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“Empirical Investigation on Success Factors in Adapting Agile Methodology in Software Development at Public Organizations”

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Abstract

Agile Methodology is an emerging approach in software development industry, it aims to offer IT professionals with an alternative approach for managing IT projects more realistically via a set of iterative and adaptive sequence of activities. Great number of firms start adapting agile methodology, and day after day researchers leverage the agile state-of-the-art methodology to a better position. The empirical study of this research study employed in a public utility organization (A), in Dubai. The research study aims to identify the key success factors that enable organization (A) in adapting agile project management methodology successfully, in order to operate day-to-day IT projects more effectively. Through the research study, we identify a group of nine key elements that influence the agile implementation, these nine elements categorized under two main enablers, the Organizational factors and People factors. We developed a group of hypotheses around the nine key elements to address research question. Survey-based methodology employed to gather data from the respondents, the survey distributed among project managers and project team members who practiced in IT projects, with a minimum of 2 years in service within the same organization. The quantitative analysis reveals that only 7 hypothesized elements have statistically significant relationship with ‘Success in Adapting Agile Methodology’, the key elements are Training and Learning, Team Size, Personal Characteristics, Decision Time, Corporate Culture, User Satisfaction, and Competency.

Keywords: Project success; Agile methodology; Agile manifesto; Organizational factors, People factors.

ملخص

تعتبر منهجية أجايل لإدارة المشاريع من المنهجيات المستحدثة في مجال إدارة تطبيقات تقنية المعلومات، فهي تهتم بتوفير آلية بديلة لإدارة مشاريع تقنية المعلومات بصورة منطقية، عن طريق تصنيف نشاطات المشروع على شكل حزمة من الفعاليات المتكررة والمتناسقة فيما بينها. مؤخراً بدأت أعداد متزايدة من المؤسسات في تبني منظومة أجايل لإدارة المشاريع التقنية، ويوماً بعد يوم، يضيف الخبراء والباحثين المزيد إلى هذه المنهجية باستمرار من أجل تحسين مستواها. إن الدراسة التحليلية المطبقة في هذا البحث جرى تنفيذها في مؤسسة خدمية عامة (أ) في إمارة دبي. إن هذه الدراسة البحثية تسعى إلى تحديد العوامل الرئيسية التي تساعد المؤسسة (أ) في إنجاح المشاريع والتكيف مع بيئة عمل إدارة المشاريع أجايل، وذلك من أجل إدارة المشاريع اليومية بفعالية أكبر. ومن خلال تحليل البحوث والأعمال الأكاديمية السابقة، فقد تم تحديد عدد تسعة (9) عوامل رئيسية تؤثر في إنجاح تطبيق المشاريع بنظام أجايل، وهذه التسعة عوامل تندرج تحت فئتين رئيسيتين من العوامل المساعدة، وهما العامل التنظيمي (Organizational Factor) والعامل البشري (People Factor). وقد تم تطوير عدد تسعة فرضيات تدور حول هذه العناصر التسعة من أجل معالجة الأسئلة البحثية وتحديد العناصر المؤثرة ودرجة تأثيرها في إنجاح تبني مشاريع أجايل. وقد تم توظيف منهجية الاستبيان المسحي من أجل جمع البيانات التحليلية من عينة محددة وهي مجموعة من مدراء المشاريع، وأعضاء عمل في فريق المشاريع في قطاع تقنية المعلومات. مع وضع بعين الاعتبار الحد الأدنى لسنوات الخبرة في نفس الدائرة بفترة سنتين. وقد كشفت نتائج التحليل الكمي وجود علاقة وثيقة بين نجاح مشاريع أجايل مع سبعة فرضيات تمثل العناصر التالية: التدريب والتعلم، حجم فريق العمل، الخصائص الشخصية، اتخاذ القرارات في التوقيت المناسب، التنقيف المؤسسي، رضا المتعاملين، وكفاءة فريق العمل.

الكلمات الرئيسية: نجاح المشروع؛ منهجية أجايل؛ بيان أجايل؛ العامل التنظيمي، العامل البشري.

Chapter 1: Introduction

1.1 Research Background

Software development has become an important aspect of our modern life, and it becomes an integral part of every machine and device that operates around us. In spite of all the efforts to improve the software development industry, the process of software development still requires more improvement to become near perfect. Due to lack of perfection in development process, software development often resulting in delays behind the schedule, cost overrun, unsuccessful, out of control or rejected projects. This deficiency have widely affected the software development industry and Information Technology as a whole (Cao & Chow 2007). The growing demands to deliver more software, more rapidly have been increasing over the last decade, this demand lead the organizations to search for an alternative software strategy that satisfies the business needs to meet the growing demands incorporating rapid changes (Ozcan-Top & Demirors 2013). The challenging question remains as 'how to improve software development processes?' and 'what methodologies to be employed?' to overcome known issues in software projects and carefully satisfy business demand.

This has made the practitioners and researchers to introduce a modern methodology of software development process named 'Agile Methodology' that operates rather differently from traditional waterfall methods (Cao & Chow 2007). Study made by Pkkarainen et al. (2011) emphasizes that employing agility in software development increases the organizations ability to respond rapidly to dynamic market changes, causes a reduction in lead times, and ultimately improves the product quality. Since the mid-1990s, there have been high embracing of Agile Practice in software development industry and the concept has captured the interest of research community (Hoda, Marshal & Noble 2008) driven by the demand for more software more quickly (Brown 2011) (Pkkarainen et al. 2011) (Ozcan-Top & Demirors 2013). Over the years, many success stories and benefits gained by organizations gradually changed the early raised question of 'Why should we adopt Agile?' to 'How do we adjust the corporate culture to adapt with Agile practices?' (Sidky, Arthur & Bohner 2007). Practitioners and researchers had understood the key agile values and principles and subsequently introduced new practices under the agile umbrella, such as Extreme Programming (XP) and SCRUM, which are constructed of a group of agile practices (Pkkarainen et al. 2011). These practices have received praise from practitioners all around world due to their abilities to deal with volatile requirements (Chan & Thong 2009) and fulfill software industry needs. Various agile practices (such as

Crystal, Kanban, SCRUM, XP, Feature Driven Development (FDD), etc.) share the same Agile concept, and bear Agile values and principles, such as giving more emphasis on rapid responding to constant changes (Pikkarainen, Salo & Still 2005) (Brown 2011), increasing customer collaboration (Pikkarainen, Salo & Still 2005), focusing on customer needs (Lemétayer & Sheffield 2013), increase business value, reduce documentation, speed up delivery of software products (Ozcan-Top & Demirors 2013), empowering project team (Lemétayer & Sheffield 2013), accelerating coding, testing, and coordinating code-test-build activities (Brown 2011).

Although it has been widely believed that agile practice should be treated as an integral part of modern software development process, the adaption of agile still often encounters resistance. Statistics reveal that only approximately half of all agile practicing organizations, in fact, follow Agile Methodology thoroughly. A series of industrial surveys have indicated the reasons for such resistance from different groups of IT personnel (software developers, testers, managers, and customers). Some of the reasons are due to present management style, lack of appropriate transition plan to Agile, limited knowledge of agile methodologies. Thus, agile aspirant organizations need a strategy and readymade guide to provision the selection, setup, and customization of agile implementation to fulfill organization's software development context (Chan & Thong 2009) (Pikkarainen, Salo & Still 2005), and finally once implemented it requires to emphasize on investigating and monitoring on the Agile success factors that ensure the sustainability and continuity of agile practice within the organization.

1.2 Research Problem and Research Question

A public utility organization (A), based in Dubai, has large base of stakeholders with interrelated interests. IT Division in organization (A) undertakes critical software projects across the organization, targeting both internal business divisions and external customers with software products related to the implementation of ERP (Enterprise Resource Planning), Customer Relationship Management, Suppliers Relationship Management, Human resource Capital management, Security Systems, etc.

At organization (A), IT projects are under high strain from the top management to accept rapid changes in business and customer requirements. In some occasions, IT project managers are forced to accept changes based on variations in technology trends. Referring to research background, the lack of clear understanding of agile methodology caused to have project managers that are unable to effectively process changes in requirements as and when they happen, and unable to accelerate resource

capabilities under the circumstance of rapid changes, ending up with spending resource efforts on managing project logs, recording variations, and managing documentations rather than delivering value to stakeholders. Recently, IT project managers in organization (A) worked hand in hand with external contractor in implementing ERP solution serving some business divisions, and throughout the project implementation they learned how to implement projects meeting with agile practice guidelines. The senior management believe in agile benefits and emphasizes on adapting unified agile project management methodology in software development projects. In this research context, and based on the organizational situation we shape our research question to investigate the success factors in adapting agile methodology in organization (A):

“What are the Success Factors in Adapting Agile Methodology in software development projects in organization (A)?”

1.3 Research Aims and Objectives

The goal of this research study is to explore and evaluate different key aspects that influence the adaption of agile methodology in software development in IT at public utility organizations. The investigation is expected to deeply explore the literatures related to Agile Methodology. We will shed the light on various Agile Practices (XP, FDD, SCRUM); compare and contrast the Agile methodology versus the traditional project management methodology, concept wise; and we will explore the literatures that are related to the association between the success in adapting agile and a predefined set of Organizational and People Factors. The objective can be summarized in the following:

- Explore agile principles and characteristics, including Agile Manifesto
- Explore different type of Agile Practices, such as XP, FDD, and SCRUM.
- Compare and contrast the agile methodology against traditional project management methodology
- Exploring the success factors in adapting agile methodology
- Examining the influence of Organizational and People factors on the success in adaption agile methodology within the organizations.

1.4 Scope of Research

The scope of this research covers the following aspects:

- The study is applied in IT department at a public utility organization (A), in the emirates of Dubai
- The empirical study will be applied on a permanent staff with a role 'Project Managers' and 'Project Team Members', with a minimum of two years of service in the same organization.
- Data is collected through survey based methodology
- The research is limited to explore the influence of selected key elements on the success in adapting agile methodology. These key elements are organized into main factors: People Factors and Organizational Factors. However, there could be other elements impacting the success of adapting agile that have not been taken in consideration.
 - Organizational Factors: End User Satisfaction; User Collaboration; User Commitment; Decision Time; Team Size; Corporate Culture.
 - People Factor: Competency; Personal Characters; Training and Learning.

1.5 Rational of the Study

In organization (A), the IT department established Project Management Office (PMO) to play supportive role in managing IT projects, the PMO is supposed to provide the project managers with policies, methodologies, templates for managing projects within the organization, and provide training on how to manage projects. However, it was noticed that every project manager within PMO follows different methodology in managing projects and there is no crystal clear methodology all project managers agreed on to follow. The methodologies employed so far are varying from Water Fall, to Agile ASAP methodology, and in some situations project managers introduced their own ways in managing projects. Applying unified project management methodology would provide a baseline to the project management practice throughout the enterprise.

