagree	Disagree	Neutral	agree	strongly agree	mean
teams closely working with teams and have feedback loop	9.7	9.7	26.3	29.1	25.0	3.50
Customers are willing to release	12.5	20.8	16.7	32.00	18.5	3.22
teams welcome modification at any time	5.5	5.5	19.4	33.3	37.5	3.90

Respondents were asked to evaluate agile development methodology challenges with respect to customer engagement themes and the percentage distribution of agreed respondents for the survey question of data customer's willingness to work as a team is 32% and practices of feedback loop within the teams is about 29.1% of total respondents. Moreover, the aggregate mean (mean of the mean) result for the customer involvement construct is found to be 3.54, which is rated in the agreement category. The other factors that the survey assess is change management perspective and only 33.3% of the respondents agreed on it. Literatures argue that unlike traditional waterfall methodology agile methodology highly depend on inputs from on-site customers Rather than predefined requirements specification documents. This aims to adopt onsite customer's involvement to reduce the cost of changes, get immediate feedback and information, throughout the whole project lifecycle. However, customers' lacking of knowledge of the requirements due to the complexity and size of the system pretenses significant challenges, these challenges are even more pronounced when customers are not available or not willing to release to the project Lan & Kannan et al. (2009).

However, customer's engagement can be affected due to lack of awareness about agile process, pressure of previous big bang approach, nature of the project means some projects need to be treated as high demand by top managements and some customers assumed following a certain process may hider doing things faster. As the survey result of customer involvement construct showing, it is one of the challenges that demands improvement for better agile practices and implementation. A sample of descriptive statistics result is presented on appendix 3.

4.5.3 Challenges Related Findings: Development process

Agile development process always encourages frequent communication among Team members; conversely, there can be issues in the communication between designers Developers and in the role of documentation requirements. In fact, Agile promotes face-to-face conversation as the most Effective means of communication in its fundamental principles, to the argument of integrating the customer in the development team (Helen & Tracy, 2016). Current Organization culture, lack of formal history of a project and continues refactoring process are challenges of agile implementation treated as development process construct in this section. The percentage distribution and the mean result of development process construct is presented below in table 9 based on the questionnaire ratings.

Table 9 : Development process agile challenges (Percentage distribution and Mean)

Agile challenges in terms of Development process	Strongly disagree	Disagree	Neutral	agree	strongly agree	mean
Organizational culture	4.2	9.7	4.2	45.8	36.1	4.00
Lack of formal history of a project	2.8	12.5	15.2	25.0	44.4	3.92
Suitability of tools and infrastructures	6.9	17	14	18	36.1	3.65
Effect of continuous restructure on agile	11.1	2.7	18.1	29.2	38.9	3.82

It's really impossible to throw out the long time practiced methodology and the heavy weight requirements documents, since sometimes you may have principles of agile in mind but do not know how it works practically. But agile development expects that something will replace them. Agile techniques require both (business Domain, technology aspect and equally good knowledge of agile practices) skill: the ability to know the right techniques for the current project, and the Ability to choose among them is the most important thing here. That is the reason behind many organizations moving to iterative development process Radah, & Renuka, et al, (2012).

Development process is examined through the level of their understanding problem on the information of certain characteristics on which how they need to conduct agile software development process. Which is total of 45.8% of the respondent agreed on organizational culture on agile development process, similarly 29.2% of the population argued that continuous refactoring of process have positive effect for agile implementation. However, based on empirical data result about 44.4% of the respondent stressed that lack of formal history of a project is the challenges of agile implementation. The aggregate mean (mean of the mean) result for the development process construct is found to be 3.85, which is rated in the agreement category. Though the data shows a positive result, however without having history for a certain project it's totally impossible to proceed as expected and gain agile fruits. thus Ethiopian IT managers and directors even the CIO should get attention for properly documenting already developed software's and sustain smooth transition to operation since it highly reduces rework, manpower and increase system usability.

The research identified that there are several challenges team work, customer engagement and development process constructs that impact the implementation of agile software development methodology in Ethiopian airlines. Conducting stand up meeting and face to face communication, failed to discuss challenges faced during software development journey within the teams and latest update about projects process or status from team work related challenges, lack of onsite customer's involvement to reduce the cost of changes, get immediate feedback and information, throughout the whole project lifecycle from customer engagement related challenges and lack of properly documenting already developed software's and sustain smooth transition to operation from development process contract as key agile challenges for the implementation of agile software development methodology.

4.6 Qualitative Data Analysis results

In addition to the quantitative study, qualitative data analysis is conducted to complement and enrich the findings obtained from the survey. Accordingly, interviews have been conducted with 3 IT managers and 2 directors of Ethiopian, to gather data regarding practices and challenges of agile methodology implementation. Furthermore, the interview also helped to discuss agile process related issues that Ethiopian Airlines encountered especially during first implementation phase in the extents of user involvement, development process and team work themes. Accordingly, the interview output has been analyzed using open coding method. Patterns are detected through a rigorous process of data familiarization, data coding, and theme development and refinement, according to (Braun & Leroux, 2006), because there was a vast amount of interview data to

manage, we decided to use open code software to evaluate the interviews. A screen shoot of some tasks on the tool is presented as appendix 4, the procedure was very quick and efficient.

The interviewees were requested regarding the overall agile achievement in terms of producing timely and quality software product. All the interviewees replied that there is an improvement on agile process in terms of meeting time line, continues product improvement, meting performance target, highly customer engagement, facilitate time to market, producing easily shippable product and high feedback loop. Bit still need more work on such practices. In line with this, two of the interviewees reacted tailoring agile process with Ethiopian environment which will ensures the overall achievement of agile process in the airline.

Another question raised was regarding the agile related training either formal or informal to developers or all agile teams in terms of content, quality and duration. However, all interviewees were commented that there is no formal training given to certify all agile teams rather there is knowledge sharing mechanism used by Ethiopian: such as coaching which is sharing standard procedures and process of agile and other related process for new assigned staff by senior one, reading agile related materials, continuous improvements, discussion with in agile teams and managements and practical project execution.

