

**Assessing the Challenges of Adopting Agile Software
Development Practices: The case of two software
development companies in Addis Ababa**



**By:
Lidya Sefefe**

**Advisor:
Abraraw Chane (Ph.D.)**

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Declaration

I, the under signed, declare that this thesis is my original work, prepared under the guidance of my advisor, Dr. Abararaw Chane. All sources of material used while working on this thesis have been duly acknowledged. I further confirm that the thesis has not been submitted either in part or in full to any other higher learning institution for the purpose of earning any type of degree.

Name: LIDYA SEFEFE Signature: _____ Date: _____

LETTER OF CERTIFICATION

This is to certify that Lidya Sefefe has conducted this project work entitled “**Assessing the Challenges of Adopting Agile Software Development Practices: The case of two software development companies in Addis Ababa**” under my supervision. This project work is original and suitable for the submission in partial fulfilment of the requirement for the award of Master of Arts Degree in Project Management.

Abraraw Chane (Ph.D.)

Signature and date

Addis Ababa University
School of Graduate Studies

This is to Certify that the project work prepared by Lidya Sefefe Doya, entitled: “Assessing the Challenges of Adopting Agile Software Development Practices: The case of two software development companies in Addis Ababa” submitted in partial fulfilment of the requirements for the degree of Degree of Master of Arts for Project Management complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

APPROVED BY BOARD OF EXAMINERS

Abraraw Chane (Ph.D.)

Research Advisor

Signature

Date

Internal Examiner

Signature

Date

External Examiner

Signature

Date

Chair of Department

Abstract

This study was conducted to assess the challenges and implementation gaps of agile software development within Atlas Computing Technologies PLC and Jasmine Addis Trading. These two companies have different project approach, the first undertaking customer-initiated projects while the later mostly undertake in-house software development projects. Qualitative and quantitative research approaches were used in this study. A qualitative research was conducted to assess the challenges these companies face in implementing ASD practices. Primary data collection using questionnaire and in-depth interviews were conducted on all software development teams. Descriptive statistics was employed to present team size, composition, years of experience and other elements of teams. Questionnaires were distributed to teams in both companies to assess the nature, composition and other aspects of teams. In-depth interview sessions were held with technical leads and project managers to gather a comprehensive and descriptive data about the agile software development challenges faced in the case companies. Data collected from participants were analysed using narrative analysis approach. Requirement engineering challenges were prevalent mainly due to absence of team-stakeholder communication. Lack of commitment, self-management, and absence of proper workspace were among the major team and process challenges. Lack of managerial commitment and lack of agile-considerate recruitment strategy were among the major organizational challenges identified. In order to eliminate ASD implementation challenges it is advisable that each companies design their own custom Agile implementation strategies that align with their organizational values, resource capacity and cultural readiness. In the case of Jasmin Addis Trading, the firm should focus on commitment of customers throughout projects to ensure the dedication of product owners in the requirement engineering process. It would also be advantageous if the organization give room for research and development so that teams can enhance their technical capacity and look for optimization mechanisms for upcoming projects. Atlas computing technologies should focus on changing the organization culture, designing agile based recruitment strategy, conducting retrospective meeting sessions and training programs to change the perspective of employees towards the advantages of implementing agile practices. Managers should accept the necessity of business analysts in the requirement engineering process to tackle most of the prevalent challenges.

Keywords: Agile, Agile software development, Agile practices, Requirement Engineering

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Acronyms

AM Agile Modelling

APM Agile Project Management

ASD Agile Software Development

PMI Project Management Institute

PMLC Project Management Life Cycle

SDLC Software Development Life Cycle

CI/CD Continuous Integration / Continuous Delivery

XP eXtreme Programming

CHAPTER ONE

1. INTRODUCTION

This chapter presents descriptions about what this project work aims to assess, the underlying problem in software development teams related to agile development, the scope, limitations and significance of the study. Organization of the study and definitions of key terms are provided in later sections.

1.1. Background of the study

Different business process and operations in organizations are automated through digital solutions provided as software packages. The development of software products is the process by which manual operations of a certain business unit are analysed into functional and non-functional requirements and generated into a digital platform where customers can execute operational processes using digital devices.(Adolfo, 2014), outlines different types of software development projects including software developed for a specific customer, off-the-shelf software or applications that can be used by various customers, vendor provided solutions customized to a customer or customer groups, ERP systems to automate operational work and automating flow of information within multiple independent systems in an organization.

The need for frequent changes in functional and non-functional requirements of software development projects along with the demand for an up-to-date and at the same time backward compatible technical solution increased the necessity of making the development lifecycle as flexible as possible. Traditional project management approach limits engagements in redundant pattern changes. Currently, the software development world is unstable due to exponential advances of technologies and non-stopping customer demand. Such unsettling environment can only be effectively handled with agile approaches and technologies. (PMI, 2017).

The competition in providing digital solutions led to shift the focus of project organizations towards customer satisfaction through generation of modular prototypes that are enhanced as frequent as changes in customer requirements demand. This indicates the complexity and incompleteness of requirements during the initial project management period. Although project teams aim to deliver a certain digital solution, comprehensive and distinct definitions of customer requirements cannot be constructed

initially. This gave rise to the need for new project management approaches that enable stakeholders simultaneously and iteratively conduct all software development life cycle phases and the practical elements of project management practices. At the beginning of a project at least one of the goals or the solutions we want to deliver are not clearly known. This usually indicated that TPM models are not suitable and process adjustments will have to be made. (Wysocki, 2011)

Recently emerging solution to the demand for flexible and fast-paced software development practice is ASD. Agile alliance (2021) defines the term 'Agile' as the ability of certain entity to respond to change. In other words, it is a way of dealing with highly turbulent environment with an ultimate goal of succeeding, i.e., achieving project objectives. According to the agile model developed by Scott W. Ambler (2001-2021), a disciplined agile software development is an iterative and incremental development approach in which tasks are collaboratively undertaken in an evolving manner by teams with self-organizing and effective governance culture. The development process in agile teams produces high quality digital solutions that meets the changing customer requirements with the least expenditure of cost and time. In agile teams the software and the big picture of the project objective evolve simultaneously. Agile teams are not concerned with future requirements and needs. (Robert, 2002). Agile design is the continuous engagement of practices and principles to improve a software product. The core values of agile modelling are promoting communication, promoting simplicity, feedback, courage and humility.

Many firms across different nations have succeeded in implementing the principles of agile development. Agile project management, according to the agile manifesto, is a software development process that values interactions and individuals over process and tools; working software over comprehensive documentations; collaboration of customers over contract negotiation; and responding to change over following a plan. PMI (2017) describes agile as a mindset that is manifested through different practices in which these practices are guided by principles, and defined by values. Agile teams are characterized by dedicated people, cross-functional team members, mixed team of generalists and specialists, and collocated in the same work space or possess the ability to manage location challenges (PMI, 2017). Among various agile practices, the most commons are conducting daily stand-up meetings, retrospective sessions, sprints, backlog preparation, backlog refinement, and frequent demonstrations.

Agile principles note that success is measured by working software. The introduction of this approach in the software development industry have given teams and organizations the opportunity to overcome the uncertainty and flexibility hitches of software development projects. Although success rate of software development projects has radially increased with the help of this approach, there are few studies conducted in exploring and addressing the challenges teams may face in implementing agile practices. Literatures in search of success rate and impact of agile development are in abundance overshadowing the need for studies that help different teams in alleviating the challenges faced while declaring to go agile.

In their research study, Turk et al. (2002) indicated that there are plenty project success stories related to agile development process and that many of these success stories are anecdotal. They also suggested the importance of empirical data comparison of effectiveness and limitations of agile and non-agile methods to have a better understanding of the true benefits and limitations of ASD. A study conducted by Miller (2013) suggest that even though agile methodologies have positive record in terms of project success, applying this approach to project management is challenging. The greater performance success of this approach has overshadowed the caution teams need to take in studying their team structure, culture and resource capacity before going for the decision to implement agile practices. There is no evidence to propose that the methodology by itself is problematic but the problems and difficulties in practicing agile principles need further exploration. This study has tried to explore the problems selected software development teams have faced in practicing agile principles.

Dikert et. al. (2016), in their systematic literature review indicated that large scale agile transformations faced challenges of change resistance by organizations, teams and individuals. This research noted that agile principles are difficult to implement even if teams mostly do well in trainings and most employees misunderstood the concepts of agile software development. Gregory et. al. (2015) indicated the existence of agile implementation challenges in the areas of sustainability, culture, scale, teams and other themes in their thematic research. Ghani et. al. (2019) identified that communication, coordination, collaboration, control and cooperation challenges are prevalent in implementing agile software development in distributed development environment. According to Rasheed et al. (2021) requirement engineering challenges in agile teams

have been the focus of many research studies, although most of these researches have failed to make suggestions to improve agile development process.

Turn et al. (2002) proposed that the limitations of agile process lie in the assumptions that agile principles were constructed on. The first assumption, colocation of teams with customers and their constant face to face communication is challenging to implement for distributed development environments. Another assumption, which undermines the role of intensive documentation and use of software model is challenging to adopt as most ASD teams tend to make use of software models and tend to practice the culture of intensive process documentation. Unless test and validation process are backed by formal specifications, it is difficult to assure safety-critical software development

Atlas computing technologies is a private technology company engaged in software development, system administration, and digital technology trainings. Having over 20 permanent employees, the firm has been in operation for about ten years. Most projects are in-house projects initiated by project and higher-level managers. Several projects were extended beyond schedule, re-done due to requirement variation and generated low business value due to products' failure to address customer business processes. Although teams claim that they implement agile practices, most agile team characterization elements are missing in this organization. On the other hand, Jasmine Addis is a small-scale digital solutions company delivering digital products for customer-initiated software projects. Even if the size and openness of managers have helped the development team in Jasmine Addis to practice agile software development, teams exhibited difficulties in employing agility features and guidelines. This study has tried to assess the challenges that hinder these two companies from implementing agile software development practices.

1.2. Problem Statement

According to a blog by Content-era-tech-space (2020) despite the benefits and popularity of agile methodology, there are several challenges contributing to project failures. Recent studies have shown that agile transformation failures are prevalent in various companies. According to Forbes Insights and MIT Sloan Management review, referenced in Sutherland's study (2020), 47% of agile transformations fail while 67% of failures are terminal. Very few empirical evidence is available of what software architecture related practices are followed by agile, and little is known about the kinds

of architectural challenges resulted from engaging agile practices. (Babar, 2009). An empirical study conducted by Regassa et al. (2017) identified the prevalence of bureaucracy in government organizations and challenges in nature of contracts and tender process for companies that use agile methods.

As prototypes are developed and enhanced to accustom requirement changes in each iteration, even though project owners picture an initial project objective, later releases become robust beyond the anticipated project scope. As an organization, resources are spent over budget, the ultimate digital solution is delivered overdue. What we can understand from this is that with the thought of prioritizing customer satisfaction and shifting our focus on incorporating more requirements in upcoming iterations, project teams fail to consider the project scope, expenditures and schedules.