Chapter 2: Literature Review

Over the years, many organizations and academicians had been searching for a solid project management methodology capable to embrace and respond to inevitable changes (Dall'Angnol, Sillitti & Succi 2004). The first sign for Agile Methodology was developed in 1975 by a group of practitioners who had designed the new methodology based on iterative and incremental approach (Lemétayer & Sheffield 2013), which was known as Agile Methodologies (Basili et al. 2002). In recent years, Agility has

been promoted as the business model of the 21st century (Tseng & Lin 2011), and has become the dominant methodology for software development projects (Cao et al. 2013), because of its proven embracement with dynamics in both technology and business environments and overcame many of the challenges faced by project managers in the software industry (Cao et al. 2013) (Lemétayer & Sheffield 2013). Researchers Tseng and Lin (2011, p.3694) further state “agility is the fundamental characteristic for survival and competitiveness”. Wideman (2006) describes the Agile methodology as a new concept that offers unique set of techniques, that have been effectively proven to lead projects where uncertainty is the primary risk factor and requires speed and thorough knowledge of the functional requirement of the client to deliver a functional outcome (Wideman 2006) (Tseng & Lin 2011). Day after day, the Agile methodology has been advancing and progressing with its unique capabilities and has become more popular in the software industry (Hoda, Marshal & Noble 2008). Basili et al. (2002) argue that Agile methodology is gaining popularity and also growing fast, although it comprises of a mix of accepted and debated software engineering practices. More companies and practitioners, now-a-days, are showing their interest on ‘Agile Methodology’ and are eager to know more about it and implement it in their organizations.

2.1 Agile – Definition

Wideman (2006, p.4), in his research study, defines Agile Project Management as “a conceptual project management framework for undertaking software development projects in which the emphasis is moved from planning to execution”. Lemétayer and Sheffield (2013) defines the Agile methodology as an iterative lifecycle designed based on short delivery cycles to deal with uncertainty in scope and rapid change in requirements. Furthermore, Lemétayer and Sheffield (2013) explain that the methodology is value-driven rather than plan-driven. Agile replaces the traditional in advance, one-time planning process by an iterative and adaptive sequence of just-in-time planning process, each of which is planned and executed only as and when needed based on the functional requirement of the moment (Lemétayer & Sheffield 2013).

In February 2001, a group of 17 remarkable software process methodologists attended a summit and agreed to work as a team and collaborate in search of a better and effective way of developing software. They formed an alliance named as ‘Agile Alliance’, which officially embraced the definition of the Agile

Software development in a form of 'Manifesto', and published the findings on the Agile Alliance website (<http://www.agilemanifesto.org>) (Cao & Chow 2007).

2.2 Agile Principles and Characteristics

The philosophy of Agile Methodology is designed around a set of core concepts. The agile practices, measurement metrics, and decision making come back to these core concepts (Karlesky & Voord 2008). The core characteristics of Agile methodology are self-organizing teams, fast execution, value-driven, and business oriented.

The Agile practice is basically promoting the concept of self-organizing (self-directed) teams that have the empowerment to organize their work on their own (Cao et al. 2013) (Hoda, Marshal & Noble 2008). Lemétayer and Sheffield (2013) claim that the success of the Agile practice is highly reliant on the empowerment of the teams to enact processes in a timely fashion. The eWorkshop discussion conducted by Basili et al. (2002, p.4) with 18 subject matter experts in the domain of Agility reveals the characteristics of Agile practice as: Iterative; Incremental; Self-organizing where "the team has the autonomy to organize itself to best complete the work items"; and emergent that "technology and requirements are allowed to emerge through the product development cycle.

Agile is always associated with speed delivery of outcomes (Wideman 2006), using tacit knowledge among team members replacing heavy documentation (Lemétayer & Sheffield 2013).

Agile principle focuses on managing the product rather than personnel (Reel 1999), Wideman (2006) affirms that Agile focuses on product objectives and not the project itself. Bang (2007) points out that agile creates the environment where changes are welcomed, so that the final product matches what users desire to procure. Wideman (2006) recommends blending the projects with business, by integrating project and business decision-making processes in order to achieve the business objectives.

Agile practice focuses on execution rather than extensive planning (Wideman 2006) (Lemétayer & Sheffield 2013). Agile provides an iterative and incremental style of development that dynamically adjusts to changing requirements and enables better risk management (Lemétayer & Sheffield 2013) (Basili et al. 2002) (Hoda, Marshal & Noble 2008). In Agile, the user holds a vital role in making decisions,

prioritizing features, testing and providing feedback throughout the project stages. The user remains as close as possible to the development team to release the requirements according to his needs (Karlesky & Voord 2008).

2.3 Agile Manifesto

The Agile Manifesto is web-based document (<http://www.agilemanifesto.org/>) that was written by the contributions of many of the authors. The Manifesto is designed based on a four-item following twelve underlying principles and confirmed by several thousands of signatories. The four-items are aiming for better and effective ways of developing software that any agile framework is built around (Hoda, Marshal & Noble 2008) (Basili et al. 2002):

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- User collaboration over contract negotiations
- Responding to change over following a plan

The Agile Manifesto was the baseline for the researchers and practitioners to introduce a variety of Agile methodologies and practices that are all complying with the spirit of Agile. Based on the nature of the project and the dynamics that are impacting the project, researchers introduced various flavor of Agile practice. Some of the famous Agile practices are SCRUM, eXtreme Programming (XP), Feature Driven Development (FDD), Dynamic System Development Method (DSDM), Adaptive Software Development (ASD), Lean Software Development (LD), Kanban, Crystal, and more (Cao & Chow 2007) (Cao et al. 2013) (Hoda, Marshal & Noble 2008). Cao et al. (2013) expound that all the Agile Methodologies share the same practice and have a common approach, but each method has its unique strategy and characteristics.

2.4 A brief description of different agile methods

2.4.1 Popular Agile Methods

A Survey conducted by Cao et al. (2013) reveals the most popular methods used are eXtreme Programming (XP), SCRUM and Feature Driven Development (FDD). Some hybrid methods were used.

Interestingly, the study remarks that both Lean Software Development and Kanban are increasingly becoming popular in IT industry (Cao et al. 2013). Basili et al. (2002) highlight that the best known methods in the software industry are XP, SCRUM and FDD, however project managers need to understand the unique characteristics of each method and use the right agile model to support their projects (Basili et al. 2002). The following are common and popular agile methodologies that are widely used in software industry:

2.4.2 eXtreme Programming (XP)

eXtreme Programming is one of the most common Agile methodologies used in software development, that has gained rapid acceptance and is in practice over the world. It was created by Kent Beck, who is considered as one of the authors of Agile manifesto (Hoda, Marshal & Noble 2008) (Cao et al. 2013). Kent Beck, compiled a collection of good project management practices and took them to the extreme. Hoda, Marshal and Noble (2008) argue that XP targets small and medium size projects. However, Cao et al. (2013) dispute that the methodology can easily be adapted in any industry regardless of project size. The XP method focuses on user, and how to achieve user satisfaction through empowering the developers to respond to changing user requirements quickly and continuously. The XP methodology relays on five values and twelve principles. The five XP values are Communication, Simplicity, Feedback, Respect and Courage. The original principles that the XP is based on are:

- Planning Game
- Small Releases
- User Acceptance Tests
- Simple Design
- Pair Programming\Test-Driven Development
- Refactoring
- Continuous Integration
- Collective Code ownership
- Coding Standards
- Metaphor
- Sustainable Pace

From the technical perspectives, the XP methodology guidelines state that the users provide the requirements in a form of 'User Stories', which is a document that is written in a business words describing the functionality or feature. User Stories help the developers in estimating the time, cost and complexity of the development prior to the planning stage. Working software is delivered in a short intervals of 1-3 weeks. In XP implementation the user is closely involved in the development through rapid feedback. Testing processes are undertaken frequently through two processes, Unit Test (UT) and User Acceptance Test (UAT) (Cao et al. 2013) (Hoda, Marshal & Noble 2008).

2.4.3 Feature Driven Development (FDD)

The FDD was originally developed by Jeff De Luca in 1997 (Cao et al. 2013), and it was highly improved through a sequence of collaborations with Peter Coad. The FDD is a model-driven methodology aims to conceptualize a model of features and their priority. The focus in this methodology is toward delivering working features that the user can use. Through a series of short iterations, the user is asked in each iteration to prioritize the features, this approach directs the developers effort toward achieving high priority features as needed in response to circumstances (Karlesky & Voord 2008) (Cao et al. 2013). This approach saves time and cost for the user, and it guarantees that what is most important to user is always accomplished first, moreover, it adds value in case the project schedule or cost become short, where the most significant and valued features are already been accomplished (Cao et al. 2013). The FDD uses the following eight practices in delivering working software packages:

- Domain object modeling
- Developing by feature
- Component/Class ownership
- Feature teams
- Inspections
- Configuration management
- Regular builds
- Visibility of progress and results

By comparing the FDD with XP we find that XP is more suitable for volatile requirements, in a projects where uncertainty is high and user is expected to make frequent changes. On the other hand, the FDD is more scalable for large teams and within corporate environment, because XP heavily relies on

communication within teams which become more complex in large teams and corporate projects. (Cao et al. 2013)

2.4.4 SCRUM

SCRUM Agile project management was initially introduced by Jeff Sutherland and formalized by Ken Schwaber and Mike Beedle (Cao et al. 2013) (Hoda, Marshal & Noble 2008). The SCRUM methodology gained increasing popularity over the last decade due to its simplicity, proven productivity in the software industry. The research survey made by Cao et al. (2013) shows that the SCRUM is among the most used practices in software industry, and it has been proven to scale to multiple teams across large firms. In a nutshell, SCRUM in general involves the following principles (Cao et al. 2013):

- Divide the organization into small, cross-functional and it encourages self-organizing teams.
- Split the work tasks into a list called 'Product Backlog', contain small and very well defined features. Each feature in the backlog is prioritized based on its importance, and consists of estimated efforts for accomplishment
- Splitting the tasks into iterations that do not exceed 3-4 weeks. Iterations in SCRUM are called Sprints, and it end up with working feature that can be presented or delivered to the users.
- The release plan and priorities are set in collaboration with user
- Optimize the process considering lessons learned from past iterations.

The SCRUM introduces couple of roles such as Product Owner, Scrum Master, and Team. The Product Owner is the voice of user, who ensures that the delivered working software meet users need. The Scrum Master work with Product Owner and facilitates the team. The team usually consists of seven (plus/minus two) members (Hoda, Marshal & Noble 2008).

2.5 Agile Vs Traditional Project Management Methodology

Karlesky and Voord (2008, p.1) define the traditional project management as "methodology where software development is viewed as a specialized version of manufacturing or as a construction project". The traditional project management methodology, or so called 'Waterfall' approach, is identified by "its sequential phases of design, implementation, and testing, planned out through critical path analysis, and usually represented via Gantt charts". Basili et al. (2002) explain the traditional project management practice as 'Plan-driven' method, where the work starts with the explanation and documentation of

business requirements as a complete set. Researchers found these initial requirements including documentations, initial conceptual and architectural design development are frustrating and probably difficult to achieve, especially under the circumstances when the entire industry and the technology moves too fast and users are unable to definitively state their needs up front. The Agile Alliance gives more value to deliver working software than providing wide-ranging documentation (Donnellan & Murphy 2009). Agile emphasizes on sharing tacit knowledge and strengthen the communication between teams in place of working on heavy documentation. (Lemétayer & Sheffield 2013)

In traditional project management, change and rework is considered the most costly aspects of software development, therefore the traditional model attempts to avoid changes through an extensive in advance planning, design and documentation. The traditional project management wisdom states that if any change happens during project execution, it means improper risk planning, design and documentation has occurred (Karlesky & Voord 2008). Hoda, Marshal and Noble (2008) argue that the traditional software development model unrealistically assumes that the user requirements remain fixed over the entire length of the project, while Agile project management focuses on user satisfaction, and allow for changes via iterative style of development, where only needed functionalities are focused on (Hoda, Marshal & Noble 2008). Agile methodology treats changes very realistically as it is something to be managed rather than avoided. It also considers planning, design and documentation beyond the necessary requirements (Karlesky & Voord 2008) (Bang 2007).