One of the interviewee mentioned, there is a concept known as SOP (Standard operating procedure) which help us to document standard agile process follow for newly joined staff to have common understanding and at the beginning. Moreover, all respondents remarked that “we do not underestimate the necessity of training since it’s still one of the major tool in which critical improvement is required”. Besides this, two of the respondents (Directors) argues that we should also be plan and engage with high level managements for training to produce highly qualified, certified, competitive agile teams not only for Ethiopian but also for external market.

Another question raised was to evaluate the agile sustainability or continuity for better improvement and almost all interviewees point out that integrating agile process to other tools and framework is vital to fully sustain. Among them Ethiopian currently practiced tool is DevOps, one of the interviewee replied that SOP plays a major roll for agile sustainability, since it helps to document standard process followed, roles and responsibilities for each teams and process are clearly defined. Three of the participants reacted that to ensure agile sustainability Ethiopian currently tries to apply agile on all projects, engaging users more and focusing on bored users, familiar all stock holders to adopt the process, learn by experience and join new teams to scrum teams. This will help to improve the product quality, completeness and timeliness. Interviewees

were also requested for their opinion regarding continuous improvement initiatives that are undertaken to ensure continuous involvement or engagement in the project. User's engagement is critical in order to address business need and meet business strategic plan (better alignment between IT and organizational strategic plan). According to one of the interviewees, customer's engagement and awareness about agile process is still progressing. Some of the users are resist to adopt and need a big bang product once same as previous one.

Moreover, most of the interviewees said "some customers are satisfied and engaged as owner of the product and engaged to give fast customer feedback, since they see feasible product with in two and three weeks and they see clear responsibilities and tasks for same goal and products. But still most of them are resist due to lack of awareness for the new process and effect of previous methodology. Finally, two of the interviewees pointed out that even though customers are part of the product in the process we do not relay on user's requirement only for the development process since, knowing the business process or knowing the problem is not knowing the solution. As a result, we have team called product owner which is responsible for to understand business process even better than customers and also know technical solution for that business problem (having both business and technical skill).

The managers were also requested concerning agile scalability for large projects and all the interviewees commented "there is a big confusion on agile regarding documentation, because agile is process used for project management parts and do not by itself dictate what type of document and in what depth we prepare document rather its up on the implementers, To clear this confusion all teams have been read different source and discussed on how we approach the process with our environment, how to customize and tailor to our problems and fit to best methodology", and all argued that event there is an improvement regarding the confusion on the development process, we still need more work in each agile teams to digest and sustain.

According to the interviewees after discussion we have been argued to integrate and used devops tool for user story (product artifact) documentation. As a result, the confusion is now better and a minimum and basic required document is prepared. One interviewee pointed out that agile is not suet for large and vendor oriented software's since vendors are not give us full document in the first place as a result difficult to plan all product with in sprint, and sometimes we use water fall process for such type of projects.

Lastly, the interviewees were asked about the current operational challenges they have during agile methodology implementation. All of the interviewees agreed that agile is a journey not the end and need to improve time to time. Moreover, the interviewees listed out some of the challenges currently experiencing in Ethiopian, some of them are there is lack of awareness for top

management and also operational level teams, some peoples miss understand that following a process may leads to delay for final output or product, for high demanding projects top management need to focus on product instead of following a certain development process, some peoples still agreed that agile not necessary required documentation, user specification not fully describe problem domain, difficult to form or adopt self-organized teams, difficult to tailor to our environment, previous organization development process and culture affect agile especially by top managements. In this regard, two of the directors stressed out that there is a lack of alignment between development and operation teams for fast product transmission in the organization, this leads to high customer dissatisfaction, resistance to use final product since they do not get enough support from operational teams due to improper product transition. Training also one major hinders to fully adopt agile process as per the interviewees comment.

As a recommendation, to address previously listed out current agile challenges interviewees stressed that training placed the first to create certified and knowledgeable agile teams and properly understand what the essence is, tailoring agile for our process and environment, work to improve the process depending on user's feedback loop, create output oriented products, enforce all teams to follow agile process for all projects and wiring the process with other tools and frameworks. Scholars also found that (Cheng & Changling, 2018) even if, the most popular development methodology which is recently adopted in many companies is agile but its main focused on software development parts. Deployment, operation, testing and maintenance is responsibilities of operation. Thus without employing thus using agile methodology is not enough. As a result, integrating agile with other tools and frameworks is encouraging to improve agile process, increase sustainability, and eliminate the gap between development and operations. The interviewees also recommended discussion with managements on better alignment of business by creating DevOps engineer teams which is responsible for smooth transition of finished products to operational team, and they informed that it's under in communication with CIO. The diagrammatic demonstration of theme development for practices and challenges of agile development methodology are presented as below table.