We cannot say the approach for this methodology leads to project failures per se, but our level of concern on how we meet customer expectation needs to balance with core organizational values. Another implementation gap arises due to the behavioural pattern of project teams in Ethiopian software development firms. The practice of frequent user engagement, continuous communication, requirement interpretation, self-led team organization are mandatory to foster the effectiveness of agile methodology. Professionalism concepts such as work ethics, commitment, high level technical capability and practical experience are necessary if we are to construct self-managed teams.

As the challenges of agile implementation continue unaddressed, the difficulties propagate to contributing for overall project failure. In the long run, higher responsibility vested on practitioners with little or no workaround will lead to stress, burnout, dissatisfaction, crumble in cultural values of employees and organizations. Both case companies face difficulties in maintaining agile practices for their software development projects. Although there are different indications on why teams face agile practice challenges. Due to the deviation of characteristics of the companies, their employees' practices and organizational cultures from study elements in previous literatures, it is important to explore the current paradigm in both companies and identify the sources of agile practice challenges.

In conclusion several problem areas arise concerning agile practices. Practitioners often find it difficult to blend agile software development approach with their practical experience and knowhow over managing software development projects. Another problem is the ignorance of organizations towards optimizing the advantages ASD methodologies provide. Had teams and organizations optimized their practical understanding, the business value generated and customer satisfaction over the course of projects would have been high. This research will identify the loopholes in practicing agile principles and propose how the implementation gap can be narrowed. In order to identify the challenges prevalent in Atlas Computing Technologies and Jasmine Addis, this research focused on assessing requirement engineering, team, process and organizational culture challenges

1.3. Objectives

1.1.1. General Objective

The general objective of this study is to assess the challenged faced in adopting Agile software development practices in Atlas Computing Technologies and Jasmine Addis Trading.

1.1.2. Specific Objectives

The specific objectives of this study are:

- ✓ To identify requirement engineering challenges
- ✓ To identify team and development challenges
- ✓ To identify organizational culture challenges
- ✓ Identify ASD implementation improvement areas

1.4. Basic Research Questions

This research will try to answer the following questions:

- I. What are the requirement engineering challenges faced by case companies that impact ASD implementation?
- II. What are team and process challenges faced by case companies that impact ASD implementation?
- III. What are organizational culture challenges faced by case companies that impact ASD implementation?

1.5. Significance of the Study

It is important for project teams to understand business values and achieve project objectives in a way that contributes to the overall organizational objectives. This progress should not only be achieved through redesigning project work flow every now and then but developing an enhanced methodology engagement pattern that takes operational, tactical and strategic elements of the project organization. We can develop such advancements if we understand the organization's project management culture and identify tactics on how we can integrate agile project methodology with our behaviour as well as business objectives. The ultimate business objective of any project organization is increasing the amount of revenue generated with project deliverables. The how question, for identifying the means to achieve this objective differ. Considering software development projects, increased user satisfaction means increase in potential customers to engage in using the digital solution we provide, in turn adding up our revenue. The agile methodology is the most common and suitable tool that align with such tactics. This study will explore the gaps between the theoretical approach towards evaluating performance and the current paradigm in software development teams

In general, the study is believed to contribute as:

- An indicator and a contribution for the research gap in relation to studies conducted to enhance agile development challenges in Ethiopian software development industry.
- A reference point for software project organizations to examine what values, cultures, opportunities, threats, capacities and PM practices exist in their company and tailor agile development adoption and implementation accordingly
- A guideline for software developers in the search for what skills to acquire in order to cope up with recent project management and agile development practices and signify the necessity of project management skills besides the technical skills mostly demanded in the selected software development companies.

1.6. Scope of the Study

The researcher has assessed the existing paradigm in the development teams of Atlas computing technologies and Jasmine Addis Trading. Other elements that affect ASD beyond the development department were not the focus of this study. The explorations in this study were limited to focus only on ASD challenges related to requirement engineering, team, development process and organizational culture. The two case companies were selected for assessment because of their engagement areas on important software development aspects such as enterprise applications, financial solutions and enterprise resource planning systems development. This does not mean that there are no other software development firms that focus on the aforementioned development areas, but the ease of access for data collection made the two case companies suitable for this project work.

- ✓ This study has identified agile development requirement engineering, team, process and organizational culture problems, challenges and gaps in Atlas computing technologies and Jasmine Addis Trading
- ✓ This study has suggested mechanisms to tackle the identified implementation gaps and enhance ASD practices

1.7. Limitations of the study

The short schedule of this project work made it difficult to broaden the study area and case companies. The researcher was forced to narrow down target population because it was difficult to convince for transparency in SD firms. This study has tried to explore existing difficulties in implementing agile practices only for Atlas computing technologies and Jasmine Addis trading. Although findings were claimed to be interrelated, the validity, and magnitude of interrelation of identified challenges were not proven in this study. Exploratory in nature, this study was not conducted to draw well tested, sound and representative conclusions with regards to challenges of ASD, but rather assess what exists in the development environments. Due to the narrow scope of this study, it is difficult to generalize the findings beyond the case companies, even if the identified challenges may exist in similar firms Addis Ababa, Ethiopia.

1.8. Organization of the study

This study is organized into five major chapters. The first chapter will provide a brief description about software development and agile projects and highlight the urgency for studying the difficulties software development practitioners face in practicing agile methodology and point out suggestions to eliminate these problems. Following the research introduction, a comprehensive overview of the concept of complex projects, agile project management, methodologies of APM, Software development, Software development team organization, trends of APM application in software development teams and summary of similar studies conducted will be provided in the second chapter. Chapter three, that focus on the research method, presents data collection and analysis methodologies employed in this study. Next on the fourth chapter, the implications of our collected data will be provided in an organized result analysis. Lastly based on what is implied in the research findings, the study will provide summary of what should be done next with respect to the implications and point out what can be done to help ASD teams to optimize agile methodology practices.

1.9. Definition of Terms

❖ Agile software development

A software development approach that is iterative and incremental where by the development lifecycle phases are undertaken repetitively through consecutive iterations. (PMI, 2017)

❖ Cross-Functional Team.

A team that is comprised of various practitioners possessing all the necessary skills to deliver valuable product increments.

❖ Requirement engineering

The process of identifying, designing, prioritizing and documenting the features of software products requested by customers

❖ Software development life cycle

The process of requirement engineering, analysis, design, implementation and quality assurance to deliver software products

❖ Sprint

A “sprint” in Scrum is typically a two-to-four-week period and during each “sprint,” the team creates a potentially shippable product increment (for example, working and tested software). (Charles, 2011)

An iteration, lasting for short period of time, in which teams focus working on a specific task

❖ Version Control Systems

Software tools that are used for tracking and managing changes to source codes overtime.

CHAPTER TWO

2. LITERATURE REVIEW

This chapter presents theoretical definitions of software project management, complex projects and agile project management. Empirical findings from different research studies that focused on challenges of adopting agile software development are presented in the empirical review section. Based on the major concern areas of related literatures, the conceptual framework of this study is constructed using the research questions and objectives.

2.1. Theoretical Literature Review

2.1.1. Software Project Management

The software development lifecycle includes planning, analysis, design, implementation, testing, integration and maintenance phases. These phases will be aligned with the overall project management life cycle. A software development life cycle (SDLC) is a framework with predefined tasks and work phases that help software development teams to plan, design, build, test, and deliver information systems. (Sarah, 2020). Software development is a relatively new area of study, that emerged after the invention of internet and growing demand for automated business systems. This indicates that only few researches have been conducted in developing the area of software project management. Software engineering has been in existence only for last 60 years or so, starting from the 1950s. Lack of sound engineering practices makes software project management a difficult proposition. (Ahmed, 2012). Although many organizations have interest over software development projects, the practical implementation is yet not matured enough to withstand problems arising due to little or no understanding of the concept.

2.1.2. Complex Projects

It is important to note that recent projects are characterised by uncertainty and complexity, indicating the urgency for complex project management approach unlike the most common traditional project management approach. It is advisable to employ a flexible project management approach for complex projects. Wysocki (2021) identifies the characteristics of the project; the organizational environment; and the external market situation as major determinants of project complexity. It is given that these factors are unstable and dynamic in nature that impose the need for elastic

management approach that can accommodate needs, optimize opportunities and minimize uncertainty impacts.

The question here is that, whether we have a clear understanding of the status of our organization and that of the selected project landscape. If we fail to answer either one of these questions, we should note that our organization and our projects are bound to fail no sooner than we realize generated business values. Whatever project environment your organization embraces, it must be able to respond immediately. (Wysocki, 2021)

2.1.3. Agile project management

Agile project management is an approach to software development that is iterative and responsive to changes. Although the application of this approach is under test for other project areas beyond software development, originally, it was initiated to tackle the problems faced by software developers due to the highly structured nature of traditional project management. Application development crisis were prevalent in early 1990s where significant lag of schedule for delivery and drastic technological and customer requirement changes were experienced. (Kanbanize, 2021). Developers needed to consider changes in order to deliver best software products, and this was achievable only if they implement frequent iterations of shorter time consumed in each, intensive testing and continuous feedback. Overwhelmed by the structure of the then traditional approach, 17 software developers discussed and came up with the AGILE MANIFESTO, a collection of principles to guide project teams on how to implement Agile project management.

Source: Wysocki (2011)

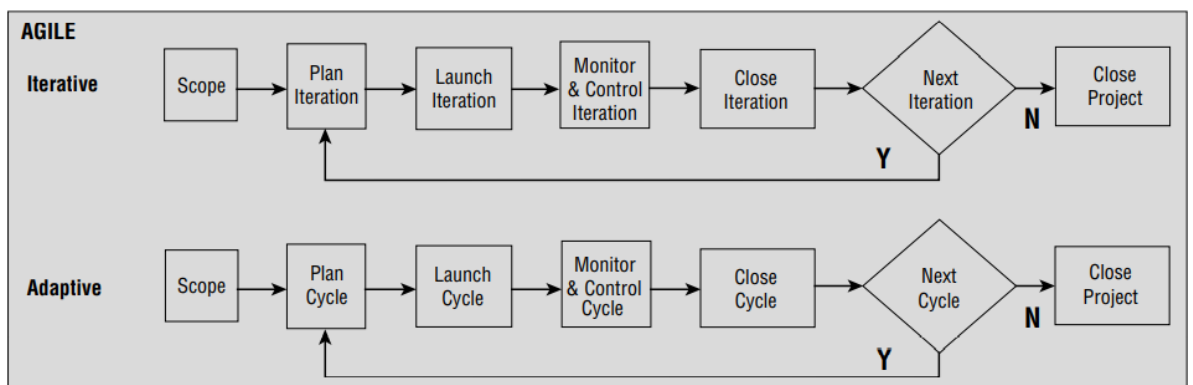


Figure 1: Agile PMLC Model

Philosophie (2017) stated that implementing agile in teams is advantageous for speedy delivery, flexibility, risk management, quality, cost control, right product and transparency. Agile teams strive for frequent delivery of products; hence, speedy product delivery is ensured. Agile embraces the idea of change accommodation in a development process, ensuring flexibility of teams to consider changes, new ideas and even omitting features. Since agile has flexible scope, the cost and schedule plans are not fixed and predetermined. High overall quality of deliverables is ensured in agile because testing is integrated throughout the development process. Frequent and incremental releases help agile teams to locate improvement areas and flaws easily.

