



**The Impact of Agile Project Management on the Effective Delivery of Innovative  
Products**

أثر إدارة المشاريع المرنة على التطوير الفعال للمنتجات المبتكرة

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## Abstract

In the recent years organization are focusing on delivering innovative products to gain a competitive advantage in the market with the other organizations, therefore some organizations are shifting from traditional project management to agile project management. Agile project management emerged from the need of having a flexible development method that enables the organization to develop innovative products that satisfy the customers and return value to the organization, as opposed to traditional methods that consist of steps that could pose an obstacle in case a change emerged. This research paper focuses on the relationship between the use of agile project management and product innovation, through the examined case studies and questionnaire finding innovation can be achieved by using agile management with the support of users engagement in the development process and also with the association of skilled team members and effective management and with using advanced tools. In order to support agile principles several recommendation were presented that could be adopted by organizations to be innovative and achieve high user satisfaction.

## ملخص

تركز معظم المؤسسات جهودها على انتاج منتجات مبتكرة تساعدهم على اكتساب فرصة للتنافس في السوق مع المؤسسات الأخرى، لذا قامت بعض المؤسسات بتغيير طريقتها في ادارة المشاريع من الطريقة التقليدية الى الطريقة المرنة أو التي يطلق عليها بأجايل، والتي تمكنهم من تطوير منتجات مبتكرة تحقق رضا العملاء وتعود بالنفع على المؤسسة، خلافاً للطريقة التقليدية التي تتألف من عدة خطوات قد تشكل عائق في حال حدوث تغيير طارئ في المتطلبات. يركز هذا البحث على دراسة العلاقة بين استخدام طريقة الأجايل في ادارة المشاريع وبين القدرة على الابتكار للتأكد من أن نتائج استخدام هذه الطريقة تنتج قطعاً ابتكارات. من خلال عمل حالات دراسية لثلاثة مشاريع ومن خلال الاستبيان الذي تم توزيعه بينت النتائج أن من الممكن تحقيق الابتكار باستخدام طريقة الأجايل من خلال دمج المستخدمين في عملية تطوير المنتجات وبالتعاون مع ادارة فعالة وأعضاء فريق ماهرين، وأيضاً باستخدام تقنيات متطورة. تم تقديم عدة اقتراحات لتبنيها من قبل المؤسسات لدعم مبادئ الأجايل ودعم المؤسسات لتقديم الابتكارات وتحقيق نسب عالية في رضا المستخدمين.

## **Chapter 1**

### **1. Introduction**

#### **1.1 Research Background**

In the recent years the product development industry is witnessing changes in a fast paced rhythm putting organizations in a constant struggle to adjust, product life cycle has shrunk and the duration of the marketing time for new products has dropped leaving organizations a very short period to come up with innovative products that will fulfill customers needs and maintain profits flowing. But delivering innovative products and services is not an easy task it requires a mindset that strive for success and open minded to new ideas and able to maintain continuous innovation that meets today's requirements and challenges, to do so most organizations are seeking towards adopting new methods that provide them the opportunity to cope with the changes, one of these methods is agile management. Agile project management methods offers flexibility in managing projects which is not offered in traditional methods, it offers the chance of continuous improvement throughout the project life cycle and in return innovations are presented and higher customer satisfaction is achieved.

Agile project management was originally developed by practitioners to face the economical changes that needs constant adjusting by developing practices that allow adding continuous improvements, changing requirements and targets (Turk, France & Rumpe 2005). The number of organizations who are adopting agile methods is increasing, due to their recognition of the benefits gained from it, but not all organizations can apply agile management as there are some certain factors that determines the ability of the organization to adopt agile management, these factors will be discussed in the literature review section.

Several methods were developed underneath agile project management such as Extreme Programming (XP), Scrum, Crystal methods, Dynamic System Development Method, Feature Driven, and Adaptive Software Development (Augustine et al. 2005). These methods share same characteristics and purposes of agile project management such as rapid adaptability to changes, achieving higher customer satisfaction, delivering innovative products, and bringing value to the organization, but they have different implementation practices. Using agile methods requires analyzing the situation to determine the applicability of the method on the situation (Turk, France & Rumpe 2005).

Even though the use of agile methods is spreading, there are still some organizations who are still using traditional methods in product development, because it's facing some resistance from their practitioners for various reasons such as incomplete knowledge of agile management, which poses a challenge to transit to agile methodologies (Chan & Thong 2009). In order for the organization to prosper and be innovative it is essential for them to transfer from traditional methods to agile methodologies, therefore having a strategy that guides the organization in adopting agile methodologies by customizing it to achieve its organizational goals is necessary.

## **1.2 Aims, Objectives and Scope of the Research**

This research aims to explore the current knowledge of agile project management by presenting an extensive literature review to identify the agile project management methods and practices that enable organization to present innovations. The exploration expands to combine a comparison between the traditional project management and agile project management in terms of concepts, management style, and culture. The following points summarize the research objectives:

- Critically review the concept of agile project management and its benefits.
- Compare and contrast between agile project management and traditional project management.
- Review the current agile methods in terms of definitions and processes.
- Investigate the impact of agile project management on the effective delivery of innovative products.
- Examine the main challenges and barriers for the adoption of agile project management.