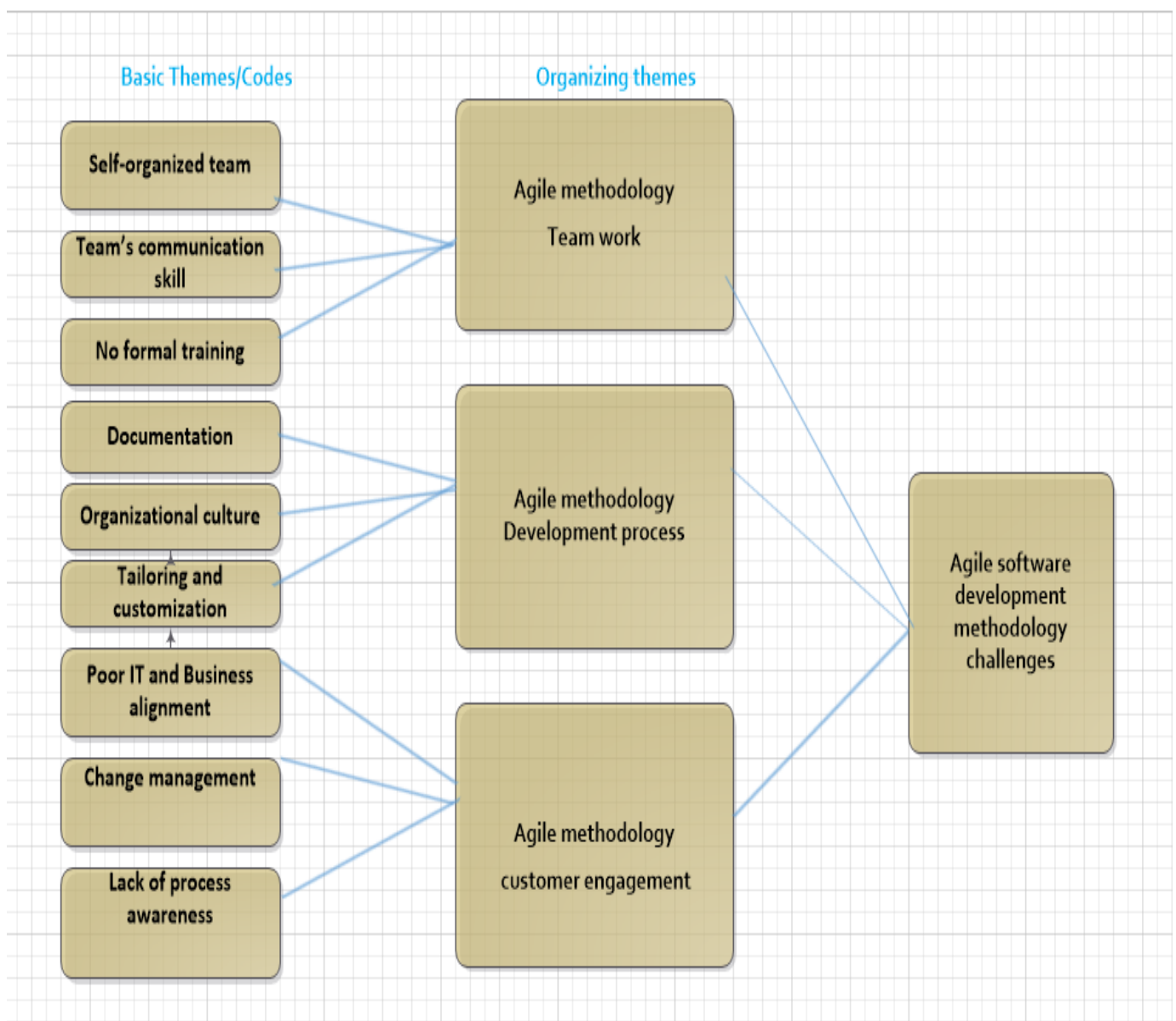
Figure 10: Agile practices key issues representation



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Figure 11 : Challenges related issues representation



4.7 Discussion

Practices and challenges of agile methods was considered to be ineffective in Ethiopian airline application development. This evaluation was based on Findings of empirical data. Despite this, we discovered a number of significant obstacles to the implementation of agile approaches. As expected, several of the issues are comparable to those previously identified in the literature. However, some of the challenges identified are particularly unique to Ethiopian airlines.

This study aims to identify practices and challenges of agile software development methodology. Through the analysis and findings from collected data, the researcher believes two of the research questions were answered; what is the current level of awareness and operational practices of agile development methodology with in Ethiopian Airlines Software development teams? What are the major challenges that currently hinders to fully implement agile Software development methodology within teams?

The first question of the research was “what is the current level of awareness and operational practices of agile development methodology with in Ethiopian Airlines Software development teams?” and the finding of empirical data shows that agile development process implementation team work practices in Ethiopian airlines are not well adopted.

The second question was What are the major challenges that currently hinders to fully implement agile Software development methodology within teams? The finding rivaled that Team work related challenges are the most critical factors of agile development methodology implementation, customer engagement and development process constructs are the second and third respectively that impact the implementation of agile software development methodology in Ethiopian airlines.it is concluded that team work related challenges are affecting agile development process implementation success in Ethiopian Airlines.

Both the Agile Manifesto and studies by (Adolfo , Nádia P, et.al, 2019) states that communication is one of the primary Challenges in running Agile projects in Global Software Development in order to delivering information to and within a development teams. Accordingly, Quantitative data confirmed that, conducting regular schedule meeting with in agile team’s accounts for 27.2% of the overall disagreement

in agile practices for team work theme. As a result, the study determined that practicing regular meeting with the team is lowest performance of agile practices in Ethiopian airlines.

The result and analysis of the data showcase team work related agile challenges are the main determinants of agile development methodology implementation. Connecting these findings to (Widia & Puji 2016) study regarding challenges in agile software development methodology and finds that among the 30 challenges in agile software development methodology which affects quality and performance of ASD the most significant challenges are team management and distributed teams following by requirement prioritization, documentation, frequent changing requirement, organization process, progress monitoring and customer feedback.

This research identifies that Training to agile teams and wiring agile with other development tools in agile methodology greatly helps an organization to develop expertise and be better prepared to implement the methodology. This is in agreement with other researches like (Livermore, 2008) who argued that there were a significance correlation between training and successful agile methodology implementation, on the same token, using different methods and tools provide more benefits for agile implementation.

One of the most important jobs for ensuring the successful adoption of agile methods is employee training. (Jouko, Kirsi , et. al, 2016), Even though the organization provided formal training, it was insufficient to ensure that individuals had a thorough understanding of the technique and essential procedures, as well as the necessary competencies. According to our findings, this was one of the primary causes for the project's faller due to lack of formal training, particularly for newly joined staffs. However, Authors suggest that formal training is insufficient; to be motivated and committed, workers must grasp and master agile ideals and concepts in addition to methods.

According to authors (Gregory, P, L, Sharp, Taylor, KJ, & Deshpande, A, 2016) study on the challenges that process with other development challenge: engaging with agile practitioners' found that due to the fact agile challenges are interlinked each other, treat in those challenges in context rather than individual is vital. There for, the study address both practices and challenges in context of team work, development process and customer engagement perspectives.