As indicated in the agile manifesto, the four values compared to what traditional project management approaches emphasize are relatively new to Ethiopian software development firms and their project management practice maturity. Regassa et al. (2009) reported that companies implementing agile practices conduct government software development projects, in which, most clients requested substantial documentations, fixed price contracts and predefined schedules. This indicated that even if software development companies adopt agile practices, it is difficult to avoid predefinition of cost and schedule and requests for intensive documentations, especially for government software development projects. Although project teams practiced what is now stated as agile principles, the concept as a concrete construct, articulated and adaptive set of principles is introduced in recent times. Given the development of project management practice, implemented by following set of well researched and documented concepts is still at an infant stage, our country, especially the IT sector needs to focus on developing the practice of agile project management, and project management at large. Many developers may practice the principles as a rule of thumb due to the nature of software projects. Our concern should be whether these developers have ample knowledge about agile project management, how they have been practicing it all along and their techniques in blending agile principles with organizational objectives. Moreover, organizations should examine their internal capacity and project management culture to check whether their environment is suitable to embrace the four principles over the traditional principles that have been in use for a longer period.

Chan and Thong (2009) developed a conceptual framework to examine the acceptance of agile methodologies. The constructed framework depicts that agile methodology acceptance is dependent on knowledge creation, retention and transfer. Factors such as

external support, experience and self-efficacy of project teams; arduous relationship, communication and shared understanding; subjective norm, organization culture and top management support, etc... are critical factors for this knowledge base elements.

2.1.4. Agile Software Development

Campbell (2020) described agile is an iterative software development approach that allows teams to work with greater self-management and focus on quality of deliverables. The core values of ASD place more focus on individuals and teams over process and tools, working software over intensive documentations, customer collaboration, and the ability to easily respond to change. PMI (2017) identified reprioritization, frequent delivery, regular plan update, frequent process adaptation, and short feedback loops as the major approaches in agile teams. According to PMI (2017), agile is considered as a development life cycle with dynamic requirement where by activities are repeated until a certain goal is correctly attained with frequent small deliveries. In conclusion, agile teams, with higher autonomy, aim at delivering high quality products as fast as possible with the continuous engagement of customer feedback.

Source: Alexsoft (2016)

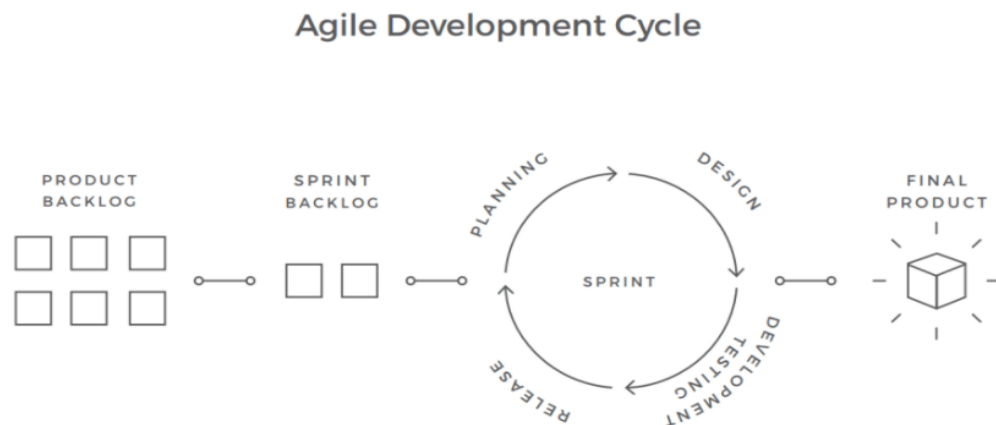


Figure 2: Agile development cycle

In agile software development, sprint planning is the first activity during the initial project phase. During this phase, extensive meeting session is held to brief project overview and goals, introduce teams, identify product owners or customer representatives, define project backlogs, identify prioritized features and reach to the same level of understanding and consensus over the project. Product/project backlog is a list of definitions of features to be included in the project deliverable. After basic features are identified, project is broken down to sprints and teams start the development process. During development, daily stand-up meetings and review/retrospective meeting are conducted. (Alexsoft, 2016). Philosophie (2017) stated that communication, dedication and good planning are critical success factors for agile software development.

2.1.5. Agile Suitability Filter Tools

Agile suitability filter tools are important to assess the circumstance in which an agile approach is appropriate for a certain organization. PMI (2017) proposes the following agile suitability filter approach.

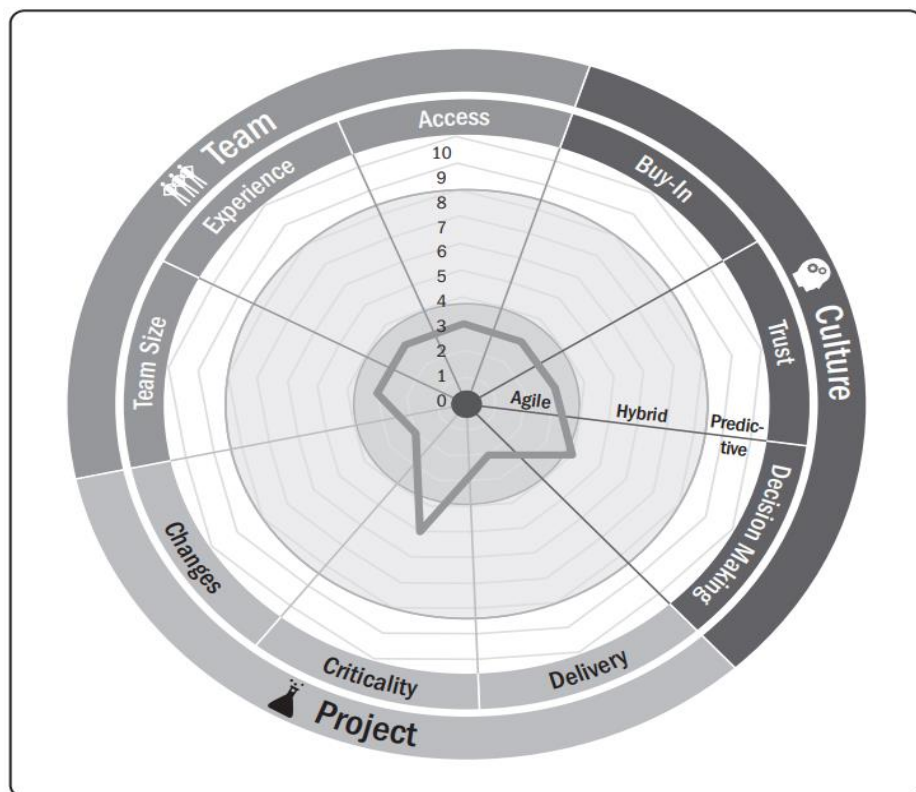


Figure 3: Model for suitability of agile approach

Three main organizational aspects are assessed using this approach

- Culture: check whether there is a supporting environment with buy-in for the approach and whether there is trust in the team
- Team: check if the team size is suitable to successfully adopt agile, check whether team members have necessary experiences, and check if team has access to business representatives
- Project: check whether there is high rate of change, check the possibility for incremental delivery and the importance of the project

(Dingsøyr et al., 2010) in their study on ASD indicated that the studied case teams were striving for facilitating quick results by using set of practices in the new software development process (agile). According to their study the agile practice is attributed by negotiable quality, new development culture, desperate rush to market and market environment that require flexibility. One bottleneck reported by this study with regards to practicing ASD was lack of experience. The study noted that very few developers understood agile principles and the change in market condition. The prior experience developers had in a corporate environment was reported to be a burden rather than an advantage. In addition, all case companies in this study reported that they faced difficulties in balancing speed and quality.

- This indicates that many developers fail to understand the principle of ASD, the change in the market environment, that requires flexibility and rush in delivery, that contradict with their previous software development experience. Furthermore, teams fail to balance quality and speed in agile environment
- The authors also indicated that agile principles encourage self-management and shared-leadership culture in teams, which is difficult to consider if employees focus on their job functions only and fail to appreciate the need for self-management leadership behaviours.
- Their implications also mention that developers need to augment their capability with social and political skills that enable them to interact with different variety of stakeholders

2.2. Empirical Review

2.2.1. Failure factors and challenges of Agile software development

Saran (2020) summarised a study conducted by a London based technology services firm, 6Point6 and demonstrated that 44% of failed agile projects failed due to lack of documentation, while 34% failed due to lack of upfront planning. More than three fourth of CIOs contacted during this survey noted that it is no longer possible to defend the fact that agile projects fail. A small and neglected failure in each iteration lead to an inevitable and costly project failure although teams pursue for solutions to customer problems. Due to lack of documentation, it is impossible to maintain a standard description of project status and pass over tasks to members that join agile teams along the way. A research by Teka et al. (2017) indicated that software development projects in low- and medium-income countries exhibit gap in education and implementation due to lack of experience, lack of trained manpower and lack of software project management skills.

An empirical study on agile software development was conducted by Dyba° and Dingsøyr (2008) to identify currently known benefits, and limitations of agile methods by reviewing information software technology cases. They managed to identify 1996 studies conducted on agile methods and only 36 of these studies were identified as empirical by the authors.

As cited in the study of Dyba° and Dingsøyr (2008), (Svensson and Host, S30) suggested that when considering to introduce agile development, companies should keep in mind simplification of terminologies, identification of important elements that needs to be introduced, avoiding the underestimation of the effort needed for introducing agile methodologies such as extreme projects (XP). This indicates that prior attempts to introduce agile development failed due to neglecting and underestimating the effort and involvement required when introducing agile development; introducing broad agile project management concepts in a manner where required aspects of agile development were not identified, prioritized and selected; inefficient training and knowledge transfer on agile principle as terminologies may not be as elaborated as the understanding level of trainees and employees

In their study, Tawanda and Ernest (2017) pointed out several factors that agile teams and professionals lack even though they have previous experience. These are technical failure, organizational, process, project and cultural factors. The first factor these authors identified was performance expectancy (perceived usefulness) of employing agile practices. The perception that ASD enables better performance increases project success. This indicates that understanding the importance of agile practices is crucial factor in paving the way for teams to easily implement ASD

Tabaka (2007) outlines the reasons why agile adoption fail. In terms of practicing brutal honesty, she suggested that organizations should be willing to embrace the high visibility that agile practices bring forward. And unless organizations strive for a culture that supports cooperative learning adopting the practice by itself in an environment where skill development and learning are not practiced would only bring frustration and rejection of agile approach. With regards to collaboration and self-organizations she noted in her article that teams must have the mandate in decision making, estimation, approach towards learning, and resource assignments. Another factor raised in this article is the ignorance or little commitment of management in agile practices after declaring to adopt the process.