Hoda, Marshal and Noble (2008) summarize the key difference between Traditional project management methodology and Agile methodology in Table (1).

Table 1:

Category	Traditional	Agile
Development Model	Traditional	Iterative
Management	Controlling	Facilitating
User Involvement	Requirements gathering and delivery phases	On-site and constantly involved
Developers	Work individually within teams	Collaborative or in pairs
Technology	Any	Mostly object oriented
Product Features	All included	Most important first
Testing	End of development cycle	Iterative and/or drives code
Documentation	Thorough	Only when needed

However, Fruhauf (2007) and Cao et al. (2013) and other practitioners tend to distinguish the difference between both approaches based on Mental (Table 2) and Principle (Table 3) models.

Table 2: **Mental Model**

Traditional	Agile
Project execution can be standardized	No two projects will ever be the same
User involvement is unlikely	User involvement is critical
Requirements need to be defined to a large extent up front	Only architecture relevant requirements need to be known 'entirely' up front
It takes time to make something the user can have an intelligent judgment on	Do first whatever enables the user to have an intelligent judgment on
Work coordinated by managers, clear separation of roles	The project is driven by self-organizing team

Table 3: **Principle Model**

Traditional	Agile
Management oriented	Technology oriented
Deadline minded	Result, quality minded
Sum of individuals	Team
Collaboration via meetings	Continuous working in team
Responsibility for processes	Responsibility for tasks
Communication via documents	Mainly face-to-face communication
Change resistant	Change tolerant
Focus on safeguards	Focus on simplicity

2.6 Why to adapt with Agile Project Management?

We live in a dynamic environment and change is an inherent characteristic of the recent life. Any growing entity faces challenges in managing the rapid changes in resources, competition, budgets, schedules, user's needs. Therefore, change must be practically considered or else it could lead to failure (Karlesky & Voord 2008) (Bang 2007). The empirical investigation (Dall'Angiol, Sillitti & Succi 2004) made on twenty-one software companies reveals that 48% of changes are due to technological changes, and 43% is due to changes in user requirements. Studies assert that a high percentage of traditional projects fail due to inability to meet the time estimate, agreed scope, or due to budget overrun (Karlesky & Voord 2008). Similarly Bang (2007) explains that the traditional projects sometimes end up with a surprise, developing features according to a giant requirement specification, keeping the testing to the

last stage makes it an extremely tough challenge to assure quality. Bang (2007) criticizes the heavy documentation in traditional project management, he argues that developing a software of higher quality requires close involvement of user. He observes that putting all the trust in written documentation and formal sign-offs does not always guarantee the quality of the final product and suitability of the product to the user because in some situations the information are misinterpreted in the development life cycle. He recommends encouraging dialogue communication and establishing a culture of trust between employees, this directs the team efforts toward productivity rather than administering and documenting the work (Bang 2007). Basili et al. (2002) shares the same understanding in more details, in his research he describes the traditional project management practice as 'Plan-driven' method, where the work begins with the clarification and documentation of a requirements fully as a complete set. Some practitioners found these initial requirements including documentations, initial conceptual and architectural design development are frustrating and probably impossible to achieve, especially under the circumstances when the entire industry and the technology moves too fast and users are unable to definitively state their needs up front (Basili et al. 2002). Lemétayer and Sheffield (2013) elaborate more about Agility, they describe Agile methodology as value-driven rather than plan-driven, and in place of heavy documentation the agile methodology uses tacit knowledge among team members. In agile methods planning goes through an iterative and adaptive series of just in time tasks each of which is executed only when required, rather than major, upfront one time planning task.

Lemétayer and Sheffield (2013, p.462) through their study on the information gathered from 10,000 projects and project managers, they found "no more than 20% of all projects have the characteristics of traditional projects, but project managers continue to apply these traditional methods on projects for which they are not suited". According to Cao et al. (2013) and Basili et al. (2002), in spite of the above facts and statistics, there are still organizations that structure their software development around plan-driven, using waterfall, incremental or spiral methods.

Cao et al. (2013) emphasize that the empirical studies have proven that Agile methodology has become a dominant and it has the capability to overcome many of the problems faced by project managers. The importance of Agile methodology stems from the fact that it treat the changes more realistically, and it adapts change rather than avoiding it. The empirical analysis of Basili et al. (2002) reveals that Agile methodology is more appropriate when level of uncertainty is high, requirements are emergent and

rapidly changing. Practitioners know that it is impossible in IT projects to plan extreme far a head in advance, realistically any project consist of certain level of uncertainty, iterations, and decision points before they can be successfully completed. Wideman (2006, p.5) states that “we would be naïve if we did not expect changes to the project plan”. He explains that in traditional project management the project managers spend long time in studying and recording variations from the original plan, as the variation grows along with project growth, the project manager role gradually changes to be more administrative role in tracking, analyzing, and documenting variations while his role is to focus on achieving the objective of the project.

Tseng and Lin (2011, p.3694) in their research study describe the companies that successfully embraced agile “quick and efficient reaction to changing market requests, the capability to customize products and services delivered to users, the capability to produce and deliver new products in cost-efficient manner, decreased manufacturing costs, increased user satisfaction, removal of non-value-added activities and increased competitiveness”, Cao et al. (2013, p.1663) sheds the light on the consequence of encouraging self-organizing teams in Agile methodology, he says this “increases productivity, enables employees to learn, innovate, and finally makes them happy with what they do”.

2.7 Transitioning to Agile

The transition from the traditional project management to Agile project management, and the guidelines to overcome transition problems has been the subject of many researches (Cao et al. 2013) (Basili et al. 2002). Organizations and practitioners that are interested in adopting Agile methodology are faced with challenge of making the transition (Hoda, Marshal & Noble 2008). The challenge varies according to the organization size and maturity of the project management practice in any organization, Hoda, Marshal and Noble (2008) propose a technique to assess the company’s need and readiness for adopting agile, and they divide the key challenges any organization faces into three categories, people-related, process-related and technological-related issues. On the other hand, Tseng and Lin (2011) recommend aligning and integrate agility providers, capabilities and drivers in order to establish the transformation strategy. Tseng and Lin (2011, p.3701), in their research study proposes technique to transform to agile methodology and try to answer relevant questions such as ‘What precisely is agility and how can it be measured?’, and ‘How can one adopt the appropriate agile enablers to develop agility?’. Bang (2007, p.207), in his lessons learned for transitioning to Agile he advises practitioners to

transition to Agile in stage wise, 'Do not try to do all at once, listen to your needs'. Moreover, he advises practitioner to be more dynamic and flexible in the implementation, 'Do not become religious', and he emphasizes that Agile method does not alone guarantee the success, it is not a silver bullet, a successful implementation requires cultural understanding and belief in its value and principle.

2.8 Success Factors in Adapting Agile

Over the last 30 years period, extensive researches have been made by managers, engineers and researchers to determine the critical factors that have direct influence on the success of Agile practice in software development projects. According to Cao et al. (2013), one of the key elements that make the software development projects so unique and that cause the project to a failure is the dynamics of software development. The fact remains that during the project execution both the technology and business environments are dynamically under continuous changes. The technology changes rapidly, and so does the business requirements (Cao et al. 2013) (Abrahamsson & Ikonen 2010).

Many authors attempted to investigate various factors that are apparent to be important in order to develop an agile approach. Distinctly, among the investigators, according to (Donnellan & Murphy 2009), the three success factors of success of any Agile practice are considered to be:

- The amount of interaction the user has with development team
- The size of the team
- The size or type of system being developed

However, Tseng and Lin (2011) extract the success factors from the characteristics of Agile practice, as the Agile methodology solves the issues of change, uncertainty and unpredictability within business environment, and as it requires a quick response, he identifies four principles that directly contribute to agile success. The four principle elements that help succeed any Agile project are:

- Responsiveness
- Competency
- Flexibility or adaptability
- Quickness or speed

Basili et al. (2002) in his research for finding the success factors, he benefited from his past experience and lessons learned from past projects, he identifies three factors:

- Culture
- People
- Communication

There are more case studies and research theories express the root cause of success and failures in Agile implementation. There is numerous numbers of factors affecting Agile methodology. However, in this research paper, we focus on specific success factors cited by the previous literatures and based on previous failure and success research studies (Cao & Chow 2007). According to Misra, Kumar and Kumar (2009) the success of Agile implementation may be based on a set of two main factors (figure – 1):

- The **Organizational** factors that are User Centric Issues, Decision Time, Team Size and Corporate Culture
- The **People** factors that are Competency, Personal Characteristics, Training and Learning and conceptual framework

2.8.1 Organizational Factors:

A. User Centric Issues

The purpose of Agility is to deliver software efficiently and in a satisfactory manner in perspective of scope, quality and time. Users are the primary driver of business value, they provide business knowledge, input and feedback to help determine priority and rank order of the deliverables (Moreira 2013). Karlesky and Voord (2008) add more to this statement, the user pays for the final product, and users should be the single point of contact and main driving force in making decisions or direction, prioritizing features and answering domain questions. Studies made by Jepsen (2002) reported that continuous cooperation is essential between users and developers to succeed the delivery of project products following agile practice. Studies made by Graffin (2001) and empirical analysis of Cao et al. (2013) emphasize the importance of user commitment, collaboration and involvement in various stages in the development process. Jepsen (2002) past experience is fully aligned with this approach, in addition he recommends having a tight cooperation between users and developers and also suggests that users must be as close as possible to the development team for a successful project completion. In

a recent study, Misra, Kumar and Kumar (2009) published a paper work with a survey reporting the importance of three key elements named as:

- ***User Satisfaction***
- ***User Collaboration***
- ***User Commitment***

Firstly, ***User Satisfaction*** can only be achieved through the delivery of software on time as per the agreed scope of work and quality. The iterative style of Agile practice itself increases user satisfaction by allowing users to prioritize the requirements, request for changes, direct developers efforts toward whatever is important to user. Moreover, the lessons learned from past iterations lead to better delivery of software quality in the next iterations (Hoda, Marshal & Noble 2008). Cao et al. (2013) analyses the principles of eXtreme Programming (XP), which already has extreme focus on user satisfaction, he justifies that this approach itself empowers the project team to respond to changes in user requirements and to quickly deliver high quality software. Hoda, Marshal and Noble (2008) and Basili et al. (2002) support this claim and adds that 'Feedback' is one of the five key values that the XP Agile method is built on. Basili et al. (2002) add that Agile is designed based on close interaction with user, and he expects that the user will be on site for the quickest possible feedback. In Feature Driven Development (FDD), Karlesky and Voord (2008) confirm that in each iteration users are invited to review the delivery, provide their feedback and prioritize the remaining features. This adds value to both users and project team such as:

- It directs the team efforts toward delivering the features in response to circumstances
- It benefits the team from the lessons learned from previous iteration
- Features of little value can be dropped or deferred from the scope
- Features that are most important to a user are always accomplished first
- Important and valuable features are prioritized in accomplishment list based on available budget and work schedule.