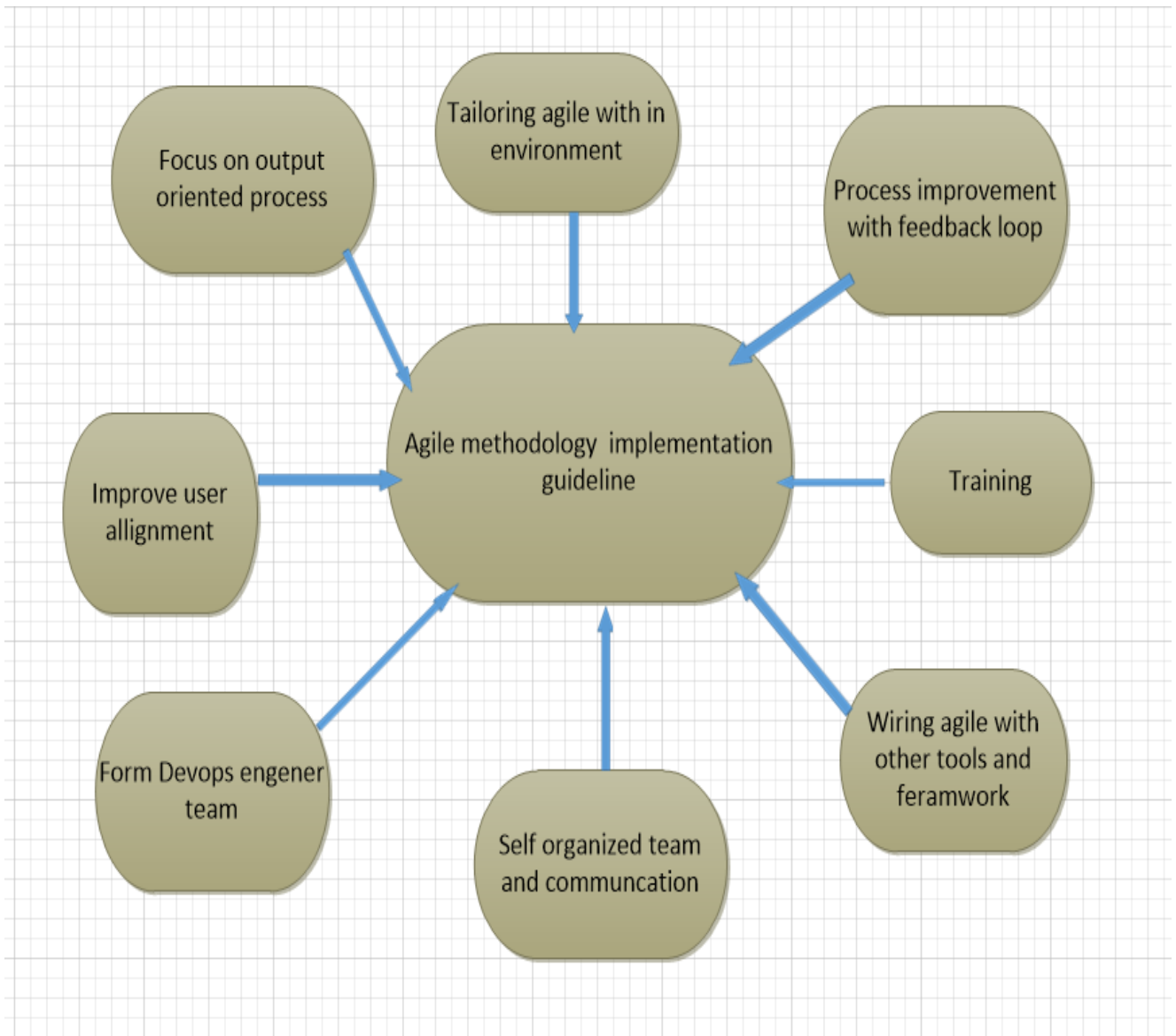
Many of challenges that figured out in our case study are also discoursed by other researchers in agile development methodology adoption or implementation success. Such as Teams communication, customer involvement and documentation requirements, (Hassan & AI Shaima, 2011), however, tailoring agile with in business requirements and connecting agile with other development framework identified in this study were not presented by any other scholars which are unique to this study findings.

4.8 Proposed Agile Development Methodology Implementation Guideline

This section addressed proposed task based guideline to address agile related challenges in software development methodology as an output of this research. The evaluation of the proposed guideline in order to ensure its acceptability, efficacy and usefulness also included. The guideline is proposed based on the empirical data findings of the study and related literatures so as to provide an answer to the third research question. The qualitative research found that the agile methodology-related training plan should be reconsidered for further enhancement, and that it should become part of the guideline. Accordingly, the proposed guideline attempted to categorize the above mentioned findings in eight main activities which is the current challenges of agile development methodology implementation and it has its own detailed suggested activates for each.

The developed guideline is named as “Task based agile development methodology implementation guide” in this study. The top level representation of the guideline, as shown in figure 11, illustrates the main issues/activities that are proposed to be execute out in order to ensure agile development methodology sustainability. Detailed task based representation are also presented in appendix 6. The study also discovered the importance of ongoing training for agile teams in order enhance agile practices and produce knowledgeable teams. Here below high level representation of implementation guideline

Figure 12: Task based agile development methodology implementation guideline



4.9 The proposed Guideline Evaluation result

In order to establish the validity and appropriateness of the proposed guideline an evaluation questioner was adopted from literature (Elsa , 2015) and used to get views and information from respondents via Google form and 11 participants participated 9 from developers and 2 managers. The survey result is computed using Descriptive analysis (mean and standard deviation) as can be seen on table 10. Questioned Items for proposed guideline evaluation is referenced in Appendix 5. The mean result of the evaluation variables is found to be greater than 3 which indicated that the participants are agreed on the clarity, completeness, and usefulness of the proposed agile methodology implementation guideline. Mean of mean (aggregate mean) result of the proposed guideline is found to be 4.45 which represent the category of „Agreement“. “. This point out that the IT developers participated on the guideline evaluation survey accepted completeness, correctness and, applicability of the proposed guideline. This study, not restricted to identifies practices and challenges of agile development methodology implementation rather

delivered a detailed suggested activates that needs to be done during agile methodology implantation. Depending on evaluation survey result we can reasonably have inferred that the proposed guideline can improve agile development methodology implementation success at the study site and similar contexts and fit for Ethiopian airlines environment.