Conboy et al. (2011), conducted case studies over 17 companies to assess the challenges faced in adopting agile practice. Among the factors identifies were: the fear of developers for exposure of their skill deficiency, expectation of organizations that developers must possess broader skill set in contrast with the principle of specialization noted in agile methodology; almost 90% of respondents raised the issue of weak communication and presentation skills; most developers in the case companies were expected to have business knowledge, and the absence of basic business knowledge led to customers losing confidence in overall skill of developers; even though teams practiced agile practices, they failed to achieve agile goals due to intangible factors like cultural issues, management style and staff personalities; 10 among 17 failed to achieve ultimate agile goals despite declaring and practicing ASD; lack of motivation of developers in adopting agile methods was exhibited in 5 of 17 case companies; devolved decision making especially in failing to understand the role of project managers, and biased and unorganized task selection by developers; failing to employ agile-compliant performance evaluation and the absence of agile-specific recruitment strategies and appropriately trained IT graduates.

Ram et al. (2018) conducted a study on software process management challenges in ASD. By conducting workshops on four case companies, the researchers have identified challenges faced in operationalizing metrics. The first challenge identified was lack of sufficient data and appropriate tools to generate metrics reports. Another challenge was the incapability of current development practice in teams to inhibit change. Although agile practice demands frequent change, some of the case organizations have normalized a development culture that is not flexible enough to encompass changes.

Schön et al. (2017) conducted an iterative expert judgement (Delphi study) for their research on identifying key challenges in Agile requirement engineering. The common challenge identified in this study was the absence or insufficient participation of stakeholders. Requirement or system changes highly affect end users and their involvement in briefing meetings, decision making and daily communications is crucial. Due to lack of involvement of stakeholders, the study suggested that requirement engineering was a challenging practice in ASD. The study constructed six major challenges related to requirement engineering.

A research conducted by Boehm and Turner (2005) provide a different perspective on where implementation challenges arise by in their workshop research to explore the difficulties management face in implementing agile process in traditional development organizations. The study findings show that it is difficult to blend existing traditional development culture with agile practices as there are conflicting practices. Compromising and customizing an organization's adoption model is crucial when introducing ASD to companies that have been practicing traditional development for longer period of time. The perception of stakeholders towards agile practices, lack of documentations as many as those generated using traditional approach, the iterative nature of development life cycle, and other practical challenges were raided in this study.

In a literature summary of a study conducted by Morris (2015), factors contributing to common agile practice challenges were presented. Among the summarized factors were, lack of trained resources, lack of vision alignment in understanding the urgency to use agile, communication failure, lack of customer involvement, lack of commitment and encouragement from managements in practicing agile processes, incompetent

leadership, lack of team accountability, unreadiness of project participants, poor social skills, etc ...

Mahanti (2006) identified common challenges in adopting agile methods by conducting a survey study. Office politics, fear of change, lack of technical specialization, documentation-heavy mindset and do-it-all-at-once attitude were among the predictable challenges.

In general, these challenges are caused due to several factors. The insights gained from the above literature reviews on causes of agile implementation challenge factors are summarized for each of the aforementioned challenges in the following table.

Table 1: Summary of contributing factors for agile implementation challenges

Challenges	Causes
Requirement analysis, interpretation, implementation	• Absence of stakeholders in requirement briefings and change decisions • lack of commitment of stakeholders throughout the project lifetime • scope creep and employee burnout due to unnecessary back and forth in requirement changes • poor requirement briefing resulting in low quality interpretation and technical implementation
People and team effectiveness	• Lack of decision-making authority • Lack of commitment and self-management qualities • Lack of collaborative learning culture • Low emphasis given for the necessity of self-management leadership qualities • Low frequency of structured and formal communication, etc...
Organizational culture and process	• Organizations and individuals fear of change • Lack of commitment of management in supporting agile development • Lack of skilled team members in promoting agile practices • Low resource commitment while expecting higher earned value, etc... • The prevalence of hierarchical management practice hinders the development of self-organizing teams.

2.3.

2.4. Conceptual Framework

Beyond the practices and principles of agile software development there are different factors that determine the effectiveness of ASD. With regards to the concepts raised above, in order to say a project is successful implementing all agile principles is crucial. This study identified the loopholes in ASD teams under study by answering the aforementioned research questions. The responses on these questions will be compared and contrasted with agile implementation principles elaborated in related literatures. Conceptual frameworks are a researcher's territory of investigation for a given research problem. Miles et al. (2018). In the case of this study, factors under study were challenges of practicing ASD, gaps in implementation and contributing factors. The study searches for what case teams claim as practical challenges and explore their contributing factors, and lastly search for the disparity between how the teams' practice ASD and what literatures propose as ASD practice guidelines.

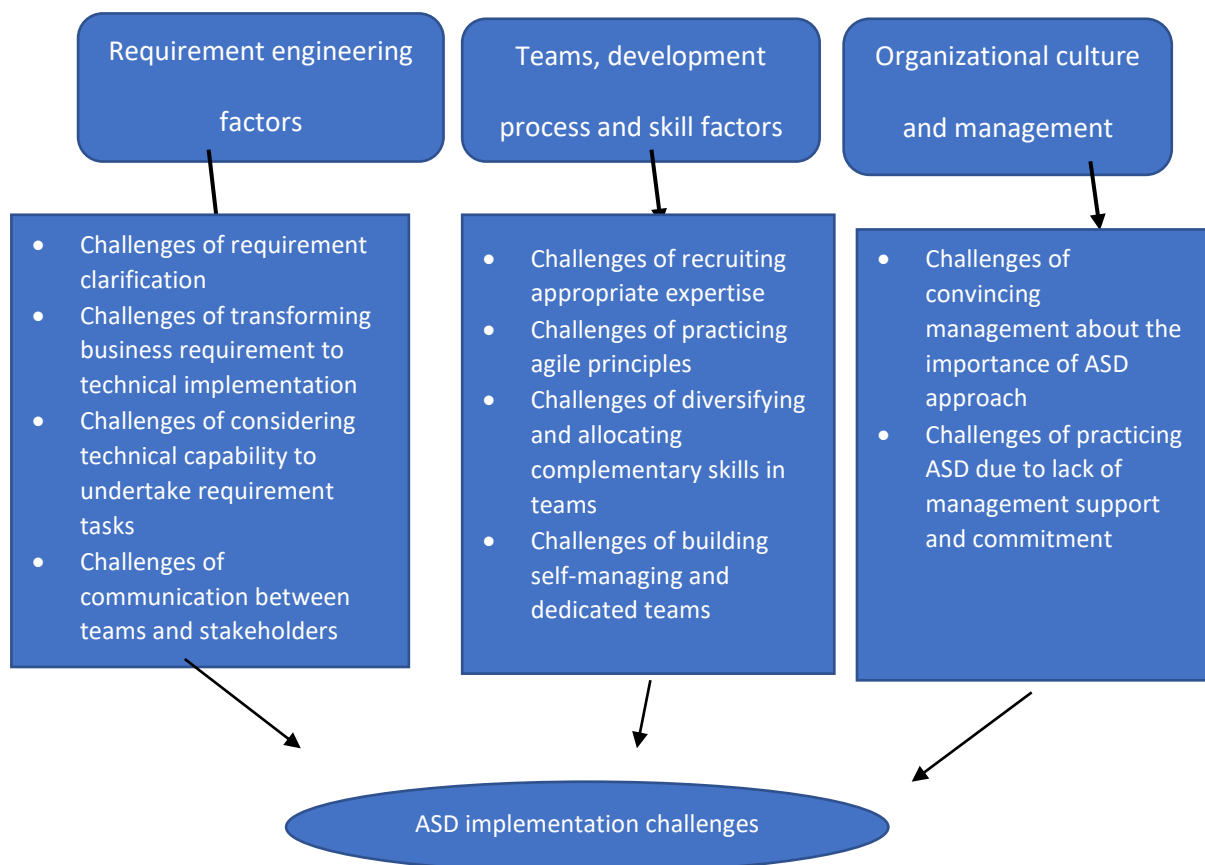


Figure 4: Conceptual framework

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1. Introduction

The research methodology section of this study encompasses brief description about the research approach and design used in the study. Following the descriptions on the approach used for data collection, analysis of collected data along with validity and reliability justifications are presented. Lastly, elements of research ethics considered in this research is shortly elaborated.

3.2. Research Approach and Design

3.2.1. Research Approach

This research has used qualitative approach to assess the gaps in ASD implementation and the practical difficulties faced in the selected case tams. Minor quantitative research approach by using descriptive statistics was used in this research. This study has thoroughly examined literatures in order to identify the implementation gaps between the practical paradigm and the theoretical constructs with regards to agile principles for software development.

3.2.2. Research Design

Exploratory in nature, this study was conducted to investigate the reasons for ASD practice challenges. Practical challenges of ASD in Ethiopian software development context have been studied by very few scholars and the literature gap indicates the need to investigate more on what the problem is. In order to pave the way for further researches in developing better practical pattern, models that can eliminate the challenges and other research area, we first need to have a more distinct picture of what the problem really is. Exploratory research is suitable for this kind of study as it helps researchers gain better understanding of existing problems. As a multiple case study, this research has analysed the pattern of existing problems in the selected case studies with regards to similar trends attributed in previous literatures on agile implementation challenges. The study has also tried to look for further practical challenges besides analysing current trends identified in previous literatures.

Examining whether findings in previous literatures relate with the results in the research's case studies helps to search for solutions applicable to previous findings, search for effective remedies that were developed based on similar findings. In addition, exploring for additional patterns ASD challenges exhibit would help to construct hypotheses and study elements for further researches.

3.3. Population and sampling

Two different companies with different service provision and operational characteristics were involved in this study. Participants from each company filled out questionnaires and project managers and technical leads from each company participated in an intensive interview. The first case company, Jasmin Addis is a digital solutions provider firm involved in customer-initiated projects. As most projects are initiated by customers, the estimation and expedition of cost and schedule is the biggest concern of the firm. In order to optimize the opportunities of agile methodology, it is important to identify challenge areas the firm is facing in implementing agile principles. On the other hand, Atlas Computing technologies is a software development company mainly focused on developing enterprise applications and digital solutions, most commonly for financial institution. The nature of enterprise applications necessitates the need for having a potential customer at least before the first production launch in order to test products' compatibility with common system platforms in enterprises such as core banking systems, enterprise resource planning systems and many more. In the case of Atlas computing technologies, it is important to identify the challenges team face in the development process and identifying the reason why managers neglect the importance of customer engagement. Unless customers are engaged in the overall project and stakeholders change their mindset about agile methodologies, it is impossible to implement agile principles and gain better experience. Both of the participant companies are located in Addis Ababa, Ethiopia, working in the fields of system development, software development, system administration, branding and digital marketing.

A brief profile summary of the participant companies and their respective teams are presented below. Jasmine Addis was comprised of 15 employees while Atlas Computing Technologies had 30 employees in the software development department. In the case of Atlas computing technologies about 14 employees in the development department were temporary assignees from the system administration department, that

rarely participated in the development process. The development team in Jasmine Addis consisted of 15 members in the development team, and development teams in Atlas computing technologies ranged from 6-8 members, 20 in total. All members of the development teams in both companies participated.

The major study elements are requirement engineering, team, development process and organizational culture challenges related to implementing ASD. The rationale behind selecting these two companies was ease of access and participants' willingness to take part in the process of data collection. Although initially a total of four software development companies were selected for case studies, only the following two were able to provide sufficient information for this research. The direction from which project ideas were generated are the main control variables that give rise to difference in sources of ASD challenges related to requirement engineering.