Secondly, ***User Collaboration*** is an essential part of any Agile Project. Misra, Kumar and Kumar (2009) encourages the user to be more active, participate in both the daily activities (scrum) and review the iteration (sprint) results every three weeks or every month (Misra, Kumar & Kumar 2009) (Moreira 2013). Moreira (2013, p.50,99) recommends adding 'User Engagement' in employee's objective and

vision of the organization. He claims that user availability and the adoption of agile approach 'Inspect-and-adapt' leads to final product that has strong business value to user. Similarly, Cao and Chow (2007) through their research study strongly recommend user engagement and consider it as one of the key success factors in Agile practice. Study made by Dall'Angiol, Sillitti and Succi (2004) reveals that the lack of communication between developers and users causes five of the top six reasons of project failure. Survey covering over 8000 projects shows that major source of project failure lies in lack of proper communication among stakeholders and wrong understanding of user value proposition (Dall'Angiol, Sillitti & Succi 2004). In SCRUM Practice, there is a role that has been introduced to present the user throughout the development lifecycle, this role is called 'Product Owner' (PO). The PO works closely with the user, maintains list of features that are asked by the user and prioritize the features based on their value to user (Hoda, Marshal & Noble 2008).

Thirdly, **User Commitment** - in a nutshell, it recommends that the users not only to be available on site, but also to be active member responsible element for succeeding the project. Thus, commitment is an important success factor (Misra, Kumar & Kumar 2009). Karlesky and Voord (2008) assume the user present as a full-time member and participate actively to align the delivered outcome with actual needs.

Survey results of Misra, Kumar and Kumar (2009) show that user centric issues, including *Satisfaction*, *Collaboration* and *Commitment* have a significant relationship with success of Agile software development, with strongest correlation with *Commitment*, followed by *User Collaboration*, and *User Satisfaction* respectively. He finalized the study with a significant relationship between Agile success and User Centric Issues (Misra, Kumar & Kumar 2009).

Based on the above literature we formulate our hypothesis as follow:

HO1a: The greater the Satisfaction of users in projects, the more likely would be the Success in adapting Agile Project.

HO1b: The greater the Collaboration with users in projects, the more likely would be the Success in adapting Agile Project.

HO1c: The greater the Commitment of the users in projects, the more likely would be the Success in adapting Agile Project.

B. Decision Time

Fast decision-making is obviously an enabler of agility, the agile practice is designed to take quick decisions within a short period, thus agile project managers encourage the team members to work and take quick decisions on the spot for any problems that occur. This can only be achieved when there is rapid communication and collaboration among the developers, users and the concerned stakeholders. Rapid communication would cut down the amount of time spent on major decisions (Misra, Kumar & Kumar 2009) (Cao et al. 2013). Moreira (2013) claims that team members must work together to accomplish tasks and establishing acceptance criteria together as a team. It is the team responsibility to take the best decisions to move forward because they are the ones who directly accomplish the work. Moreira (2013, p.121) calls the 'development' team as 'engineering' team because the team does not only do development, but also do cross-functional and design activities. The empirical study made by Misra, Kumar and Kumar (2009) reveals that decision time has significant correlation with success, with high coefficient of correlation, which indicate how strong is the influence of decision time over the success of projects. Around 84% of the surveyed practitioners believe that the whole idea behind agility is being fast, fast and effective communication, whereas the same practitioners claimed that in some situations they had to take an important decisions rapidly within a short time frames. According to Cao et al. (2013), self-organizing team manage the work more effectively, the team decides how to coordinate works among members, release of features, and provides control over development process, similarly agreed with Abrahamsson and Ikonen (2010), staff empowerment lead to successful project results. In his case study, Maurer et al. (2007) observes that the project teams are more self-organized and confident of what task need to be performed next, rather than being assigned to them (Maurer et

al. 2007). Basili et al. (2002) encourages organizations to grant teams some certain local control with ability to adapt working practices as they feel appropriate.

In conclusion, Agility is all about making the right decision fast and response to business needs in a very efficient way. In regards to the time and its influence to the project success, studies of Dall'Angno, Sillitti and Succi (2004) shows that 71% of all surveyed managers indicated that the main problem in software development industry is delivering the functionalities on time. This result complies with the survey result conducted by Standish Group on 8000 projects, which shows that only 26% of the development projects were completed on time.

Therefore, we propose the relationship between Decision Time and Agile success in the following hypothesis:

H02: The Quicker the appropriate decisions are taken in a project; the more likely would be the Success in adapting Agile Project.

C. Team Size

The degree of communication between members is highly influenced by the total number of members in each team, the less are the number, and the easier is the communication among team members. In large teams, the rapid communication and interaction becomes more complex, as the number of staff increases the number of communication channels multiplies based on the formula $N(N-1)/2$. Small teams raise the informal communication among members, while large teams could introduce a formal procedure for communication that ultimately slows down the decision-making. Practitioners recommend that large teams to be divided into smaller teams for better management (Misra, Kumar & Kumar 2009). Several researches assume that in Agile the team size should be seven, plus or minus two members. If the team is too small, the project team may not have all the skills required to accomplish the job. On the other hand, if the team becomes too large, it becomes too hard to organize. Cao et al. (2013) describes the Scrum methodology, the project work force are organized into small, cross-functional, self-organizing teams.

Cockburn and Highsmith (2001) conclude in their book stating that Agile development is not appropriate and difficult to implement for large teams, and plan-driven (traditional method) can be scaled up better.

In contrast, Basili et al. (2002, p.4) in his eWorkshop with 18 agile subject matter experts dispute that Agile is able to manage projects of different sizes, “Any team could be agile, regardless of the team size”. In his study on different team sizes of 12, 25, 100 and 800 people, he states that Agile practice can handle projects with large team size by making a slight change in the configuration of the teams. This can be achieved by introducing a new roll called ‘Scrum of scrum’ (SOS), assuming the project teams are divided into teams and sub-teams, with solid mesh collaboration between senior staff in each team, and proposing frequent meetings of cross-project sub-teams. In conclusion, Basili et al. (2002) sees that regardless of the team size, any team could be agile, but as the team size increases the communication and collaboration becomes harder, with small teams the collaboration is easier which lead to successful results.

From the literature, we reveal the influence of team size on the success of Agile projects in the following hypothesis:

HO3: The Smaller the Size of the teams in a project having appropriate skills included, the more likely would be the Success in adapting Agile Project.

D. Corporate Culture

Agile development normally takes place in a specific organizational context, including organizational culture. Many researches have examined the relationship between corporate culture and the success of agile implementation, which have clearly demonstrate couple of significant factors that directly influence the success of agile implementation in any organization. Other studies found it impossible to study the success of Agile implementation without considering the interaction with organizational culture and the context in which the agile is being implemented (Livari & Livari, 2011). Keeping in mind that corporate culture is one of the essential factors the Agile Manifesto emphasis on.

Misra, Kumar and Kumar (2009) claim that agile practice is not an appropriate practice in a bureaucratic organizations, whereas a dynamic and fast changing organization will find Agile practice extremely helpful. Moreira (2013) explains that the transformation to agile practice is a culture transformation that requires cooperation of the management at all levels in order to meet the values and principles of agile practice. A crystal clear reasons must be given to the management to get their buy in and support the cultural change. He emphasizes on aligning the whole organizational vision, values and objectives with

agile values and principles in order to gain the full business benefits from Agile, and help everyone in understanding the need in adapting agile. Moreover, the senior management and executives to provide public support periodically as and when required. In more details, he recommends assigning agile sponsor to support the cultural change, and allocate agile champions within the scope of agile implementation. In his case study about Agile implementation in 'Medium Distributed Project', he notices that the lack of sufficient support from the sponsor to lead the culture change needed for agile implementation was one of the factors for Agile failure. In contrary, Cao and Chow (2007) through his empirical study he could not prove the criticality and significance of some factors such as strong executive support and strong sponsor commitment, so does Cao et al. (2013).

Basili et al. (2002) states that being agile is a cultural matter, if the culture is not supportive for agile, then the organization cannot be agile.

HO4: The Stronger the corporate culture exists in the organization, the more likely would be the Success in adapting Agile Project.

2.8.2 People Factors

A. Competency

Competence according to Moreira (2013) refers to individuals past experience, technology domain, and possession of good interpersonal and communication skills. He explains the team competency is the ability of the team to establish the product with minimum dependency on others outside the team. The core competence of the team should include but are not limited to analysis, design, programming, confirmation management, testing and technical writing. The need for high level of competence of project team members is very essential because the Agile practice focuses on delivering working software fast and distinctly. The principle of Barry Boehm is very true in the domain of Agile practice, which recommends to use better and fewer people (Basili et al. 2002). The more experienced team and their high competencies do not only dictate the delivery of final product on time but also meeting the quality of final product in a level that satisfies the user (Misra, Kumar & Kumar 2009). The research study made by Cao and Chow (2007) on 48 research hypotheses has significantly reveals that high-caliber team lead to success of any project.

Basili et al. (2002) emphasizes several critical factors such as talent and skills to succeed Agile practices, and he explains that having competent team members are crucial.

HP1: The More Competent is the individual team members in a project, the more likely would be the Success in adapting Agile Project.

B. Personal Characteristics

There is an ongoing debate between practitioners and researchers about whether or not agile requires 'good people' to be effective. Some researchers suggest that Agile practice could be attributed to the team of good people, however some others argue that Agile methodology emphasizes on the final product rather than the personnel aspects, and the Agile practice itself is naturally valuable that guarantee the effectiveness of any implementation.

Misra, Kumar and Kumar (2009) and Moreira (2013) argue that choosing the right people in terms of experience and competence may not be the only reason for success, there are other personal characteristic factors that bridge the gap between the team members and make them work in harmony. Such as sense of responsibility, collaborative attitude, honesty, readiness to learn and work with others. Jepsen (2002) claims that high qualifications and deep technical experience alone does not succeed a project, there are personal characteristics such as cooperativeness among team members. Basili et al. (2002) add sociability and friendliness as critical people-factors in Agile practice. Moreira (2013) explains that the team must know how to collaborate and cooperate with each other, because they need to work together closely. Therefore, the team members must respect each other's values and opinions to become a collaborative self-organizing team, the same were supported by Dall'Angnol, Sillitti and Succi (2004). The empirical study made by Misra, Kumar and Kumar (2009) found significant relationship between personal characteristics and success of agile practice. Cao and Chow (2007) name the environment where team is cooperating as agile-friendly team environment, and he emphasizes that the more the environment is friendly, the more the opportunity that the agile practice succeeds. The group dynamics, harmony and understanding are critical toward project success (Abrahamsson & Ikonen 2010).

HP2: The Better the Personal traits and collaborative attitude of each team member in a Project, the more likely would be the Success in adapting Agile Project.