Table 10: Mean and standard deviation for proposed guideline

Descriptive Statistics						
	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Content clear	11	4	5	4.27	.141	.467
improve agile implementation	11	3	5	4.36	.203	.674
coverage complete objective	11	3	5	4.45	.207	.688
understandable	11	3	5	4.45	.207	.688
content complete	11	4	5	4.45	.157	.522
fit to organization	11	4	5	4.55	.157	.522
guideline applicable	11	3	5	4.64	.203	.674
Valid N (list wise)	11					

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Overview

This chapter presents the conclusions drawn from the research study, recommendations that emphasize on how agile methodology challenges addressed depending on the empirical data presented during the course of the study and also suggestions for future study are also included at the end of this chapter.

5.2 Conclusions

Our research primary goal is to experimentally examine and understand the practices of agile software development and potential challenges, as well as to proposing solutions to mitigate agile implementation challenges. We believe that by grasping this concept, practitioners will be able to understand agile Essen's more and successfully practiced into their work. Ethiopian Airlines is used as a case organization in this study to look at how the established agile software methodology is managed. The goal of this study was identify practices and challenges of agile methodology with related to team work, customer involvement and development process themes in Ethiopian, as well as propose a guideline for addressing the challenges and ensuring agile development methodology implementation success.

A combination of quantitative and qualitative methodologies is employed to effectively answer the research questions and achieve the study's objective. This method is utilized to validate the quantitative analysis' conclusions using the qualitative study's output, and vice versa. After a systematic study of the literature and empirical data output, a research guidelines were proposed, which included the key constructs of teamwork, customer engagement, and agile development process. That help to improve current agile challenge with in Ethiopian Airlines Software Development teams.

The questionnaire items for data collection instruments were partially derived from reviews of the literature and the remainder were created from scratch to match the research's objective. Accordingly, the content of some the interview outline are derived from the subjects of the questionnaire items and some are fully adopted from literature. In addition, document analysis was

carried out to obtain more information on the study. And also the use of both quantitative and qualitative methods helps to triangulate the results and get better results.

To summarize, the study was able to: 1), identify the team work, customer engagement, and development process practices of agile software development methodology implementation in Ethiopian Airlines, 2), identify team work, customer engagement and development process challenges in agile implementation and 3), propose agile development methodology implementation guideline to improve the identified challenges.

The following conclusions are reached from the study based on the analysis and findings:

The total mean score of teamwork agile practices is lower than customer engagement and development process related mean variable, according to the empirical data investigation. Consequently, agile development process implementation team work practices in Ethiopian airlines are not well adopted.

According to the findings from Quantitative data, conducting regular schedule meeting with in agile team's accounts for 27.2% of the overall disagreement in agile practices for team work theme. As a result, the study determined that practicing regular meeting with the team is lowest performance of agile practices in Ethiopian airlines. Agile teams size is the next lowest performance construct of agile methodology practices. Based on the empirical result, 13.9% of the agile practices irregularity is contributed by code review before the actual deployment.

From team work related practices that need ongoing improvement in agile development process implementation are having Demo session to share work progress with in agile or scrum teams and agile team leader's empowerment to facilitating project information to stakeholders in the process cycle. Since interactive connection between agile teams and team leaders is essential to agile approaches. Thus progress update and proper communication with agile team leaders are one of the improvement areas that need attention in order to improve agile development practices.

Ethiopian Airlines' customer's engagement to agile process is not at the needed level from Customer engagement related agile practices, according to the survey results. Only 29.2% of the total respondents are aggraded on User story consideration before doing actual software and implementation. According to the qualitative study, customer's engagement is still progressing concept due to lack of awareness about agile process. As a result, it's reasonable to conclude that the creating awareness, give treating for customers and participating them as owner, should be improved. Regardless of customer's involvement, proper feedback loop and smooth transition of

software products are the key practices of agile, the study found that it needs to be improved in order to produce quality product, minimize change, and increase time to market.

Training is one of the lowest rated practices development process theme. Several academics, consider that training is the most important factor in implementing agile development process, successfully implementation, tailor to our business process and to realizing agile methodology benefits. According to the quantitative result, training accounting for only 15.2 percent agreement of the total survey respondents. Additionally, results from qualitative study demonstrates Ethiopian airlines did not give formal agile training to teams. As a result, it can be concluded. The next lowest rated agile practices from development process theme is employing automatic UI Test. Depending on quantitative data practicing all automatic agile fruits is totally not practiced due to lack of knowledge with in agile teams. In today global world all agile process is automated, like automatic UI, automatic deployment and testing. On the other hand, quantitative survey result shows that, 32.2 percent of the total respondents are disagree on Practicing Automatic UI testing with in agile teams. Therefore, proper agile training should be considered one of the major area to continuously improve agile practices and use all functionalities of agile development process.

The study found that productivity and effectiveness of using agile development methodology and employing source code management system (Git , Git hub) with in agile teams respectively are the most rated practices. Findings from qualitative data also stressed that over all achievement of using agile is highly influence software product quality, high customer feedback, easily shippable products and increase in time to market. Accordingly, productivity is highly achieved or sustained by practicing agile as per both qualitative and quantitative study findings.

Team work related challenges are the most critical factors of agile development methodology implementation. The empirical study indicated that, the overall mean score of teamwork theme challenges is lower than both customer engagement and development process related mean variables hence, it is concluded that team work related challenges are affecting agile development process implementation success in Ethiopian Airlines.

As per the quantitative output indicated, only 5.6% of the total respondents of the survey agreed on having face to face communication with in agile teams Thus, the study identified face to face communication as the top most challenges of agile development methodology implementation success. Qualitative data result also supports forming self-organize agile teams and communication between teams are the main hinders for agile implementation Due to level of understanding and lack of experience working in teams.

Discussion of challenges faced at the end of software producer is the next highest factor construct agile software development methodology implementation success from team work related challenges. Depending on the survey result, 38.1% of the respondents were disagreed on having discussion on challenges faced during the development cycle. Since experience sharing session is the key unit of analysis of this study. Hence, experience sharing session determines agile development methodology implementation success.

Latest project update with in team members is found to be the third highest factors that affect agile development process implementation in Ethiopian airlines. Even though, agile team members used source code management system According to empirical data result, this we can conclude that latest project update with in team members is one of the improvement areas that need attention in order to improve agile development methodology.

Customer involvement in the development process determines agile development methodology implementation. Customer involvement was found to be the second most important determinant that hinder agile implementation next to team work related in Ethiopian airlines as per survey result. In connection with this customer engagement is among the most challenges Ethiopian airlines encountered as per qualitative data findings.