Table 2: Description of Case Companies

Company	Size	Experience	Profile
Company A: Jasmine Addis	5-10 permanent employees and 5-7 contract employees working in 1-2 development teams. At the time of data collection there were 15 members engaged in software development projects	More than 8 years with over 50 projects	• Branding • Application development • Server management • Digital marketing • AR solutions • Most projects are client projects
Company B: Atlas Computing Technologies	20-30 permanent employees working in 2-5 development and system administration teams. At the time of data collection, there were 20 members in the development department.	+10 years	• Banking IT infrastructure services • System Engineering services • Network infrastructure services • IT infrastructure consultancy • Software development • Most projects are in-house projects focused on enterprise applications for banks and billing companies

3.3.1. Survey design

Given the size of the two case companies, convenience for data collection, clarity and significance of interview responses, a survey assessment was conducted. It should be noted that case studies often focus on small samples and examining real life phenomenon, therefore samples selected are representative of the whole population and the rationale in the inclusion of participants is necessary. All members of the development teams participated in the questionnaire while in-depth interview session was conducted with technical leaders and project managers to further elaborate and analyse what the questionnaire respondents provided. In the case of participants selected for interview, since the research objective was to gain an insight on ASD challenges and implementation gaps, technical leaders and project managers were believed to have better exposure and comprehending capability to articulately describe what the situation looks like in the case of their teams.

3.3.2. Survey population size

Heterogeneity in research population and scope of the research were the two basic considerations to determine the sample size of this study. Formal statistical guidelines for sample design are very few and depends on convenience and past experience of researchers. The limitation approach for qualitative research is used to determine the sample for this study. This approach dictates the consideration of research limitation such as timing, intended scope, audience availability and other factors to determine a feasible sample size. Since the scope of this research is limited to studying the problems and challenges of ASD implementation in Jasmine Addis and Atlas Computing Technologies, the participation of all members in development teams was crucial. On the other hands, engaging technical leads and project managers was important to better understand the response indication found through the questionnaires. In order to avoid collection of data in larger quantity and of similar contents, the research demanded sampling, data collection and analysis to be conducted simultaneously to avoid repetition of response data. In conclusion, out of 35 distributed questionnaires 26 responses were collected and all six in-depth interview sessions were conducted successfully.

3.4. Data Collection

Majority of data were collected from primary sources through two data collection techniques. In depth interviews with project managers and technical leads were conducted. Each interview lasted for over one hour with broader and in-depth discussions and simultaneous case analysis. In depth interviews are advantageous for case study researches as far richer responses can be gained by covering wide range of topics chained with questions raised using the continuous feedbacks of participants. Another data collection technique used in this research was mixed (open ended and close ended) online questionnaire. This included interval/ratio questions and categorical questions like checkbox, yes/no and multiple-choice questions, and description questions. The questionnaire was designed for the purpose of examining whether common ASD implementation challenges generalized from related researches exist in the research's case studies. On the other hand, the in-depth interviews were purposeful to look for new and different perspectives with regards to implementation challenges.

Questionnaire was sent out to respondents using google form. Informed consent was described, confidentiality of respondents' data and whether appropriate individuals participated in the questionnaire was tracked using emails of respondents. On the other hand, in-depth interviews were conducted using voice recording tools to keep track of conversations later during data analysis. In addition to the primary data collected through questionnaires and interview, secondary data sources such as related articles, ASD guideline literatures were reviewed to compare and contrast the practical trends in the case companies with what the guidelines have stated as practical approaches. This was purposeful for identifying the implementation gaps in ASD. Most of the questions in the questionnaire were based on a mini-survey conducted by Scott W. Ambler (2011). The selected questions were included for the purpose of identifying the type of communication, frequency of communication, team size, project management and agile practice background and the geographical distribution of participants in each team.

In-depth interviews focused on three major ASD challenge areas:

Challenge 1: Requirement Engineering challenges

Challenge 2: Team and development process challenges

Challenge 3: Organization culture and support challenges

To collect significant data in identifying requirement engineering challenges focus areas from Schön et al. (2017) were forwarded for discussion with participants

Question 1: What are the key challenges in Agile Requirement Engineering?

Question 2: How can we deal with the identified challenges?

To collect significant data in identifying team and development process challenges several questions were asked to participants. Questionnaire questions to explore team and development trend of case teams were retrieved from Scot W. (2011) Agile teams mini-survey. Basic interview focus points were:

Focus 1: Team composition and challenges in learning and experience sharing

Focus 2: Employees' perspective in believing agile promotes efficient product development

Focus 3: Challenges in workspace and availability of infrastructures

Focus 4: Challenges in inter-team, intra-team, and team-management conflicts

Focus 5: Challenges in Schedule planning

To collect necessary data on Organizational culture and support challenges, focus areas of proposed questions were:

Focus 1: Commitment of management in supporting collaborative learning, experience sharing, rational and effective resource allocation

Focus 2: Emphasis on team development and cultivation

3.5. Data Analysis

Qualitative research data analysis aims to describe variations, group norms and individual experiences over research samples. Since data analysis was conducted along with data collection process, what data to collect next was determined by previous data collections. Questions asked in later sessions depended on the responses of participants for the initial inquiries. Bernard et al. (2018) indicated that qualitative data analysis is inductive in nature and the research analyst is responsible for identifying important categories, relationships and patterns in data through a process of discovery. For the purpose of this study content and narrative analysis were used. In the case of this study, the ASD challenges described in questionnaires were categories in to the three major

study elements and analysed along with the responses gathered from in depth interviews.

Content analysis was used to generate behavioural categorization of respondents and their responses. This approach was useful to identify what elements are missing in ASD practices of the case companies and gain clear idea of how the teams are practicing agile. Narrative analysis was used in analysing responses gathered during in-depth interviews. This contributed for constructing a descriptive and focused interpretation of current practical paradigm in both companies. What was missing and what was not were identified using content analysis, while why the case companies failed to implement missing elements and cause and effect relationships among practice elements and project types was examined using narrative analysis approach.

Data condensation is a form of analysis that sharpens, sorts, focuses, discards, and organizes data in such a way that “final” conclusions can be drawn and verified. Miles et al. (2018). Contents gathered from questionnaires and interviews were organized in such a way that clear indication of gaps and practical trends are captured during the analysis process. This includes reducing redundant data, expanding the richness of responses by including various sample groups of different educational and work background. Another analysis activity engaged in this study was data display. Generically, a display is an organized, compressed assembly of information that allows conclusion drawing and action. Miles et al. (2018). Accordingly, grouping of responses to representative categories and defining category representations to complement the data interpretation process.

3.6. Scale Reliability and Validity

Questions in international Agile practices survey conducted annually were used in this study. The most important sources were the surveys conducted by Scott W. Ambler, <http://www.ambysoft.com/surveys/>. Another important source for the contents of questionnaire and interview was PMI (2017) agile suitability filter test. It was important to engage the questionnaire contents from these sources to make use of the standardized questionnaire approach customized specifically for agile surveys. To ensure reliability of interview responses, sessions were recorded and contents on record files were later intensively discussed. Another important practice that was used to ensure reliability was delimiting the researcher’s role in the process of data collection, especially during

in depth interviews to avoid biased narrative analysis. To ensure the validity of the data collected during in depth interviews, the researcher has tried to generate meaningful and rich-in-context description of responses that are as comprehensive as what the research questions require. Another approach used by the researcher to ensure validity was identification and elimination of contrasting evidences unlike previous literature findings. To ensure external validity or transferability, this study has tried to comprehensively discuss findings and describe the behaviour of teams. Described in detail in the next chapter, the research findings were congruent with prior theories. To develop a comprehensive description of the challenges data triangulation was employed by using vast range of sources about agile software development. Method triangulation was employed by the use of multiple data collection and analysis methods, i.e., questionnaires and interviews; content and narrative analysis

3.7. Ethical Considerations

Miles et al. (2018) noted that, the need to reach for explicit agreement between researcher and participant about shared expectations. In order to reach into an agreement over expectations, the researcher has briefly described the following prior to data collection.

- Openly stating the time and effort required by the participant
- Let participant know that the data collector is the one to conduct the study (analysis and conclusions)
- Affirming anonymity of respondents will be maintained
- Ask for voluntary participation with persuasive than coercive inquiry

The core ethical consideration of any researcher should be the worthiness of the project. The researcher believes that this study will fill the literature gap with regards to ASD studies in Ethiopian context, specifically for the case of the two target companies. Although plenty of studies have been conducted over the success rate, failure factors, implementation impacts of ASD, researches conducted in examining the bottlenecks practitioners face in practicing agile are rare. In this regard, even if the study is conducted using two case companies, the generalizability and transferability of the research's findings increase the significance of this research.

CHAPTER FOUR

4. RESULTS AND DISCUSSION

4.1. Introduction

This chapter presents general representation of samples, response rate, background of participants in the first sub topic. Results, interpretation and discussion on research questions are presented later for each case company. Tabular and graphical data presentations are also presented in the last sub section of this chapter

4.2. Response rate and demographic data

A total of 15 invitation for questionnaire was sent out to participants in Jasmine Addis and 10 participants responded, on the other hand, 20 invitations were sent out for company B participants and 8 members from two development teams responded. Invitation for in-depth interviews were sent out to project managers and technical leads in each team (two participants from each team in Atlas computing Technologies and one team in Jasmine Addis), and all participants agreed and took part in the interview process.

4.3. Results

With total of 26 respondents for questionnaire and six respondents for in-depth interview, description of geographic distribution, team size, communication modes are summarized below.

In terms of role composition in participants' teams, the development teams in Jasmin Addis were comprised of project managers, technical leaders, senior and junior developers. In the case of teams in Atlas computing technologies, in addition to the above roles, quality assurance professionals were part of the teams. In terms of participants' years of experience, out of the total number of participants more than half of them had less than 3 years of experience, while senior developers, technical leaders and project managers, comprising around one-third of the population, had 3-10 years of work experience. On the other hand, more than two-third of the participants had no prior project management or agile development training experience. More than 15 participants had prior exposure to agile development environment. In terms of team size, each development teams in Atlas computing technologies had eight members

while there were 7 members in the development team of Jasmine Addis. In both companies, teams worked in similar workspace.

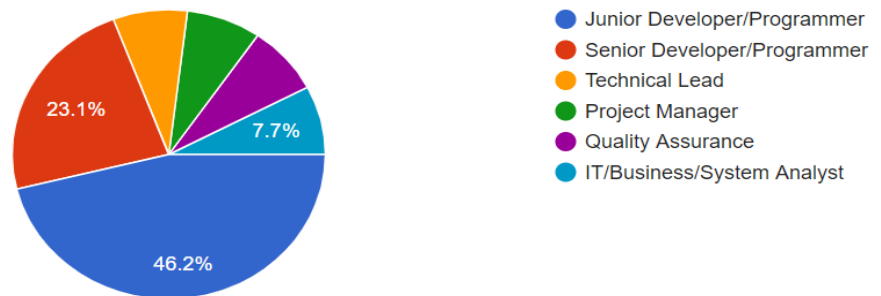


Figure 5: Participants' role in their teams

Teams were composed of fewer junior programmers with at most three two senior developer, one technical lead, at most two quality assurance experts, one business analyst and one project manager. The involvement of business analysts was claimed to be rare, according to the project managers.