C. Training and Learning

Many literatures come across training and learning as an important factor for the organization to successfully adapt agile principles and values. The question that always raise is how much training? and what level of training is required to succeed agile practice? Misra, Kumar and Kumar (2009) assume that informal training such as mentoring, knowledge sharing between peers, and professionally guided discussion are more useful than formal training. Moreover, they emphasize on transferring tacit knowledge between individuals. In his empirical study, training and learning was found to have significant correlation with success of Agile practice. The same is recommended by Moreira (2013), every team should consist of a combination of agile experienced and committed personnel to help guide the project team. However, from his experience he claims that the SCRUM Agile methodology requires a Certified Scrum Master (SCM) to play a role of Scrum Master. The role of Scrum Master requires a formal training plus an adequate experience in agile implementation in order to support and maintain the scrum practices. From the case study in 'Small Collocated Project', Moreira (2013) claims that due to unexperienced Scrum Master and due to lack of adequate training it was hard for the Scrum Master to support the Agile practice, sustain the mechanics, and enforce the Agile values and principles to change the culture.

Majority of researchers and practitioners felt that Agile method require less formal training than traditional method, and Agile emphasizes on the tacit knowledge and the informal training (Basili et al. 2002). Dall'Angiol, Sillitti and Succi (2004) claim that sharing of knowledge facilitates the transfer of knowledge within a group, the same was supported by Standish Group studies on 8000 projects. Basili et al. (2002) give an example from the pair programming, where developers sit together during programming session mentoring each other, this approach minimizes the need for explicit training and gives the chance for informal training to take place.

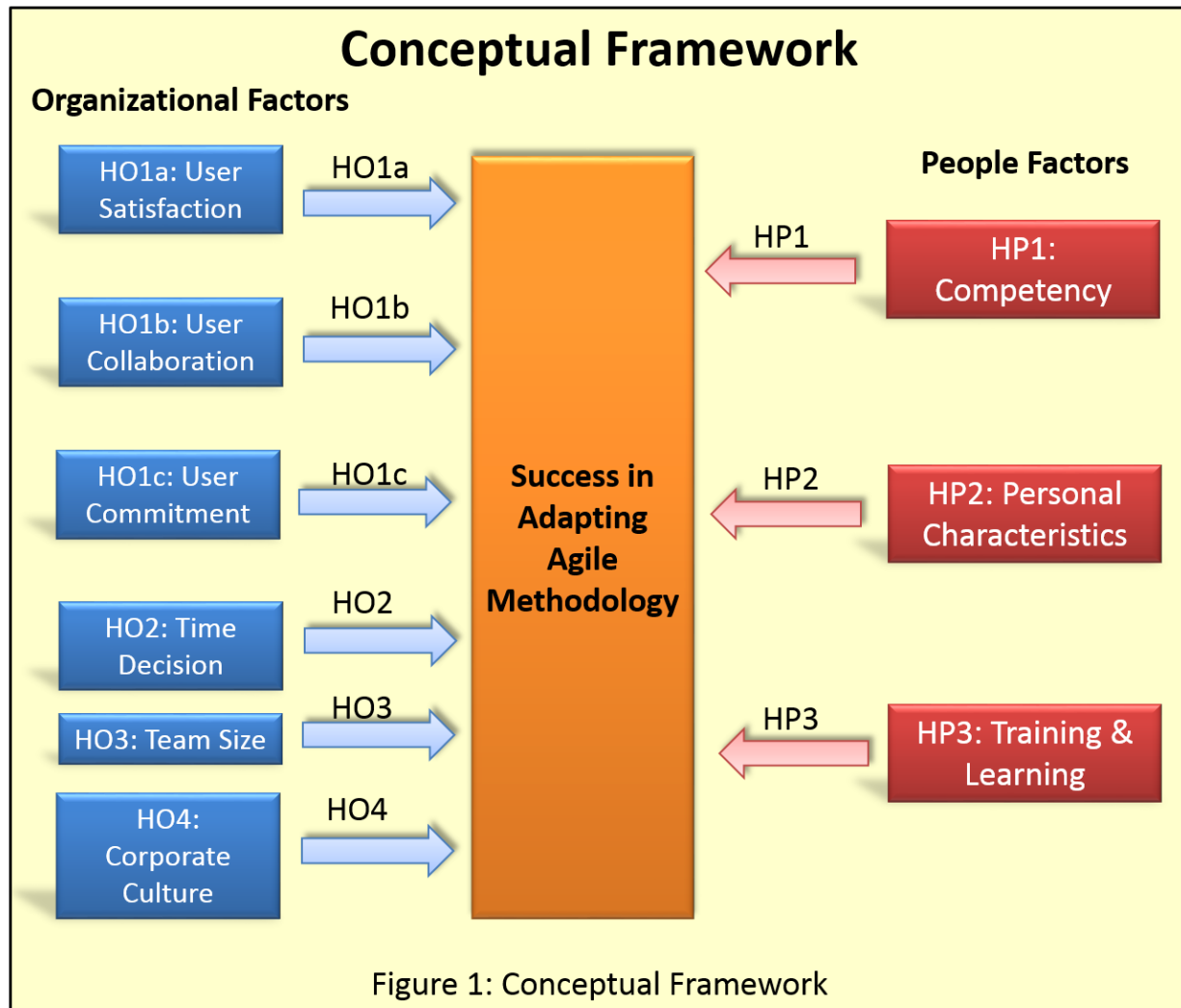
HP3: The better is the environment for learning and sharing knowledge, the more likely would be the success in adapting Agile Project.

2.9 Conceptual Framework

From the review of related literature and studies, we start connecting all aspects of inquiry to construct our conceptual framework. We draw the dependent and independent variables from the proposed hypothesis and map them together in a coherent structure to interpret research phenomenon. Figure (1), illustrates the relationship between the dependent and independent variables, and present the key facets that influence the success in adapting agile methodology in public organizations. The independent variables in our research study are classified into two groups: **Organizational Factors**; and **People Factors**. The Organizational Factors consist of six constructs: User Satisfaction (**HO1a**), User Collaboration (**HO1b**), User Commitment (**HO1c**), Time Decision (**HO2**), Team size (**HO3**) and Corporate Culture (**HO4**), while the People Factors consist of three constructs: Competency (**HP1**), Personal Characteristics (**HP2**), and Training and Learning (**HP3**), Table 4.

Table 4: **Research Hypothesis**

Organizational Factors	People Factor
<p>HO1a: The greater the Satisfaction of users in projects, the more likely would be the Success in adapting Agile Project.</p> <p>HO1b: The greater the Collaboration with users in projects, the more likely would be the Success in adapting Agile Project.</p> <p>HO1c: The greater the Commitment of the users in projects, the more likely would be the Success in adapting Agile Project.</p> <p>HO2: The Quicker the appropriate decisions are taken in a project; the more likely would be the Success in adapting Agile Project.</p> <p>HO3: The Smaller the Size of the teams in a project having appropriate skills included, the more likely would be the Success in adapting Agile Project.</p> <p>HO4: The Stronger the corporate culture exists in the organization, the more likely would be the Success in adapting Agile Project.</p>	<p>HP1: The More Competent is the individual team members in a project, the more likely would be the Success in adapting Agile Project.</p> <p>HP2: The Better the Personal traits and collaborative attitude of each team member in a Project, the more likely would be the Success in adapting Agile Project.</p> <p>HP3: The better is the environment for learning and sharing knowledge, the more likely would be the success in adapting Agile Project.</p>



Chapter 3: Methodology

This research study employs quantitative approach, both descriptive and inferential statistical methods, to reveal the relationship between the entire dependent and independent variables and to examine the proposed hypothesis. In this research paper, we follow a number-based research discipline that statistically measure project managers and team member's satisfaction, behavior, and performance. The quantitative approach is more objective and it is able to effectively translate data into easily quantifiable charts and graphs. Moreover, quantitative approach has a series of test methods and techniques that can easily enable the researcher to generalize data to a larger population. The ability to generalize the

data helps researchers to have insight on the situation at large population and help the organization in shaping their long-term strategy. From the sample perspectives, the quantitative approach has an additional advantage, it allows easy distribution of surveys among large population efficiently throughout the internet, email or even the phone.

Chapter 4: Data Analysis and Results

4.1 Sample/Data gathering

This study employed survey approach to gather data from the target population. The questionnaire consists of five sections, the first section is an introductory about the purpose of the survey study and written assurance to the respondents that the information will be used for research purpose only without disclosing the identity of respondents. The second section is demographic questionnaire that includes the respondent's demographic information such as gender, education, role and length of service, as well as the agile project information. The third section is about the organizational success factors. A 5-point Likert scale is introduced to measure the importance of each success factor. The fourth section is about the people success factors, and the factors are also measured using 5-point Likert scale. The fifth section is about the success Agile methodology. The Likert in sections three, four and five measures respondents level of agreement through scale ranging between, 1=Strongly Disagree and 5=Strongly Agree. Refer to Appendix A for Questionnaire.

Before distributing the survey questions to the target sample, a pilot survey conducted with three project managers to ensure the integrity, readability and validity of the survey questions before distribution. The questionnaire was distributed personally to seventy (70) selected employees that have already worked in IT projects either as Project Managers or as Project Team Members in software development area, with a minimum of 2 years of service in IT at the same organization (A). The survey period lasted 1 week, through which a total of fifty six (56) respondents responded to the survey.

Detailed descriptive analysis were performed, in addition to Reliability test, Correlation Analysis and Regression Analysis to explore the correlation and magnitude level of significance between the dependent and independent variables. Total of fifty six (56) respondents submitted the survey over a period of 7 days.

4.2 Descriptive Analysis

Total 56 respondents responded to the survey study in organization (A), out of 70 selected sample which represent **80%** of the sample size. The frequency of demographic data is presented in table 5:

Table 5: Demographic Frequency Table

Description	Category	Frequency	Percentage (%)
Gender	Male	42	75
	Female	14	25
Age	Less than 25	1	1.8
	25 – 35 Years	35	62.5
	36 – 46 Years	17	30.4
	47 – 57 Years	2	3.6
	58 or above	1	1.8
No. of Years in Service	2-7 Years	38	67.9
	8-13 Years	14	25
	14-19 Years	3	5.4
	20 years or above	1	1.8
Education	Diploma	3	5.4
	Bachelor Degree	39	69.6
	Masters or above	14	25.0
Role in Project Management	Project Manager	20	35.7
	Team member	36	64.3
Project management Methodology	Feature Driven (FDD)	1	1.8
	Agile SAP (ASAP)	26	46.4
	Traditional (Waterfall)	2	3.6
	Hybrid Model	12	21.4
	Not known	15	26.8

The demographic dataset in table 5, reveals that the majority of the respondents were male, with **75%** of the total sample. The age of majority of respondents are between 25 – 35 years, with **62.5%** of total sample, this figure is expected as IT projects is in need for young employees that have new skills and knowledge in the latest technology, and this figure also indicates that the IT in the organization (A) is in growing stage, attracting new graduates. This proposition is supported by the total years of service, the majority spent between 2-7 years in organization (A), **67.9%**. Most of the respondents hold bachelor degree and above, with higher percentage of bachelor degree **69.6%** and good percentage of Master's Degree holders **25%**, which indicates that the environment is having competent resources. Around **64.3%** of the sample are members in project team, and **35.7%** are project managers. The most popular

project management methodology employed in organization (A) is Agile SAP (ASAP) methodology, with a **46.4%**, followed by 'Not Known Methodology' with **26.8%**, and followed by Hybrid Model **21.4%**. The majority employed ASAP methodology based on their experience in implementing SAP ERP (Enterprise Resource Planning) system in various business divisions in the organization since year 2009.