The study shown that customer's willingness to release products affects the implementation of agile methodology. From the total survey respondent's only 18.5 % agreed on customer's willingness during deployment. According to the qualitative study, customers are sometime resistance to change due to lake of knowledge, fearing business process change and fearing of not getting enough support from operational teams. Consequently, improper product or system transition from development to operation affects user willingness to release and use the new product.

The study shows that development process related challenges are the third determinants of agile development methodology implementation depending on survey result. In addition, qualitative result also stressed that since agile development process is a journey there exist any confusion and miss understanding regard to the process especially the concept of documentation in agile and how we tailoring to our environment without failing agile principles.

Lack of formal history of a project is one of development process related challenges that need responsiveness so as to improve agile development implementation. Even though, From the quantitative data findings there is a practices of using automatic source code management system with in agile teams (Git,Git hub) getting formal history of a project and having latest project update are still the major challenges of agile development methodology implementation. From a total survey respondent 44.4% are agreed on projects history insufficiency. There for it can be

conclude that lack of formal history of a project is the main challenges of agile implementation among development process related challenges.

5.3 Recommendations

From the analysis and results reached, the following recommendations can be made. It is provided in the context of a study on practices and challenges of agile development methodology implementation in Ethiopian airlines. The result of this study supposed to guide software developers, IT managers and directors of the main detailed activates which help to eliminate agile development methodology challenges and realize the intended agile benefits as well. Accordingly, the following are recommendations.

- ✓ The study finds out that Ethiopian airlines should improve agile development methodology implementation practices by concentrating more on team work related theme as a primary objective. Consequently, in order to improve agile development practices and to gain continuous improvement implementation of the proposed guideline is suggested. It's also recommended to follow the proposed guideline by giving greater attention for teamwork because it is thought that improving team work related challenges can help to improve both customer involvement and development process related challenges.
- ✓ Practicing face to face communication and daily stand up meeting with agile teams is vital to constantly ensure agile development methodology implementation. Communication and collaboration is critical not only inside agile teams but also with in customers and other stockholders as well. As a recommendation, to manage the coordination process an organization focus on communication and information transfer among teams, the way managing relationships between agile teams and customers, attend agile seminars and conferences and work to build self-organized teams.
- ✓ Ethiopian airlines agile teams should get formal Training and creating certified teams should get the required level of attention by considering their importance to practice agile development methodology. Agile teams should better understand what the essence of agile is and use all agile fruits like automatic UI, automatic deployment and testing. In addition, agile teams should compute not internally only to external markets as well in order to enhance time to market, meet product performance target, tailoring agile with our requirements, continuous product improvement, highly customer involvement and easy shippable product delivery.

- ✓ In order to improve stakeholders understanding of agile process and make more responsible for their work effective communication is energetic. Ethiopian airlines should consider that the successful software projects have solid communication process between customers and agile teams. In line with this, Ethiopian airlines should work to streamline IT and business alignment by arranging discussion session with business higher managements on the importance of agile process, continuously train and engage them, prioritize customers' requirements, give fast response for customer feedback and produce feasible product with in two or three weeks to build trust on customers.

- ✓ Ethiopian airlines should focus on how to tailor and customize agile development methodology fit in to Ethiopian environments. Since software development process vary depending on its business domain, organizational culture, technology and customer's requirements. As a result, adjustment to the standard software process should give required attention to make agile suitable to a particular environment.

- ✓ Wiring agile method with other development tools and frameworks should get required effort, software developers should adopt different combination of tools and methods rather than following all the steps prerequisite by particular method. Due to the fact that Agile may not complete by itself to support the whole development process.

- ✓ Ethiopian airlines should have committed to form DevOps Engineer section to eliminate the gap between developments and process. Moreover, management (specifically IT management) should communicate with higher management by demonstrating already existing software transition problem and the consequence on usability of new software products.

5.4 future research

The following are researcher's recommendation for future further researches.

Research on multiple organizations and multiples case study

This research is conducted by considering Ethiopian airlines as a single case organization. In addition to this, instead of single case, employing multiple case-studies can give a complete picture what agile practices are and what potential challenges that hinder practitioners to implement effectively.

Research using various data source

This study was able to collect data from Ethiopian airlines software developers and development team managers and directors only a future research that incorporate the understandings stockholders can provide helpful information for the improvement and sustainability of agile software development processes.

Further improve the proposed guideline

In this study, agile development methodology practices and challenges are identified using quantitative and Qualitative study. Piloting longitudinal research helps to improve the quality, efficiency, usability and content of proposed guideline by using continuous evaluation methods and feedback mechanism.

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APPENDICES

Appendix 1: Questionnaire Survey



ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL SCIENCES

SCHOOL OF INFORMATION SCIENCE

DEPARTEMET OF INFORMATION SYSTEM

Dear Respondents:

In partial fulfillment of the requirements for the Degree of Master of Science in Information System, I am undertaking a research on “Practice and challenges of Agile software development methodology implementation: The Case of Ethiopian Airlines” at Addis Ababa University. I have accordingly prepared this Survey questionnaire. The objective of the survey is to investigate current operational practice and challenges during agile implementation in Ethiopian Airlines software development process. This research is believed to produce results that can improve the utilization and understanding of agile software development process between teams and timely product delivery within planned budget your honest responses to each question and statement are extremely valuable to the outcome of this research. The

questionnaire survey will take approximately 25 minutes to complete and the results of the survey will be used for academic purpose only. As a result, all Responses will be kept in strict confidentiality.

Your dedication is most valued and appreciated and I would like to take this opportunity to thank you in advance for your kind participation, honest and on time response to the Questionnaires.

Thank you again!

Tirualem Yitayew

Note:

1. No need of writing your name.
2. Thick/Click the Block and will mark **X** on the appropriate block/cell.
3. If you need further explanation Please contact me and discuss with (Telephone No. 0921285002,
4. E-mail Tirualem3@gmail.com or company Email Tirualemy@ethiopianairlines.com).