Figure 6: Availability of infrastructures

Development machines, office appliances and version control systems were available and teams hardly used project management tools. Participants were asked to reflect on their perception towards the advantages of Agile development and twenty-one participants believed that agile development had enhanced the performance while two participants described that this methodology have not contributed to their performance enhancement at all. Participants claimed that they rarely conducted retrospective meetings and discussion sessions at the end of sprints or phases.

Participants were also asked if office apparatus and infrastructures were available for their team, most of them indicated that development tools and infrastructures were more or less available and they used version control systems all the time but the use of project management tools was claimed to be low.

In terms of the composition of teams with cross functional professionals, both companies constructed their teams with common and similar expertise mostly focused on technical development capacity. The engagement of business and system analysts and product owners was very low and the role of requirement elicitation was often handled by managers and technical leaders. On the other hand, Junior participants reflected that they are incapable of rotating over tasks due to their limited expertise knowledge of the full development platform elements. Senior developers were found to be more flexible and they could easily take over various types of tasks.

Considering the culture of presenting progress for higher level managers and end users (customers), the teams in Atlas computing technologies were found to demo their progress as they are deemed to do so, rather than having a regular interval for the sessions. On the other hand, the team in Jasmine Addis claimed that they conducted frequent demo sessions for customers and the interval in which these demos are conducted were often decided based on the availability and convenience of customer representatives.

Question element	Findings
Team size	Average team size is 8 members
Geographic distribution	Almost all participants work in similar offices within common workspace
Educational Background	Most team members are from the background of software engineering and computer science. Other less frequent educational backgrounds are electrical engineering and business administration
Prior agile experience	More than half of the participants claimed to have prior agile projects experience
Prior PM and ASD trainings	About one-fourth of the participants claimed to have prior training experiences on project management and agile software development
Frequency of stand-up meetings	The team in Jasmine Addis conducted daily meetings as frequent as once a day, 2-3 times a week and sometimes once in a week or once in two weeks. The teams in Atlas computing technology conducted stand up meetings as frequent as what projects required without a fixed and formal schedule.
Time taken before first production launch	The average time taken before the first production launch was 1 year
Availability of agile supportive workspace and infrastructures	Proper development machines, internet infrastructure and appliances, integrated version control systems were available. Use of project management tools like Trello is rare in all teams
Mode of communication	The most common communication mode is face to face while other frequent methods were virtual meetings and email.

Table 3: Summery of findings

4.3.1. Requirement Engineering challenges

Participants were asked to describe the challenges faced in the requirement engineering process. Most of the challenges identified, were claimed to be contributing directly or indirectly to the other ASD challenges.

- ❖ Most customers have product ideas in mind but they are not sure about how those products should be presented in terms of richness of features, scope of features, end user groups addressed.
- ❖ Most products are requested just because using digital solutions is a trend and almost no focus is given on the projects and the deliverables.

- ❖ All customers request for technical solutions and fail to assign selected stakeholders to commit time in the project life cycle
- ❖ Most requirements are technically unrealistic and hard to implement
- ❖ Even if requirements are addressed, end users who have practical experience over the project solution are not committed to address possible use case scenarios
- ❖ Even if the initial requirement requests are limited, large number of requirement suggestions are made based on the first prototype and it is difficult to limit the scope of the project
- ❖ Most customers cannot articulately define the requirement in mind and it is difficult to meet their demands
- ❖ For large customer companies, it is hard to say no to requested requirements, even if implementing those requests consume more time and needs more cost expenditure
- ❖ For in house projects, a product owner or end user never participate in the development process and defining requirements, categorizing into sprints, prioritizing sprints, constructing functional scopes for sprints is difficult
- ❖ It is challenging to formulate comprehensible requirements without the presence of requirement analysis expertise.
- ❖ Developers are forced to interpret requirements in team discussion and how they implement their interpretations differ resulting in clashing prototypes
- ❖ Day by day interpretations to requirements widen, resulting in unnecessary back and forth in technical implementation
- ❖ Sometimes a complete redo of the system is requested when products are first introduced to potential customers.
- ❖ It is challenging to design requirements in such a way that changes can be adaptable with reasonable effort.
- ❖ Absence of expertise to prioritize sprints lead to challenges in focusing on requirement refinement to fit for smaller sprints

4.3.2. Team and development process challenges

Team and process challenges include the challenges development teams face in implementing agile practices in the development process the difficulties faced due to their team composition. These challenges indicate the work and interaction culture within teams. These challenges are alerts for teams and individuals to shape their interaction and interdependence as an individual and as a team.

- ❖ Lack of commitment of employees to cover tasks beyond their assignment
- ❖ Lack of technical planning in selecting the most appropriate way to implement requirement definitions
- ❖ Negligence of developers in engaging best practices and product optimization
- ❖ Unclear requirements drag the development process behind as more time is consumed in interpreting what the client wants
- ❖ Difficult to recruit self-managing, committed employees
- ❖ Conflict among employees as clashing ideas over requirement interpretations are forwarded.
- ❖ Negligence of tasks due to lack of prioritizing sprints
- ❖ Since the cost for schedule delay is not immediately realized, employees have developed a culture of procrastination and most requirement requests are neglected and left unaddressed during deadlines
- ❖ Laziness of employees to use standard communication, development, continuous deployment tools and absence of committed expertise in enforcing the use of such tools
- ❖ Absence of constant and frequent status meeting mislead managers about project progress
- ❖ Lack of communication across teams in multi-team projects often led to conflicts over changes in common and shared project resources
- ❖ Lack of cooperation and collaboration in teams
- ❖ Inability to accommodate changes with minimum waste of effort
- ❖ For projects won over biddings, it is often risky to implement agile practices as cost estimations and schedule plans are conducted initially, teams are forced to use waterfall approach

- ❖ Employees claimed that it was often challenging to meet deadlines as schedule are planned by the management team without consulting technical expertise about the anticipated time consumption for tasks

4.3.3. Organizational culture and support challenges

ASD challenges due to organizational culture arise due to the strategies managers follow in relation to generating business values, valuing employees, and maintaining a flexible and dynamic work environment. Problems that prevail due to the cultural paradigm in an organization will lead not only to project failures but the failure of the organization as a whole.

- ❖ Absence of standard prototype boilerplates to evaluate deliverables
- ❖ Absence of automated testing to inspect prototypes for potential failure points
- ❖ Lack of commitment of management to support research and development
- ❖ Failing to acknowledge the need for stakeholder involvement in the development process
- ❖ Lack of strategic recruitment and training procedure to select best fit, and self-managing teams
- ❖ Absence of career development and cultivation practices

4.4. Discussion

I. Requirement Engineering Challenges

The requirement engineering process in software development is a crucial phase as the project success is defined by the correctness of gathered requirements in meeting customer needs. (Ochodek and Kopczyńska, 2018). Considering the dynamic and complex nature of requirements, software project teams and managers should be considerate of tailoring their requirement gathering, organizing and analyzing approaches to achieve maximum correctness and appropriateness of requirement definitions. During the in-depth interview sessions with project managers and technical leaders, the presence of common requirement engineering practices in agile model such as direct communication of stakeholders and team members; consistency and prioritization of requirements; change management; and use of prototypes to get feedback from the client were discussed.

The first requirement engineering challenge was the vagueness of customer requirements. According to the team at Jasmine Addis, most customers often found it difficult to comprehensively define their ideas in terms of features, scope and end user groups. Another requirement engineering challenge was the absence of customer involvement throughout the development process. In the case of Atlas computing technologies managers believed that in-house projects need to be kept anonymous for the purpose of concealing project ideas from competitors. Hence, development teams were responsible for gathering, organizing, interpreting and designing business requirements, even if most developers in the development teams possessed the least expertise level on business analysis. The reason for absence of customer delegates or product owners was different in the case of Jasmine Addis as most projects were initiated by customers themselves. The problem was found to be lack of commitment of customers in participating in the development process. The project manager in Jasmine Addis indicated that customers lack a positive attitude towards digital solutions and rather engage in such projects because it is accepted as a modern trend and most competitors are undertaking software development projects. The technical leader in Jasmine Addis stated *‘a well understood requirement will then be generated as a prototype with less issues and errors.’*. But as customers demand for features and provide vague explanations, what teams deliver are bound to fail in satisfying end users. Software development projects are types of complex projects with incomplete and complex requirements. The increase in project complexity results in the decrease of success in designing a complete, meaningful and viable requirement definition. (Wysocki, 2011).

Challenges in prioritizing and maintaining consistency of requirements often occurred due to the absence of communication of project teams with stakeholders. The absence of such communication culture enforced developers to overtake the prioritization tasks. Considering the gaps in the type of expertise required and the bounded technical capacity of developers, team members were highly likely to fail in keeping consistent requirement definition that can accommodate changes and updates. Here is where the role of business and system analysts is vital. Unless professionals with analytical skills and business process expertise take part in identifying what should be done, what should be removed, and what to prioritize, the products delivered by development teams are possibly vulnerable to technical misinterpretation and malfunction.

Another common challenge raised by project managers and technical leaders was the problem of scoping requirements. In an ideal scenario, a single task definition in agile teams addresses a single, lowest level feature definition of an overall product. The incompleteness of requirements at different phases of the project misled managers in defining a clear demarcation about what to deliver at the end of a specific sprint. Unless project managers and teams are aware of the full requirement definition in a certain iteration, it is impossible to prioritize and narrow down tasks and easily deliver viable prototypes.

Since the number and duration of iterations to be undertaken over the course of a project are not known, Jasmin Addis often requests for payments per iteration. Customers often find iteration-based payment requests costly and misleading and it is challenging to convince them. In agile software development, continuous management of requirements is a challenge since not all of the requirements are fully defined at the beginning and they may change over the course of the project. Schön et al (2017).

After accepting projects from large customer companies with predefined project budget, requirements are often found to be unrealistic in terms of cost capacity and development viability. In such case, the project company bear the cost burden. Not only the cost burden is an issue, but in such cases, schedules are bound to be delayed which is not acceptable by customers, and this creates customer dissatisfaction. It is often challenging to convince clients about progresses, problems and technical bottlenecks, leading to delays in managerial decisions to assign more resources, take measures, and even terminate the projects. Impracticable projects are often terminated later after incurring costs, wasting time and stressing out employees.

II. Team and Process Challenges

Team and process challenges often arise from the cultural practices of teams with regards to discipline, communication, commitment, cooperation and synergy. The most prevalent team challenge faced in Atlas computing technologies was employees' demotivation on continuous and consistent practices of agile principles. Although questionnaire respondents claimed that they are aware of the advantages of agile practice, in their interview sessions, project managers raised that teams do not possess the enthusiasm to maintain agile culture for a longer period of time. Considering a more specific scenario, project managers were asked about why teams were unable to conduct

frequent daily standup meeting and retrospectives. A technical lead in Atlas Computing technologies claimed: *'We were not aware of what to work on now and what to discuss next'*. This is directly related to the effects of vagueness and inconsistency of requirement definitions.