4.3 Inferential Stats

Coefficient of Reliability

It is very essential to conduct Internal consistency Reliability (ICR) test to ensure full reliability and validity of the score of scale before we deeply enter in detail analysis. In our research study, we employ one of the most popular and well-known ICR test method that is called Cronbach's alpha, to estimate the internal consistency associated with scores for set of questions related to each variable. Cronbach's alpha measures how closely related a set of items are as a group. We test the reliability of scale against cut-off Cronbach alpha value of 0.6, Table 6. Any question that lead to alpha less than 0.6 will be eliminated from further analysis.

Table 6: Reliability Test

Dataset	Category	Questions	N	Cronbach's Alpha Coefficient	Data Analysis
1	User Satisfaction	USR.SAT.1, USR.SAT.2, USR.SAT.3, USR.SAT.4	56	0.61	Cronbach Alpha \geq 0.6, Reliable Score
2	User Collaboration	USR.COL.1, USR.COL.2, USR.COL.3, USR.COL.4	56	0.74	Cronbach Alpha \geq 0.6, Reliable Score
3	User Commitment	USR.COM.1, USR.COM.2, USR.COM.3, USR.COM.4	56	0.75	Cronbach Alpha \geq 0.6, Reliable Score
4	Decision Time	DEC.TIM.1, DEC.TIM.2, DEC.TIM.3, DEC.TIM.4	56	Result 1 (0.51) Result 2 (0.67)	The score of the scale is not reliable (0.51). We need to neglect question 4 (DEC.TIM.4). This question will be eliminated from further analysis. The new Cronbach's Alpha is: 0.67
5	Team Size	TEM.SIZ.1,	56	0.8	Cronbach Alpha \geq 0.6, Reliable

		TEM.SIZ.2, TEM.SIZ.3, TEM.SIZ.4			Score
6	Corporate Culture	COR.CUL.1, COR.CUL.2, COR.CUL.3, COR.CUL.4	56	0.83	Cronbach Alpha \geq 0.6, Reliable Score
7	Competency	COMP.1, COMP.2, COMP.3, COMP.4	56	0.64	Cronbach Alpha \geq 0.6, Reliable Score
8	Personal Characteristics	PRS.CHR.1, PRS.CHR.2, PRS.CHR.3, PRS.CHR.4	56	0.68	Cronbach Alpha \geq 0.6, Reliable Score
9	Training and Learning	TRN.LRN.1, TRN.LRN.2, TRN.LRN.3, TRN.LRN.4	56	0.77	Cronbach Alpha \geq 0.6, Reliable Score
10	Success in Adapting Agile Methodology	SUC.AM.1, SUC.AM.2, SUC.AM.3, SUC.AM.4	56	0.77	Cronbach Alpha \geq 0.6, Reliable Score

From the reliability test in table 6, we find that all scores are reliable in the dataset except for question (DEC.TIM.4), which will be eliminated from future analysis.

Correlation Analysis

We perform Bivariate Correlation analysis to describe the correlation between each independent variable and dependent variable in our construct. The correlation analysis can easily describe the strength, direction and coefficient of determination. We notice that N is 56 in all cases, which indicate that there is no missing data. We will explain the correlation for each variable considering the level of significance Alpha = 0.05, we also classify the strength of relationship, as small between 0.1 to 0.29; medium 0.3 to 0.49; and large 0.5 to 1.

Table 7: Correlations

		User Satisfac-tion	User Collaborati-on	User Commitment	Decisi-on Time	Tea-m Size	Corpora-te Culture	Competen-cy	Personal Characteri-stic	Trainin-g & Learnin-g	Success Agile Methodolo-gy
User Satisfac-tion	Pearson Correlati-on	1	.699**	.473**	.332 ⁺	.324 ⁺	.383**	.121	.203	.162	.310 ⁺
	Sig. (2-tailed)		.000	.000	.013	.015	.004	.375	.133	.234	.020
	N	56	56	56	56	56	56	56	56	56	56
User Collaborati-on	Pearson Correlati-on	.699**	1	.643**	.262	.468**	.516**	.325 ⁺	.249	.293 ⁺	.207
	Sig. (2-tailed)	.000		.000	.051	.000	.000	.015	.065	.029	.125
	N	56	56	56	56	56	56	56	56	56	56
User Commitment	Pearson Correlati-on	.473**	.643**	1	.146	.307 ⁺	.336 ⁺	.167	.204	.026	.018
	Sig. (2-tailed)	.000	.000		.285	.021	.011	.218	.132	.848	.893
	N	56	56	56	56	56	56	56	56	56	56
Decision Time	Pearson Correlati-on	.332 ⁺	.262	.146	1	.487**	.433**	.273 ⁺	.445**	.508**	.416**
	Sig. (2-tailed)	.013	.051	.285		.000	.001	.042	.001	.000	.001
	N	56	56	56	56	56	56	56	56	56	56
Team Size	Pearson Correlati-on	.324 ⁺	.468**	.307 ⁺	.487**	1	.552**	.515**	.562**	.448**	.536**
	Sig. (2-tailed)	.015	.000	.021	.000		.000	.000	.000	.001	.000
	N	56	56	56	56	56	56	56	56	56	56
Corporate Culture	Pearson Correlati-on	.383**	.516**	.336 ⁺	.433**	.552**	1	.524**	.392**	.246	.335 ⁺
	Sig. (2-tailed)	.004	.000	.011	.001	.000		.000	.003	.068	.012
	N	56	56	56	56	56	56	56	56	56	56
Competen-cy	Pearson Correlati-on	.121	.325 ⁺	.167	.273 ⁺	.515**	.524**	1	.581**	.424**	.307 ⁺
	Sig. (2-tailed)	.375	.015	.218	.042	.000	.000		.000	.001	.021
	N	56	56	56	56	56	56	56	56	56	56
Personal Characteri-stic	Pearson Correlati-on	.203	.249	.204	.445**	.562**	.392**	.581**	1	.613**	.461**
	Sig. (2-tailed)	.133	.065	.132	.001	.000	.003	.000		.000	.000
	N	56	56	56	56	56	56	56	56	56	56
Training & Learning	Pearson Correlati-on	.162	.293 ⁺	.026	.508**	.448**	.246	.424**	.613**	1	.560**
	Sig. (2-tailed)	.234	.029	.848	.000	.001	.068	.001	.000		.000
	N	56	56	56	56	56	56	56	56	56	56
Success Agile Methodolo-gy	Pearson Correlati-on	.310 ⁺	.207	.018	.416**	.536**	.335 ⁺	.307 ⁺	.461**	.560**	1
	Sig. (2-tailed)	.020	.125	.893	.001	.000	.012	.021	.000	.000	
	N	56	56	56	56	56	56	56	56	56	56

	N	56	56	56	56	56	56	56	56	56	56
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** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

HO1a: User Satisfaction

We capture subset of the correlation table above for analysis in table 8. The correlation between User Satisfaction and Success in Adapting Agile methodology is significant, Alpha = .02 which is less than alpha level 0.05, the R value is .310 which indicate medium positive correlation. Table 8.

Table 8: User Satisfaction Correlation Test Result

		User Satisfaction
Success in Adapting Agile Methodology	Pearson Correlation (r)	.310
	Sig (2-tailed)	.02
	N	56

Testing the hypothesis reveals that $p \leq 0.05$, therefore, we have enough evidence to accept the HO1a hypothesis and we reject the null hypothesis. Statistically there is significant correlation between User Satisfaction and Success in Adapting Agile methodology, the following hypothesis is true:

[HO1a: The greater the Satisfaction of users in projects, the more likely would be the Success in adapting Agile Project.](#)

HO1b: User Collaboration

The correlation between User Collaboration and Success in Adapting Agile methodology is not significant, Alpha = .125 which is higher than alpha level 0.05, table 9.

Table 9: User Collaboration Correlation Test Result

		User Collaboration
Success in Adapting Agile Methodology	Pearson Correlation (r)	.207
	Sig (2-tailed)	.125
	N	56

Testing the hypothesis reveals that $p \geq 0.05$, therefore, we failed to reject the null hypothesis. Statistically there is no significant correlation between User Collaboration and Success in Adapting Agile methodology, the following hypothesis is not true:

HO1b: The greater the Collaboration with users in projects, the more likely would be the Success in adapting Agile Project.

HO1c: User Commitment

The correlation between User Commitment and Success in Adapting Agile methodology is not significant, Alpha = .178 which is higher than alpha level 0.05, table 10.

Table 10: User Commitment Correlation Test Result

		User Commitment
Success in Adapting Agile Methodology	Pearson Correlation (r)	-.217
	Sig (2-tailed)	.178
	N	40

Testing the hypothesis reveals that $p \geq 0.05$, therefore, we failed to reject the null hypothesis. Statistically there is no significant correlation between User Commitment and Success in Adapting Agile methodology, the following hypothesis is not true:

HO1c: The greater the Commitment of the users in projects, the more likely would be the Success in adapting Agile Project.

HO2: Decision Time

The correlation between Decision Time and Success in Adapting Agile methodology is significant, Alpha = .001 which is less than alpha level 0.05, the R value is .416 which indicate medium positive correlation.

Table 11.

Table 11: Decision Time Correlation Test Result

		Decision Time
Success in Adapting	Pearson	.416

Agile Methodology	Correlation (r)	
	Sig (2-tailed)	.001
	N	56

Testing the hypothesis reveals that $p \leq 0.05$, therefore, we have enough evidence to accept the HO1a hypothesis and we reject the null hypothesis. Statistically there is significant correlation between Decision Time and Success in Adapting Agile methodology, the following hypothesis is true:

HO2: The Quicker the appropriate decisions are taken in a project; the more likely would be the Success in adapting Agile Project.

HO3: Team Size

The correlation between Team Size and Success in Adapting Agile methodology is significant, Alpha = .000 which is less than alpha level 0.05, the R value is .536 which indicate large positive correlation. Table 12.

Table 12: Team Size Correlation Test Result

		Team Size
Success in Adapting Agile Methodology	Pearson Correlation (r)	.536
	Sig (2-tailed)	.000
	N	56

Testing the hypothesis reveals that $p \leq 0.05$, therefore, we have enough evidence to accept the HO1a hypothesis and we reject the null hypothesis. Statistically there is significant correlation between Team Size and Success in Adapting Agile methodology, the following hypothesis is true:

HO3: The Smaller the Size of the teams in a project having appropriate skills included, the more likely would be the Success in adapting Agile Project.

HO4: Corporate Culture

The correlation between Corporate Culture and Success in Adapting Agile methodology is significant, Alpha = .012 which is less than alpha level 0.05, the R value is .335 which indicate medium positive correlation. Table 13.

Table 13: Corporate Culture Correlation Test Result

		Corporate Culture
Success in Adapting Agile Methodology	Pearson Correlation (r)	.335
	Sig (2-tailed)	.012
	N	56

Testing the hypothesis reveals that $p \leq 0.05$, therefore, we have enough evidence to accept the HO1a hypothesis and we reject the null hypothesis. Statistically there is significant correlation between Corporate Culture and Success in Adapting Agile methodology, the following hypothesis is true:

HO4: The Stronger the corporate culture exists in the organization, the more likely would be the Success in adapting Agile Project.