Part - I: Demographic related Questionnaires (please use X mark on the choice you Select)

1. What is your current level of education?
 - . Diploma
 - . Degree
 - . Master's degree
 - . Ph.D.
 - . Other: _____
2. Which of the following best represents your current position in Ethiopian Airlines?
 - . Software Developer
 - . Software Tester
 - . Software team leader
 - . Scrum master
 - . Product owner
 - . Other: _____
3. Please indicate your seniority/ Service year in Ethiopian Airlines IT software Development?
 - < 2 years
 - 2-5 years
 - 6-10 years
 - 11-15 years
 - > 15 years

Part -II: practices Related Questionnaires

1. Can you please indicate the size of your software development teams?

- 1 – 5
- 6 – 10
- 11 – 15
- 16 – 20
- 20+

Please indicate your level of agreement or disagreement (where 1 = Strongly Agree and 5 = Strongly Disagree).

questionnaires	Strongly Agree 1	Agree 2	Neutral 3	Disagree 4	Strongly Disagree 5
Team Work Practices					
The team holds regularly scheduled meetings between team members and customer representative.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
The team conducts Code Reviews on a developer’s work before it can be deployed to the production server.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
We always Demo our work to the teams and clients on user Stories we completed.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Our team leader is empowered to eliminate obstacles that are faced by our team members during the cycle	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Development Process practices					
I am familiar with Agile Software development methods	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
the organization has supported and encouraged the use of agile methods in the development process	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	using an agile method will make the team more effective and productive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I have been participated in a training program (formal or informal) in an Agile software development method such as Scrum, XP, FDD..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	The size of our software development teams appropriate for agile method	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	My team employs automated UI tests to ensure requirements are met at handover and prevent unintentional changes in the future	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	My teams employ a source code management (Git, Github) to facilitate code collaboration and version control system between developers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Customer Engagement practices

	Usually our team members Deliver Software product with in the planned time and budget	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	User stories are always estimated before a developer can start working on them	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Our team members need to report on the work progress of their respective user stories?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Part -III Challenges Related questionnaires

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
questionnaires	1	2	3	4	5

team work challenges

1	We have face to face communication between teams and we are geographically co located	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Every team member is informed on the progress of the project and empowered to make design on his/her own	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	At the end of our delivery cycle the team reflects on the challenges faced by the team during the delivery cycle and suggests solution to ensure the next cycle will be improved.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Development Process challenges

4	Current decentralized and uniform organizational structure positively affect top management and team members communication	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	There is a lack of formal history of a project for our teams to understand the evolution of the system	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
6	Continuous restructure on existing code help us to improve design, structure and implementation of our software products	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
7	Current technology, infrastructure, tools and instruments are suitability for our work	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Customer Engagement challenges

8	The team are closely working with customers and obtain information and feedback	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Our customers are available and willing to release the software	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	The team welcomes modifications of requirements during and after the Implementation of a feature or software functionality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11	Usually Final software products we Delivered are same as what we initially planned	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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12. What Challenges do you face in carrying out your current software development process in terms of?

A. Teamwork

B. The software development process used at Ethiopian airlines?

C. Customers

13. What improvements do you recommend to deal with difficulties or how did you?

Try to resolve them? Are the solutions working?

Thank you Very much indeed!!!

Greetings,

As you may have informed on my previous mail am working my MSC thesis on practices and challenges of agile software development methodology implementation in case of Ethiopian airlines, thus this is to request your valuable response on below interview questions.

Please see below interview outlet and arrange sometimes convenient to you for short discussion.

Introductory part:

1. How do you see the overall achievement of Agile Software development methodology to meet on time Delivery of product in Ethiopian Airlines?
2. How do you see Agile related trainings content, quality, duration?

Practices of Agile method

3. What kind of initiatives do you make to ensure continuous agile methodology utilization and upgrade and also progress of the method?
4. What kind of initiative is there to encourage Agile related learning and knowledge sharing?
5. Is there a means to place procedures to document, capture and disseminate agile methodology related knowledge sharing?
6. Is the already existing knowledge sharing mechanisms helping Developers to get new knowledge of Agile?
7. How do you see the continuous improvement of agile method in order to address on time product delivery and quality software, teamwork, customer involvement? What kind of initiative do you make for the continuous improvement?
8. Comment on the operational contributions of agile methodology in Ethiopian Airlines Development teams. It can be seen from the perspective of team work, customer satisfaction, experience sharing etc.
9. How do you rate Agile Development methodology in terms of improving business and IT alignment?
10. How do you see current software development team's size in terms of software product quality, time and budget, team work and customer engagement?

Challenges of Agile method

11. How do you see the overall scalability of Agile for large projects?
12. Are the current organizational structure as well as culture of Ethiopian airline works well for agile development process implementation?
13. What Challenges do you face in carrying out your current software development process in terms of team work, development process and customer involvement?
14. What improvements do you recommend to deal with difficulties or how did you try to resolve them? Are the solutions working?

Appendix 3: Descriptive statistics of the survey mean and standard deviation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Agile Familiarity	72	1	5	4.26	.979
Agile team regular Schedule meeting	72	1	5	2.82	1.336
always demo work progress for the teams	72	1	5	3.36	1.293
deliver products on planned time	72	1	5	3.36	1.166
effectiveness and productivity of using agile	72	1	5	4.12	1.331
organizational Support	72	1	5	4.00	1.088
team leaders empowerment	72	1	5	3.53	1.321
teams conduct code review	72	1	5	3.33	1.256
teams employ automated UI tests	72	1	5	2.79	1.501
teams report on the work progress of their respective user stories	72	1	5	3.75	1.160
training participation on agile	72	1	5	2.42	1.518
user story estimated	72	1	5	3.31	1.274
Valid N (list wise)	72				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
at the end teams discuss challenges faced	72	1	5	3.04	1.272
Continuous restructure effect	72	1	5	3.82	1.293
customers involvement and engagement	72	1	5	3.53	1.332
Every team members have latest project update	72	1	5	2.72	1.335
lack of formal history of project	72	1	5	3.96	1.168

organizational structure and culture positive effect	72	1	5	3.14	1.202
suitability of current tools and infrastructures	72	1	5	3.65	1.323
teams closely working with teams and have feedback loop	72	1	5	3.50	1.245
teams have face to face communication	72	1	5	2.36	1.271
teams welcome modification at any time	72	1	5	3.90	1.140
Valid N (list wise)	72				