Another related challenge that occurred due to requirement ambiguity was conflict among members in what to prioritize next. Requirement prioritization conflicts were also triggered due to the team composition in both companies. Unless there is a gap among team members in seniority and technical expertise, team members with relatively low age and experience gaps often clash over prioritization. The technical lead in Jasmine Addis stated that developers with similar level of expertise are often overshadowed by the thought that the idea of their peers are not as significant in the development process. Instead of defending for ideas, peers are often led to unnecessary technical and psychological competition to prove the righteousness of their ideas. All suggestions and ideas for changes should be entertained in broader meetings to ensure the constructive involvement of all team members. This is due to the absence of frequent meeting and discussion platforms, which is highly recommended in agile methodology.

Project managers raised that it was difficult to build the culture of self-management in teams. Agile teams are controlled less by project managers as members are responsible enough to overtake tasks without assignments and manage their progress without the involvement of managers. But in the case of both companies, project managers claimed that self-commitment culture is not prevalent. Another issue related to self-management was the fear of making decisions without the involvement of project managers. This can be an indicator for the lack of involvement of team members in the process of decision making. But agile teams, once list of tasks are defined for a specific sprint, employees will select tasks for development based on their technical knowhow without waiting for decisions and assignments from project managers. Agile teams provide an opportunity for team members to participate in important meetings, gain ample awareness on what is to be done, and participate in decision making. Hence, the problem of self-management was raised due to the absence of members' participation in decision making and lack of commitment to overtake tasks without waiting for directions from project managers.

According to project managers, the competition within developers in all three teams have degraded the value of cooperation and collaborative learning. The 'I' mindset should be completely removed in agile teams so that members can easily and purposefully interact for an optimal output. In all three team cases, project managers stated that team members often focus solely on their assigned tasks, and completing those tasks would not necessarily mean that team objectives are met. Since all tasks and members' activities are interdependent, team members were supposed to interact with their peers to communicate about how they can deliver their solutions so that subsequent tasks can be completed easily.

In the case of teams in Atlas computing technologies, negligence of schedules and deadlines were claimed to be prevalent. Project managers discussed that the absence of a designated product owner or stakeholder have affected the completion of sprints on schedule. If there are no designated stakeholders that eagerly wait for results and give feed backs at the end of sprints, teams can not feel the pressure of meeting project schedules.

Another development process challenge that was affected by the absence of communication with stakeholders was inability to improve prototypes since it was impossible to get customer feedback. In agile teams, the important driving factor for prototype enhancement is feedback from customers. Even if teams were to be ready for improving their deliverables, the tendency to make valuable improvement is low because of the absence of customer feedback.

III. Organizational Culture Challenges

A major organizational culture challenge raised was the absence of research and development to try modern solutions to develop teams and enhance productivity. This is because teams are engaged in projects most of the time and learning periods are short, often unavailable. Even if managers knew the right way to practice ASD, budget constraints challenged them in utilizing resources, avoiding employee burnout due to overcrowded tasks. Managers often fail to engage outstanding employees for golden opportunities. It is because managers underestimate the use of analyzing employee behavior. *'Just because one person can carry 10 bags, it doesn't mean you should hand him/her all 10 at once, but let him/her carry your bag of diamonds.'* A participant mentioned that outstanding employees are often bound to be overcrowded with tasks

and such inconsiderable measures compromise individuals' productivity. Team and process challenges were claimed to be related to requirement engineering failures.

A participant in Atlas computing technologies claimed that efforts required for requested requirements are either underestimated or over estimated. When required effort is underestimated, management expectation exceeds team and individual performance leading to conflicts and dissatisfaction. when required effort is overestimated, more resources are assigned than what the task actually require. Another common challenge is management belief that engaging more people will diminish the time consumed. *'If tasks are going to take time, they will. It doesn't mean that we can reduce the time required by assigning more people to the tasks.'* the company's technological capacity is often approximated to generate solutions that fit our problems, but if research and development opportunities existed, better ways to solve business problems would have been identified in shorter period of time.

'Except for believing that recruited teams will perform well, we don't even know how to look for the right-fit employee.' Managers neglect the need for involvement of HR professionals in designing a strategic recruitment mechanism that comply with our project demands. Project managers mentioned that it was difficult to recruit dedicated and disciplined professionals that can overtake several tasks without being directed. They claimed that most applicants possess technical capacities but lack commitment and enthusiasm that agile teams require.

Another organizational challenge is the absence of resource allocation of project management and agile practice tools. Project managers mentioned that managers often perceive those modern technological solutions are expensive to acquire. It is notable that vendor provided solutions are all-in-one packages with sufficient project management tools and features. But it is important to acknowledge the availability of open-source digital solutions to manage agile teams. Managers fail to provide enough resources such as suitable workspace, whiteboards, notebooks, digital project management tools, meeting platforms for teams and project managers.

CHAPTER FIVE

5. SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1. Introduction

In this section, summary and conclusion of findings and implications are presented with complementing reviews of related literatures. Based on summarizations from supporting literatures recommendations are provided on how teams can eliminate ASD challenges and implementation gaps. Mentioning the limitations and gaps of this research suggestions are made for further study.

5.2. Summary

For both case companies, requirement engineering challenges were prevalent and the severity was high that problems of schedule delay, cost overhead, customer dissatisfaction were inevitable. Team and process challenges are more prevalent in Atlas computing technologies due to the absence of basic agile practices such as frequent meetings, and stakeholder involvement. Jasmin Addis, in contrast, faced team and process challenges due to lack of commitment of employees. Organizational culture and management support challenges were not highly prevalent in Jasmine Addis, while Atlas computing technologies was found to have various problems due to lack of management support for ASD practices.

Requirement engineering challenges occurred mostly due to lack of commitment of end users in taking part over the course of the project. This was due to the negative perception of customers about how insignificant automating operations through software projects is. According to the project manager in Jasmine Addis, most managers in customer companies have little knowledge on the significance of the usage of digital products and that they engage in such projects just because many experts suggest to do so. And since they give such projects the lowest attention and priority, it was impossible to convince customers to dedicate a product owner who can take part in the whole software development project lifetime as a requirement interpreter.

Atlas computing technologies had no involvement of product owners and end users as most projects were in-house projects and it was believed that project ideas need to be kept anonymous before production launch to minimize the competition over similar software products. This resulted in the involvement of developers over requirement

engineering despite having insufficient level of expertise over the business requirements.

After numerous unnecessary iterations to deliver a minimum viable product, customers who participate in demo sessions give suggestions and project redesign ideas that is completely or partially different from what the developers came up with. This resulted in two redesigning challenges. One was due to the incapability of prototypes and development procedures to accommodate customer suggestions. Additionally, developers became confused about what their focus should be and there arise a scope creep where non-ending customer requirements were added to the existing product, leading to a complete failure.

In the case of Atlas computing technologies, there were frequent scenarios where bidding projects necessitate the use of waterfall approach in order to avoid under estimation of costs and schedule. Managers believed that each and every requirement from customers need to be elaborated at the beginning of the project resulting in difficulties of incorporating further requirement requests after beginning the implementation process. In the case of Jasmine Addis, managers were open to accommodate changes and charge customers on the new requested features besides the original project cost estimation. Of course, it is understandable that Atlas computing technologies could not try an incremental cost charging approach as there are other competent software development companies that could win biddings with minimal project cost and schedule proposals.

In the case of team and process challenges, the lack of belief of individuals about the significance of agile development resulted in inability to conduct agile practices and adopt it as an organizational culture. To conduct stand-up meetings, retrospective sessions, collaborative learning sessions and other agile development practices, the employees were found to have no interest in doing so. This is partly the case organizations' fault as it requires a timely dedication and commitment from managers as well. Unless managers take part in conducting trainings and workshops to prove the value agile development can add, employees will never understand its significance, so it is difficult to have positive team participation.

Most of the above-mentioned challenges were caused due to the absence of agile-focused recruitment strategies where employees can be recruited and trained to shape their work culture in conformance with agile practices and principles. Another problem was the absence of project management tools to enable project managers track project progress on time and in detail. Vague requirement definitions added up with inefficient task division over-pressured developers and led managers to misinterpret project status.

5.3. Conclusion

Requirement engineering challenges mostly occurred due to the absence of customer involvement and formal team-stakeholder communication. The absence of such communications resulted in vagueness of requirements and misleading interpretations and delivery of malfunctioning prototypes. The absence of customer communication also resulted in conflicts over requirement prioritization and narrowing down focus of sprints. Redundant back and forth in tasks over-pressured employees and resulted in stress and burnout.

Implementing agile practices was difficult due to the mindset of employees, absence of project management tools, lack of motivation and focus in maintaining agile practices as team and individual culture. Even if teams were to conduct frequent meetings, what to discuss on meetings, what to do next and other crucial decision-making elements could not be identified and addressed because requirements were not properly defined and prioritized.

The prevalence of the 'I' mindset in teams hindered collaborative and cooperative development culture. The competitive culture among team members overshadowed the importance of working together towards common goal. The aim of members is dispersed towards different objectives rather than solely focusing on project objectives.

The incompleteness of prioritized requirement definitions created difficulty in diminishing sprint goals and focus on the lowest level definitions of tasks. This contributed in delays of schedule, scope creep, malfunctioning deliverables and dissatisfaction of customers. This also contributed to the delay in overall project schedule and project scope creep.

All of the above challenges are interrelated and one factor contributes to others directly and indirectly. A single point of failure that give rise for these challenges is failing to acknowledge the need for proper agile implementation with the engagement of project management professionals such as scrum masters.

5.4. Recommendations

With regards to requirement interpretation the absence of stakeholder involvement, inability of involved end users to articulate their demands, absence of end use commitment throughout the project are among the contributing factors. Development teams are burdened with interpreting, documenting and designing requirements while their concerns should be limited to implementing technical requirements. Simple modifications that can add value to products are neglected. Teams face difficulties in identifying what to address first and focus on refining their approaches because they tend to lose the bigger picture while struggling to manage individual requirements. *‘Stakeholder interest is the paramount factor for the life of any project. Therefore, their involvement in the project must be ensured. To make a success of the project, they must take initiatives and influence its progress.’* Ahmed (2012)

A major contributing factor for process challenges is the absence of communication practice conducted as frequent as possible with maximized significance of discussion topics. Even if teams were to conduct frequent status meetings, unless pertinent decisions are made, and common understandings over issues and requirements are ensured, process challenges cannot be eliminated. Another factor is the absence of positive perception about importance of agility in software development projects. Even if free project management tools are available online, teams neglect their significance and fail to use them in their daily operation.

Atlas Computing technologies faced challenges in meeting deadlines due to the absence of frequent status meetings and lack of use of project tracking tools and inexperience in the use of agile approaches. PMI (2017) suggests the use of Kanban boards to make progress more visible to teams and managers to avoid delays, and training team members about the fundamentals of agile mindset and principles and provide workshop if teams decide to employ a specific agile approach.

Organizations often fear implementing ASD as flexibility of agile practices make cost estimations uncertain. The common trend managers are familiar with is a complete cost estimation at the beginning of projects which completely contrasts with estimating costs at the end of sprints prevalent in most agile teams.