HP1: Competency

The correlation between User Satisfaction and Success in Adapting Agile methodology is significant, Alpha = .021 which is less than alpha level 0.05, the R value is .307 which indicate medium positive correlation. Table 14.

Table 14: Competency Correlation Test Result

		Competency
Success in Adapting Agile Methodology	Pearson Correlation (r)	.307
	Sig (2-tailed)	.021
	N	56

Testing the hypothesis reveals that $p \leq 0.05$, therefore, we have enough evidence to accept the HO1a hypothesis and we reject the null hypothesis. Statistically there is significant correlation between Competency and Success in Adapting Agile methodology, the following hypothesis is true:

HP1: The More Competent is the individual team members in a project, the more likely would be the Success in adapting Agile Project.

HP2: Personal Characteristics

The correlation between Personal Characteristics and Success in Adapting Agile methodology is significant, Alpha = .000 which is less than alpha level 0.05, the R value is .461 which indicate medium positive correlation. Table 15.

Table 15: Personal Characteristics Correlation Test Result

		Personal Characteristics
Success in Adapting Agile Methodology	Pearson Correlation (r)	.461
	Sig (2-tailed)	.000
	N	56

Testing the hypothesis reveals that $p \leq 0.05$, therefore, we have enough evidence to accept the HP2 hypothesis and we reject the null hypothesis. Statistically there is significant correlation between Personal Characteristics and Success in Adapting Agile methodology, the following hypothesis is true:

HP2: The Better the Personal traits and collaborative attitude of each team member in a Project, the more likely would be the Success in adapting Agile Project.

HP3: Training and Learning

The correlation between Training and Learning, and Success in Adapting Agile methodology is significant, Alpha = .000 which is less than alpha level 0.05, the R value is .56 which indicate large positive correlation. Table 17.

Table 15: Training and Learning Correlation Test Result

		Training and Learning
Success in Adapting Agile Methodology	Pearson Correlation (r)	.56
	Sig (2-tailed)	.000
	N	56

Testing the hypothesis reveals that $p \leq 0.05$, therefore, we have enough evidence to accept the HP3 hypothesis and we reject the null hypothesis. Statistically there is significant correlation between Training and Learning and Success in Adapting Agile methodology, the following hypothesis is true:

HP3: The better is the environment for learning and sharing knowledge, the more likely would be the success in adapting Agile Project.

From the above correlation analysis we come to a conclusion that the dependent variable 'Success in Adapting Agile Methodology' in organization (A) is significantly dependent on the variables Training and Learning (31.4%), Personal Characteristics (21.3%), Team Size (28.7%), Decision Time (17.31%), Competency (9.43%), User Satisfaction (9.61%), and Corporate Culture (11.2%), all in sequence. However, we reveal that the Success in Adapting Agile Methodology does not show any correlation with the independent variables User Collaboration and User Commitment.

Regression Analysis

The Multiple linear regression analysis is a model-based technique used to estimate the relationships among variables. More specifically, it helps to make quantitative predictions of one variable from the values of another. Regression gives insight how typical value of the dependent variable changes when any one of the independent variables is changed, while the other independent variables are held constant.

In the Model Summary, Table 17, we are interested in the values, R (Correlation Coefficient), R Square, and adjusted R Square.

Table 17: Model Summary for each individual variable

Independent Variables	R	R Square	Adjusted R Square	Std. Error of the Estimate
User Satisfaction	.310 ^a	.096	.079	.411

User Collaboration	.207 ^a	.043	.025	.423
User Commitment	.018 ^a	.000	-.018	.433
Decision Time	.416 ^a	.173	.158	.393
Team Size	.536 ^a	.287	.274	.365
Corporate Culture	.335 ^a	.112	.096	.408
Competency	.307 ^a	.094	.078	.412
Personal Characteristics	.461 ^a	.212	.198	.384
Training & Learning	.560 ^a	.314	.301	.358

In the following analysis we perform regression analysis for independent variables separately in order to present how much each independent variables could explain the variability of the dependent variable. The Coefficients table, Table 18, presents the relationship between the dependent and independent variables with coefficient. We are interested in the t statistics value, the significance level and Beta:

Table 18: Coefficient Table (Individual analysis of Independent vs Dependent Variables)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Average User Satisfaction	.267	.111	.310	2.397	.020
Average User Collaboration	.159	.102	.207	1.557	.125
Average User Commitment	.015	.111	.018	.135	.893
Average Decision Time	.335	.100	.416	3.366	.001
Average Team Size	.453	.097	.536	4.666	.000
Average Corporate Culture	.269	.103	.335	2.609	.012
Average Competency	.363	.153	.307	2.372	.021
Average Personal Characteristics	.446	.117	.461	3.815	.000
Average Training & Learning	.546	.110	.560	4.969	.000

We notice from the coefficients table that all the independent variables are significant, except for two independent variables which are not significant, User Collaboration and User commitment, as per the following, table 19:

Table 19: Regression Analysis Finding

Independent Variable	Beta (B) (unstandardized)	t Stats	Sig (p)	Discussion	Result
User Satisfaction	.267	2.397	.020	The significance level $p=.020$ less than $.05$, with positive coefficient value $B=.267$.	It has predictability on dependent variable and we reject null hypothesis
User Collaboration	.159	1.557	.125	The significance level $p=.125$ more than $.05$, with negative coefficient value $B=-.159$	Failed to reject null hypothesis
User Commitment	.015	.135	.893	The significance level $p=.893$ more than $.05$, with positive coefficient value $B=0.015$	Failed to reject null hypothesis
Decision Time	.335	3.366	.001	The significance level $p=.001$ is less than $.05$, with positive coefficient value $B=.335$	It has predictability on dependent variable and we reject null hypothesis
Team Size	.453	4.666	.000	The significance level $p=.000$ less than $.05$, with positive coefficient value $B=.453$	It has predictability on dependent variable and we reject null hypothesis
Corporate Culture	.269	2.609	.012	The significance level $p=.012$ less than $.05$, with positive coefficient value $B=.269$	It has predictability on dependent variable and we reject null hypothesis
Competency	.363	2.372	.021	The significance level $p=.021$ less than $.05$, with positive coefficient value $B=.363$	It has predictability on dependent variable and we reject null hypothesis

Personal Characteristics	.446	3.815	.000	The significance level $p=.000$ less than $.05$, with positive coefficient value $B=.446$	It has predictability on dependent variable and we reject null hypothesis
Training and Learning	.546	4.969	.000	The significance level $p=.009$ less than $.05$, with positive coefficient value $B=.546$.	It has predictability on dependent variable and we reject null hypothesis

From the table above we come to a conclusion that (**User Satisfaction, Decision Time, Team Size, Corporate Culture, Competency, Personal Characteristics, Training and Learning**) are all having significant impact and have proven to be leading the ‘Success in Adapting Agile methodology’.

We can also interpret the sensitivity of dependent variables to changes in independent variables by using Beta (Standardized Coefficients). One unit increase in User Satisfaction, yield to increase the ‘Successful Adaption of Agile Methodology’ by **.310**, the same with Decision Time, one unit increase in Decision Time yield to increase in the ‘Successful Adaption of Agile Methodology’ by **.416**, as per table 20 below:

Table 20: Standardized Coefficients

Independent Variable	Standardized Coefficients
Training and Learning	.560
Team Size	.536
Personal Characteristics	.461
Decision Time	.416
Corporate Culture	.335
User Satisfaction	.310
Competency	.307

On the other hand, we conclude from the regression analysis that the independent variables User Collaboration and User Commitment do not affect the Success in Adapting Agile Methodology in organization (A).

In addition to above, we also consider the Coefficient of Determination in order to give an idea of how much variance all variables share, Table 21:

Table 21: Coefficient of Determination ($R^2 \times 100$)

Independent Variable	Coefficient of Determination ($R^2 \times 100$)
Training and Learning	31.4%
Team Size	28.7%
Personal Characteristics	21.2%
Decision Time	17.3%
Corporate Culture	11.2%
User Satisfaction	9.6%
Competency	9.4%

Discussion

Total of 56 out of 70 selected sample responded to the survey questions in organization (A). From the descriptive analysis we find that the project managers do not follow a single project management methodology in the organization, each project manager has his own project management methodology to manage projects. This is clearly presented in the statistics, 46.4% follows ASAP, 21.4% follows hybrid models –undefined model, 26.8% did not know which project management methodology they follow, 3.8% follows the traditional (waterfall) methodology, and very few uses Feature Driven Development (FDD) 1.8%. In the inferential analysis we deployed Cronbach's alpha to test the reliability of the scale, as a result we neglected one question (DEC.TIM.4) in order to keep the Cronbach's Alpha coefficient higher than or equal 0.6.

The correlation analysis reveals that the coefficient of the following hypothesis is significant (HO1a: User Satisfaction, HO2: Decision Time; HO3: Team Size; HO4: Corporate Culture; HP1: Competency; HP2: Personal Characteristics; HP3: Training and Learning), therefore the mentioned hypothesis have enough evidence to be acceptable and there is significant correlation between the independent variables and the Success in Adapting Agile Methodology. We also add that the correlation is positive and varies between medium to large positive correlation (Large Positive Correlation: HO3, HP3) (Medium Positive correlation: HO1a, HO2, HO4, HP1, HP2). In table 21, the coefficient of determination gives us an estimate of the influence of the independent variables over the Success in Adapting Agile methodology as follow: Training and Learning (31.4%), Team Size (28.7%), Personal Characteristics (21.3%), Decision

Time (17.3%), Corporate Culture (11.2%), User Satisfaction (9.6%), and Competency (9.4%). all in sequence. However, we reveal that the Success in Adapting Agile Methodology does not show any correlation with the independent variables User Collaboration and User Commitment in the context of our research.

The results of regression analysis have completely come inline and supported the correlation analysis. The multiple linear regression analysis reveals that the independent variables (HO1a: User Satisfaction, HO2: Decision Time; HO3: Team Size; HO4: Corporate Culture; HP1: Competency; HP2: Personal Characteristics; HP3: Training and Learning) are all significant and have proven to be leading the Success in Adapting Agile methodology. The level of regression and sequence of influence of each independent variable is about to be similar to the correlation result, in sequence as per Table 20: Training and Learning (0.560), Team Size (0.536), Personal Characteristics (0.461), Decision Time (0.416), Corporate Culture (0.335), User Satisfaction (0.310), and Competency (0.307). On the other hand, we conclude from the regression analysis that the independent variables User Collaboration and User Commitment do not affect the Success in Adapting Agile Methodology in organization (A).

Chapter 5: Research Conclusion

5.1 Conclusion

In this research study, we have visited varies literatures and conducted empirical quantitative study to explore the influence of selected key elements over the success in adapting agile methodology in public utility organizations. The empirical study focused on two key elements and their influence over the IT projects in a public utility organization in the emirates of Dubai, the key elements are Organizational Factors and People factors. The goal was to identify the success factors, and then empower the success factors that have positive influence and reduce the focus on the factors that have less or no impact over the success in adapting agile methodology. We conclude our study with the following findings:

Training and Learning: Respondents in organization (A) gave high rating to learning and knowledge sharing (HP3). This factor was considered highly important factor to succeed the adaption of agile implementation. The same findings were supported by Moreira (2013), and the findings are fully complying with the research questions and the empirical study conducted by Misra, Kumar and Kumar (2009), who claim that informal training such as tacit knowledge sharing between peers, mentoring and

professionally guided discussion are more useful than formal training. Therefore, the following hypothesis is true:

HP3: The better is the environment for learning and sharing knowledge, the more likely would be the success in adapting Agile Project.