OpenCode - Project opencode project

File Text 2 Code Synthesis 1 Synthesis 2 Memo Help

Document: Agile practices answer | Open Text 2 | Assign Code: Ad

Document: Agile practices answer					
	Text	Text 2	Code	Synthesis 1	Synthesis 2
1	meet time line contnous product improvment		meet timeline		

Code List

Project: opencode project

Domain

Project

Selected Document(s)

Agile practices answer

Click on column headings to sort

Code	Count	Synthesis 1
back loop	1	
customer engag...	4	
meet timeline	2	
product improv...	3	
quality	1	
shapable product	1	
sustainability	5	
time to markate	3	
timly product	2	
traning	3	

Appendix 4: theme generation in open code

Appendix 5: Proposed Guideline Evaluation Survey

Dear Sir or Madam:

In partial fulfillment of the requirements for the Degree of Master of Science in Information System, I am undertaking a research on “practices and challenges of agile development methodology implementation: The Case of Ethiopian Airlines” at Addis Ababa University. Based on the empirical data findings collected within Google form and interview, I have proposed guideline to address current agile challenges and accordingly prepared this survey questionnaire. The objective of the survey is to evaluate the proposed guideline with respect to its usability, clarity, acceptability and correctness.

This research is believed to produce results that can improve the utilization agile development methodology in Ethiopian Airlines, other sectors and organizations.

Thank you for your dedication to provide your genuine feedback regarding the proposed Guideline.

Thank you again!
Tirualem Yitayew

questionnaires		Strongly disagree 1	disagree 2	Neutral 3	Agree 4	Strongly Agree 5
1	The proposed guideline is complete in terms of coverage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	The content of the proposed guideline is clear.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	The content of the proposed guideline is complete	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4	The proposed guideline is applicable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	The objective of the guideline is understandable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	The implementation of the proposed guideline fits with the organization.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	The applicability of the proposed guideline can improve agile-implementation process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix 6: Task based agile development methodology implementation guideline

Challenges in using Agile methodology	Core Activates	Detailed suggested activates De	R References
Teamwork and communication	Self-organized team and communication	Make daily stand up meeting Practice pair programming Arrange personal meeting Maintain transparency between teams Feel sense of responsibly Apply agile process in all projects Join new staff to the scrum team Follow a standard process (SOP) Learn by experience Collective owner ship Foster knowledge sharing culture Use collaborative tools like Microsoft teams, Skype for business.	Finding Literature Finding Literature Finding Finding Finding Finding Finding Literature Finding Literature
Training	Training for agile teams	Understand agile essence Create certify and competitive agile teams Allocate required resources for training Make a plan for recurrent training. Enhance the agile methodology training plan. Participate agile conference Practice Agile monitoring and coaching Invest on continuous improvement Infrastructure, process, culture Evaluate agile based on agile values	Finding Finding Finding Finding Literature Literature Finding Finding Finding

<p>Lack of formal history of project</p>	<p>Wiring agile process with other frameworks and tools</p>	<p>Adopt other development tools (e.g. DevOps)</p> <p>Complement with agile tools</p> <p>Adhere on How to approach on nature of different projects</p> <p>Apply all agile functionalities like Automatic UI test, deployment.</p> <p>Benchmarking best practice and business processes</p>	<p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Literature</p>
<p>Customer involvement</p>	<p>Agile process improvement with feedback loop</p>	<p>Check Agile process update</p> <p>Value customer input</p> <p>Continuous product improvement</p> <p>Meet performance target</p> <p>Create awareness and Engage customers as owner</p> <p>Prioritize customer feedback</p> <p>Produce feasible product with 2 to 3 weeks</p> <p>Good understanding to talk the same language and communicate with the business.</p> <p>Plan good change management process</p> <p>Create awareness sessions of cross-functional business units</p> <p>improve agile methodology through continuous refactoring</p> <p>Constantly evaluating and improving processes in the light of their flexibility, iterativeness..</p>	<p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Literature</p> <p>Finding</p> <p>finding</p> <p>literature</p> <p>Literature</p>
<p>Development process</p>	<p>Tailoring agile with Ethiopian process and environment</p>	<p>Agile process customization to fit with our organization</p> <p>Clearly aware top management about the process</p> <p>Train and Improve organization culture</p> <p>Shape agile with current business process</p> <p>modifying stakeholder roles suitable to business</p>	<p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Literature</p>

		<p>Ensure high product delivery</p> <p>Adhere to agile development Standards</p> <p>Adopt appropriate process depending on customer's demand and business need</p> <p>Write User story in a language and form that are understandable by its targeted final users</p> <p>dropping an activity or adding an activity from a different methodology</p>	<p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Literature</p> <p>Literature</p>
Level of understanding among team members	Practical project and output oriented process	<p>Apply agile to all software products</p> <p>Train new comers with practically executing the process</p> <p>aware customers and top managements with feasible output</p> <p>ensure that agile practices are observed and validated across teams</p>	<p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Literature</p>
User alignment	Discussion and Improvement on user alignment	<p>maintain regular discussion with customer's higher management</p> <p>friendly work with customers to understand the business</p> <p>plan or schedule customer onsite visit</p> <p>give the change to customers to participate on what could be the best approach</p> <p>shape organizational culture with continuous discussion</p> <p>Demonstrate regularly to customers the advantages of the best practices implemented on agile development methodology</p> <p>Train users to change process mentality by teaching the benefits of agile methodology</p> <p>Develop US that have a defined functional test plan</p>	<p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Finding</p> <p>finding</p> <p>finding</p> <p>literature</p>

<p>Miss alignment with in IT teams</p>		<p>Adhere smooth product transition</p> <p>Collaborate with all stockholders during deployment</p> <p>Prepaid clear user and admin guide</p> <p>Plan for parallel testing and deployment</p> <p>Define SLA between stockholders</p> <p>Plan for proper handover</p> <p>Communicate with IT higher management and form DevOps Engineer section</p>	<p>Finding</p> <p>Finding</p> <p>finding</p> <p>Finding</p> <p>Finding</p> <p>Finding</p> <p>Finding</p>
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