Considering the shift towards agile development both companies are not purely practicing all the principles. But this doesn't indicate that the two companies do not suffice the conditions to be termed as agile software development practitioners. As Charles (2011) stated, there is a misconception associated with the term 'agile' that the only way to be agile is to implement pure agile methodologies such as scrum.

Ahmed (2012) identified the requirements for a successful project manager: understanding project management, software engineering, technology & tools, manage teams, customers and supplies, and work under organization framework. Considering these requirements, project managers from both companies claimed to have sufficient project management, team and customer management experience with ample understanding of concepts, tools and technologies. But it is implacable that had all these requirements are not bound to be totally fulfilled and the learning process takes time. Therefore, the practical implementation of agile project management might be difficult.

It is important to consider the behavior of our teams and individuals to optimize value flow. Members should be willing to collaborate in order to deliver valuable work within short period of time. Besides the project manager and team leaders, each individual must be aware of the tasks undertaken by peers in order to minimize waste through avoiding redundancy of tasks and multitasking. According to PMI (2017), an ideal team size would range from 3-9 members that should be collocated in team space. Considering how teams in both companies are dispersed and working remotely most of the time due to COVID-19 pandemic, their productivity is highly likely to decrease.

In order to address the challenges of practicing ASD, teams first need to explore what agility mean and look for a way to tailor their capacity and team culture to create a suitable environment for its practice. Considering agile principles, it is important to involve customers in each development phase to ensure customer satisfaction. This can significantly decrease the back and forth of prototype modifications. Agility means the ability to easily respond to changes. This can be achieved by delivering products in

such a way that changes can be acquired with minimum effort. Detection of failures and changes as early as possible is also another solution to ensure agility.

Effective implementation of agile approach needs higher level of commitment, skill set and discipline of each and every individual in a team. Project managers need to closely overlook their resource capacity to effectively allocate them for the maximum possible outcome.

It is advisable for project managers to construct their team with diverse expertise and eliminate waste through continuous and collaborative improvement. Adopting agile shouldn't be a matter of implementing the principles only. Our priority as software development teams and project managers should be optimizing our outputs with minimum effort and attaining maximum customer satisfaction. As PMI (2017) indicated, the end goal is not to be agile for its own sake, but to continuously deliver to customers and achieve better business outcomes. In this case, we can either adopt a formal agile approach, customized for our organization or change our practices to increase our progress on a certain principle. PMI (2017) has identified common agile pain points and troubleshooting possibilities. This can be handy to all software development teams as major challenges are exhibited across many teams.

5.5. Suggestion for further study

The scope of this study is limited to providing the findings in assessing ASD challenges in the selected cases. Further study should be conducted to enhance the current implementation trend in agile teams. Although most findings are generalizable and transferable to similar teams in different software companies, the challenges attributed in other teams may vary, contrast and deviate from the findings presented above. Similar studies in higher scale, preferably survey studies can be conducted in the future to look for other problems that teams face in implementing agile software development.

Although requirement engineering challenges identified in this study are complementary with previous literature findings, this study has explored the reason why stakeholder communication is absent in both companies. The findings indicated that for the case of Atlas computer technologies, it was the decision of managers in order to keep anonymity of project ideas. And in the case of Jasmine Addis, it was lack of enthusiasm and prioritization from customers that led to the rare involvement of customers and other stakeholders. There are plenty of researches that indicate the

absence of customer involvement in agile teams that experience implementation challenges. So, future researches can be conducted to identify why customers are not involved in agile software projects. Another focus area for future researches can be the process of recruiting suitable professionals for agile teams. Although agile principles indicate the importance of collaborative development environment, how teams can recruit active and supportive professionals can be the attention of further studies.

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Annex 1: Questionnaire

Challenges to Implement Agile Development in Software Projects:

The purpose of this questionnaire is to explore challenges software development teams face in implementing agile development practices. For a quick reference on agile project management, you can refer to <https://agilemanifesto.org/principles.html>

Email* _____

Informed Consent

You are invited to participate in a research study that Explore the challenges software development teams face in implementing agile project management. This study is conducted by lidya.s164@gmail.com, a graduate student from Addis Ababa University, School of Commerce, for the partial fulfilment of the requirements for the degree of Masters of Art. The information shared in this questionnaire will be kept completely confidential. By submitting your responses, you have agreed to responsibly fill this questionnaire.

1. Which of the following best describe your role in your team?
 - ☐ Junior Developer
 - ☐ Senior Developer
 - ☐ Technical lead
 - ☐ Project manager
 - ☐ Product owner
 - ☐ Other: _____
2. Can you briefly describe your educational background?
3. How many years of experience do you have?
 - ☐ <1 year
 - ☐ 1-3 years
 - ☐ 3-5 years
 - ☐ > 5 years
4. Have you ever participated in project management training programs? (This may include online lessons, virtual conferences, formal education, certification programs, ...)
 - ☐ Yes
 - ☐ No

5. Have you ever participated in agile software development or agile project management training programs? (This may include online lessons, virtual conferences, formal education, certification programs, ...)
 - ☐ Yes
 - ☐ No
6. Are you familiar with agile development practices in prior experiences?
 - ☐ Yes
 - ☐ No
7. Do you believe that implementing agile practices has increased your productivity as an individual?
 - ☐ Yes
 - ☐ No
8. Do you believe that implementing agile practices has increased your productivity as a team?
 - ☐ Yes
 - ☐ No
9. How often do you participate in planning meetings of the software projects you have worked on?
 - ☐ Never
 - ☐ Occasionally
 - ☐ Sometimes
 - ☐ Often
 - ☐ Always
10. How often do you get the mandate for participating in decision making for planning, development process and resource assignment of the software projects you have worked on?
 - ☐ Never
 - ☐ Sometimes
 - ☐ Always
11. Do you believe that there is a proportional and appropriate task division in your team?
 - ☐ Yes
 - ☐ No

12. How do you rate your communication and socialization skill?
- ☐ Very Poor
 - ☐ Poor
 - ☐ Average
 - ☐ Good
 - ☐ Excellent
13. How do you rate your confidence in forwarding suggestion ideas in meetings and discussions?
- ☐ Very Poor
 - ☐ Poor
 - ☐ Average
 - ☐ Good
 - ☐ Excellent
14. How do you rate your requirement analysis and interpretation capacity?
- ☐ Very Poor
 - ☐ Poor
 - ☐ Average
 - ☐ Good
 - ☐ Excellent
15. How many members are there in your team?
- ☐ 1 - 5
 - ☐ 6 – 10
 - ☐ > 10
16. Is there anyone in your team with sufficient experience in implementing agile development?
- ☐ Yes
 - ☐ No
 - ☐ May be

17. What is the geographic distribution of members in your team?
- ☐ Use common workspace in a similar office
 - ☐ Dispersed workspace in similar office
 - ☐ Located in different areas with less frequent face to face communication
 - ☐ Located in different areas with no possible face to face communication
 - ☐ Other _____
18. Which of these communication methods are employed by your team?
- ☐ Face to face communication
 - ☐ Email communication
 - ☐ Manual document communication
 - ☐ Modern virtual communication with Google Meet, Microsoft Teams, Zoom ...
 - ☐ Other _____
19. How often do you conduct stand up meetings?
- ☐ Twice a day
 - ☐ Once a day
 - ☐ 2-3 times a week
 - ☐ Once a week
 - ☐ Once in 2 weeks
 - ☐ Never
 - ☐ Other _____
20. On average, how long would software projects last in your team before the first production launch?
- ☐ < 5 months
 - ☐ 6-12 months
 - ☐ 1-2 years
 - ☐ > 2 years
 - ☐ Other _____
21. Is there anyone in your team that represent customers/end users and describe requirements?
- ☐ Yes
 - ☐ No

22. How often does your team present progresses to end users and managers?
- ☐ Once a week
 - ☐ Once in two weeks
 - ☐ Once in a month
 - ☐ At the end of each sprint
 - ☐ At the end of the project
 - ☐ Other_____
23. My team promotes a collaborative learning environment
- ☐ Strongly Disagree
 - ☐ Disagree
 - ☐ Neutral
 - ☐ Agree
 - ☐ Strongly Agree
24. My team develops products that can easily be modified to accommodate changes
- ☐ Strongly Disagree
 - ☐ Disagree
 - ☐ Neutral
 - ☐ Agree
 - ☐ Strongly Agree
25. Me and my team members can easily rotate and take over tasks based on requirements and resource availability
- ☐ Yes
 - ☐ No
26. My team delivers prototypes frequently and continuously
- ☐ Strongly Disagree
 - ☐ Disagree
 - ☐ Neutral
 - ☐ Agree
 - ☐ Strongly Agree

27. My team is comprised of cross functional expertise that include IT & business analysts, developers, product owners, end users, project managers and quality assurance experts
- Agree
 - Disagree
 - Other_____
28. Me and my team members often have relatively similar understanding of requirements
- Strongly Disagree
 - Disagree
 - Neutral
 - Agree
 - Strongly Agree
29. We reflect on lessons learned in previous sprints and share experiences on how to be more effective
- Always
 - Sometimes
 - Never
 - Other_____
30. My organization provides sufficient office apparatus and infrastructure to support agile software development
- Proper development workspace with tables, chairs, boards and notebooks
 - Proper development machines and appliances such as laptops, desktops, mouse, keyboard, headsets, ...
 - Agile project management software like Jira, trello, slack,.. are used
 - Suitable and integrated version control system is available
 - There is proper internet infrastructure in our workspace
 - None
 - Other
31. Check if you have experienced one or more of these situations
- I am constantly required to upgrade my technical skills which is sometimes tiresome and frustrating
 - My team expects far more than what i can actually achieve

- Usually, I don't clearly understand requirements and there is no one or few people to comprehensively describe requirements
- Schedule plans and task time estimates are made without consulting with each team member, which puts me in lots of pressure in meeting deadlines
- As a team, we usually experience scope creep in several sprints
- Other_____

32. What are the most common difficulties you and your team faced in the process of requirement engineering?
33. What are the most common difficulties you and your team faced in maintaining team and development practices of agile principles?
34. What are your suggestions to tackle these problems so that software developers can efficiently use the opportunities agile development provide?

Annex 2: In-depth interview

❖ Requirement Engineering

- ⇒ How do you describe customer involvement and communication during software development processes?
- ⇒ What are the contributing factors for the difficulties faced in requirement engineering?
- ⇒ Can you describe the reason why customers are not involved in the overall development process?

❖ Team and development process

- ⇒ How do the current team composition, behaviour and practices affect the adoption of agile practices?
- ⇒ Most participants in the questionnaire indicated the absence of frequent status meetings and retrospective sessions, why do you think this happened?
- ⇒ Why do you think teams fail to maintain agile culture and adopt the practices for a longer period of time?
- ⇒ How can we enhance team cooperation and create a supportive environment?
- ⇒ Can you describe how teams are coping with the dynamics and instability of software development projects?

❖ Organizational culture and support

- ⇒ What are the challenges you faced from managers and teams related to the use of project management and version control tools?
- ⇒ What other contributing factors can you describe with regards to the difficulties teams faced in adopting agile practices?
- ⇒ Can you describe the challenges faced because of projects acquired through bidding?