Team Size: In organization (A), project managers and team members prefer to work in small teams to insure proper communication among team members. This was proven via the correlation and regression analysis of the survey result. This is complying with findings of several researches that assume the Agile team size should not exceed seven, plus or minus two members, that is to ensure a proper manageability of team and smooth communication among peers. (Mistra, Kumar & Kumar 2009) (Cockburn & Highsmith 2001). As explained by Basili et al. (2002), any team could be agile regardless of the time size, but as the team size increases the communication and collaboration becomes harder, with small teams the collaboration is easier which lead to successful results. Therefore, the following hypothesis is true:

HO3: The Smaller the Size of the teams in a project having appropriate skills included, the more likely would be the Success in adapting Agile Project.

Personal Characteristics: There is an ongoing debate between practitioners and researchers about whether or not agile requires 'good people' to be effective. However, the findings from the inferential analysis in organization (A) supports the researchers who suggest that agile practice could be attributed to the team of good people. As claimed by Misra, Kumar and Kumar (2009), the members in agile project should have personal characteristics that bridge the gap between members and make them work in harmony, such as sense of responsibility, collaborative attitude, honesty, readiness to learn and work with others. The same is emphasized by Jepsen (2002). Therefore the following hypothesis is true:

HP2: The Better the Personal traits and collaborative attitude of each team member in a Project, the more likely would be the Success in adapting Agile Project.

Decision Time: The empirical analysis in organization (A) supports fast decision making process. Fast decision-making is obviously an enabler of agility, the agile practice is designed to take quick decisions within a short period. The same is supported by various literatures (Misra, Kumar & Kumar 2009) (Cao et al. 2013) (Moreira 2013). Therefore the following hypothesis is true:

HO2: The Quicker the appropriate decisions are taken in a project; the more likely would be the Success in adapting Agile Project.

Corporate Culture: We cannot detach the agile project management from the corporate culture, if the corporate culture supports and encourage agile practice then it succeed at all levels with different projects. The empirical findings fully comply with research findings that success adaption of Agile practice requires corporate culture support, sponsor commitment, and achieve the high management buy in. (Basili et al. 2002) (Cao et al. 2013). Therefore the following hypothesis is true:

HO4: The Stronger the corporate culture exists in the organization, the more likely would be the Success in adapting Agile Project.

User Satisfaction: The user satisfaction is highly associated with the success of project, the delivery of software on time with agreed scope and quality leads to high user satisfaction. The Agile project management has very high emphasis on user satisfaction by engaging users throughout the stage of project implementation and follow an iterative method of plan-do-check-act to ensure that the project is always in line with user need. (Cao et al. 2013) (Hoda, Marshal & Noble 2008). The findings in the inferential analysis demonstrate the importance of keeping the users satisfied, which lead to acceptance of the outcome of the agile projects. Therefore, the following hypothesis is true:

HO1a: The greater the Satisfaction of users in projects, the more likely would be the Success in adapting Agile Project.

Competency: Competence according to the literatures refers to individuals past experience, technology domain and possession of good interpersonal and communication skills (Moreira 2013), and it is also the ability of the team to accomplish the work with minimum dependency on others outside the team. The findings in Competency factor correlates directly with success in Adapting Agile project management.

In the priority of coefficients it is less because the team has already has competence, 69% are holding bachelor degree in IT or related specialization, and 25% are holders of Master's degree and above.

Therefore, the following hypothesis is true:

HP1: The More Competent is the individual team members in a project, the more likely would be the Success in adapting Agile Project.

User Collaboration and User Commitment: The empirical study did not prove the significant relationship between End User Collaboration, and Commitment with the success in Adapting Agile methodology. Participants in the survey felt that end user collaboration and their commitment is not necessary to success the agile projects, this could be valid due to one of the following reasons:

- a) **Possibility 1:** Business team initiate their requirements very clearly in a way that IT do not require to contact business users again and again till the completion of the product of project.
- b) **Possibility 2:** IT initiates the projects without engaging business based on IT understanding of business requirements. Afterword, IT enforces solutions to business.
- c) **Possibility 3:** Business users initiate their requirements, then do not follow up the requirements with IT teams, and do not take the subject seriously especially in the stage of testing.
- d) **Possibility 4:** Most of the projects are not related directly to business users, those projects are more related to the backend infrastructure development that does not require direct user involvement, such as linking backend systems together, develop apps to monitor servers, etc.

From the empirical study we failed to reject null hypothesis, therefore, the following hypothesis are not true in organization (A):

HO1b: The greater the Collaboration with users in projects, the more likely would be the Success in adapting Agile Project.

HO1c: The greater the Commitment of the users in projects, the more likely would be the Success in adapting Agile Project.

5.2 Limitation and Future Recommendation

This study only explores selected key determinants of successful adaption of agile methodology, such as Organizational Factors (End User Satisfaction; User Collaboration; User Commitment; Decision Time; Team Size; Corporate Culture), and People factors (Competency; Personal Characters; Training and Learning), there might be other explicit and implicit facets that affect agile level of adaption, such as Communication and Negotiation, Societal Culture, Team Distribution, and other factors that influence the agile adaption in any organization. The second limitation is the sample size, 56 respondents in this study, it is recommended to increase the sample size with more than 56 respondents in order to simulate the actual influence and generalize findings into higher level. This research is based on survey

study, which by itself has limitation, the findings may not be applicable for all environments, it varies from person to person, project to project based on project type, size, domain and organizational situation. Some independent variables used in this research that are highly subjective, such as Corporate Culture. The definition itself has wide meaning however we limited ourselves in this research to the Corporate Cultural that influences the adaption of agile methodology. The study focused only on one industry, specifically on single utility organization.

Additional future research could be necessary to generalize the findings, and identify a particular common patterns or trends, by applying the same empirical study on other public utility organizations. It would also be beneficial to generalize the findings and deeply investigate the behavior by applying the same quantitative investigation on larger sample size within the same organization, in order to generalize the findings within the same firm. Future researches might be to address the best practices in deploying agile methodology, in IT division at public and private organizations. Another interesting subject for future researches is to explore the success factors for transitioning organizations from traditional (waterfall) project management methodology to agile, especially in the context of large organizations with multi-site development where enormous cultural change may be required. Researchers might also be interested in exploring the feasibility of using agile methodology in industries other than IT, such as security surveillance projects, marketing, sales, and finance projects.

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Appendix A

Questionnaire

Dear Sir/Madam,

My name is Adel Al Tamimi, I am master's student studying Project Management at the British University in Dubai (BUid). I am doing a research study about various success factors in adapting Agile Methodology at public organizations. I would like to offer you this questionnaire, which gives you the opportunity to express your views on a wide range of issues related to project management methodology. Please note that there is no right or wrong answer.

The questionnaire will be used to collect the primary data needed for a research study. Therefore, we seek your assistance to be as open, faire, honest as possible as you can in your responses.

The researcher assures you that no individuals will be identified from their responses and there are no requests for confidential information included in the questionnaire. The results of the analysis will be strictly used by the researchers for study purposes **only**.

The questionnaire comprises three parts:

1. General Information
2. Organizational Factors
3. People Factors
4. Success in Adapting Agile Methodology

Thank you,

Adel Al Tamimi

Part Two: General Information

(Please tick one box for each question. You are requested to consider single project in your answer)

A. Sex

- Male
- Female

B. Education:

- Less than high school
- High school
- Diploma
- Bachelor Degree
- Masters or above

C. Age:

- Less than 25
- 25 - 35
- 36 - 46
- 47 - 57
- 58 or above

D. No. of years working in current organization:

- One year or less
- 2 - 7 years
- 8 - 13 years
- 14 – 19 years
- 20 years or above

E. Your role in software development projects *:

- Project Manager
- Project Team Member

F. Which project management methodology are you currently using in software development *:

- SCRUM Methodology
- eXtreme Programming (XP) Methodology
- Feature Driven Development (FDD) Methodology
- Agile SAP (ASAP) Methodology
- Traditional (Waterfall PMI/PRINCE2) Methodology
- Hybrid Methodology (mix of the above)

() Not known to me

Part Three: Organizational Factors*(Please tick one box for each question. You are requested to consider single project in your answer)***User Satisfaction**

Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
In our projects, we give very high priority to achieving customer satisfaction					
We welcome changing requirements even up to the last moment of the final development					
Users accept the delivered software immediately after the first successful User Acceptance Test (UAT)					
We always meet user expectation in terms of time, scope and quality					

User Collaboration

Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
In our projects, customers closely collaborate with the development team members					
Users are actively involved and contribute throughout all the stages of the project					
We emphasize more on face-to-face communication for conveying information to and within the development team					
We promote sustainable development. Our sponsors, developers, and users maintain a collaborative active involvement indefinitely					

User Commitment:

Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
In our software development projects, users are committed to the success of the project					
Users consider themselves responsible for making the project a success					
Users are committed to test and provide the UAT on the final outcome on time					

Users are attending the milestone/review sessions and actively participate in discussions					
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Decision Time:

Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
We aim to make important project decisions on the spot in order to meet the deadline					
Our development teams are self-organizing, our teams can (re)-organize continuously in different group combinations to adapt with the changing requirements and face newly arising challenges of the business leading to success					
We are authorized to take fast decisions to overcome project problem in order to efficiently meet deadlines					
Quick response from business users help in meeting the deadline					

Team Size:

Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
We work in small teams (no more than 10-15 members) in our projects					
The communication among team members is fast , efficient and effective					
The work in small teams, allocated in one place encourages the informal communication between peers, whereas working in large teams increase the formal communication					
In large projects, we break the workforce in teams and sub-teams					

Corporate Culture:

Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Our organization encourages rapid communication					
Our organization has the culture of having faith on the staff					

Our management has the culture for supporting the decisions of the developers					
Our organization encourages fast feedback from users/customers					

Part Four: People Factors

(Please tick one box for each question. You are requested to consider single project in your answer)

Competency:

Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Our team generally consists of experienced project management and skilled technical personnel					
Team members are able to accomplish the project with minimum dependency on personnel from outside the team					
The competence of the team significantly influence the project delivery in terms of time and quality.					
In our projects we always select fewer and better people for executing projects					

Personal characteristics:

Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
The majority of our team members have strong <i>interpersonal and communication skills</i>					
The majority of the members of our team consists of people who are honest and dedicated					
The majority of the members of our team are of high collaborative attitude					
The majority of members of our team have a sense of responsibility coherent to their character					

Training and Learning:

Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Our team members are in general always willing to continuously learn from one another and train team mates through mentoring and professionally guided discussions bypassing costly formal training					
The majority of the members of our team consists of					

people who are always ready to learn					
Our team members are learning through mentoring, knowledge sharing between peers					
Working teams consist of a combination of project management experienced and technical experienced personnel					

Part Five: Success in Adapting Agile Project Management

(Please tick one box for each question. You are requested to consider single project in your answer)

Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
The delivered software meet the proposed implementation timelines					
The product of the project complies with user expectations in terms of quality and scope					
Project objectives are achieved within the allocated budget					
Effectiveness of handling technical issues and risks in all stages, including design, development, testing and rollout					