## **1.3 Research Question**

The government of Dubai has announced that the year 2015 is the year of innovation in the UAE, his Highness Sheikh Mohammed bin Rashid Al Maktoum ruler of Dubai has declared that one of the strategic decisions of the initiative is to turn Dubai into a smart city and make it globally recognized in the innovation arena. The benefits gained from innovation have a significant impact on the government investments and revenues, it plays a central role in the economic growth and success of the country, therefore, the initiative has driven organizations both in the public and the private sector to a fierce competition to be innovative.

And since the number of literatures examining the relationship between adopting agile project management and the organization's ability to deliver innovative products is limited, this research is focused on finding an answer for the following question "Does agile project management enables organizations to deliver innovative products?".

#### **1.4 Research Structure**

The research paper consists of five chapters described below:

##### **Chapter 1:**

Introduces agile project management history and how it emerged, with the existing agile methods, it also explains the research aims, objectives and the research question.

##### **Chapter 2:**

Presents an extensive literature review of agile project management, it covers agile project management definition and characteristics, a comparison between the agile methods and the traditional methods, a review of the existing agile methods and strategies, the impact of agility on product innovation, and the challenges and barriers of agile management adoption.

##### **Chapter 3:**

Describes the research methodology, including the research instrument and the tools used to collect and analyze the data.

##### **Chapter 4:**

Examines the agile projects that were selected for the case studies, and presents the survey findings with a critical analysis and discussion of the findings.

##### **Chapter 5:**

Presents recommendations for the presented studied cases and a conclusion of the research with the final results and future research topics.

## Chapter 2

### 2. Literature Review

#### 2.1 The Beginning of Agile Project Management

Dealing with the increasing competitive environment between organizations have put project managers in a constant challenge and struggle to adjust with the changes (Augustine et al. 2005), the markets demands are changing constantly especially the technology market due to the changes of consumers demands (Highsmith 2004). These continues changes in the market has dropped the marketing time for new products in the market significantly, Highsmith (2004) has mentioned that in the 1990s the marketing time for new products in the US has dropped from 35.5 to 11 months making it difficult for organizations whose following traditional methods to produce new products in a short period of time since consumers are expecting new innovative products that are better than the previous ones in terms of quality, thus, it forced organization to find new methods that help them to adapt. Many different product development methods were introduced in the last 25 years but very few of them are still used today (Abrahamsson et al. 2002), before the rise of agile methodologies, practitioners used traditional plan driven methods for product development, it included documentation of the system requirement and followed by system design development (Lindvall et al. 2002). Examples of plan driven methods are Personal Software Process (PSP), Team Software Process (TSP), and Rational Unified Process (RUP) Lindvall et al. (2002) have pointed out that the initial steps of the plan driven methods such as documentation, design development and architecture might be an obstacle when the environment starts changing in a fast rate. These steps require time and most importantly they require customers' needs to be stated in advance, but that would not be possible since technology advances in a fast manner leaving customers unable to define their needs in advance. Thus, an iterative and incremental method was needed to adapt to the changes, as a result the agile methodologies emerged.

The agile methodology was developed under the pressure to gain competitive advantage by presenting high level products that achieve customers satisfaction through an iterative process that allow a continues adjusting to sudden changes(Turk, France & Rumpe 2005). The agile methodology gives the organization an incredible opportunity to compete as it provides a flexible and a quick development process for products that are close to the end of lifecycle (Highsmith 2004). It seems that the flexibility offered by the agile management has contributed to its wide use



in the product development industry, the various agile development methods gave the product industry the opportunity to determine the use of agile or traditional method or a hybrid method based on project characteristics.

## **2.2 Agile Definition and Characteristics**

To have a better understanding of the agile methodology several literatures were reviewed to find an accurate definition, Highsmith (2004) has defined agility as the ability to balance between stability and flexibility, while Lindvall et al. (2002) has defined agility as an iterative and incremental process that allows the project team to organize itself in a way that best suits the work with the ability to emerge requirements through the development of product lifecycle. On the other hand Chin (2004) definition share some similarities with Lindvall et al. definition which is a repeatable method to deliver a flexible project management process. So to conclude the previous definitions in another term, agile project management is a flexible and iterative management process that enables the project team to be ready for motion for emergent requirements throughout the project cycle.

Several agile methodologies were developed share same characteristics, these characteristics were developed by seventeen practitioners who had gathered to form an alliance called the Agile Software Development Alliance (Scott Ambler and Associates n.d.), all of them were from various background and were able to agree on the characteristics and combined them into four essential values called Agile Software Manifesto (Surendra 2009).

The manifesto's first value is "individuals and interactions over processes and tools" which highlights the importance of collaboration between the stakeholders and the software developers and working effectively together as a team over the importance of software development process and tools, because even if the best processes and tools are employed they won't be any use of it if the people involved are not working together effectively. The second value is "working software over comprehensive documentation", it indicates that the primary goal is to deliver value to customers instead of focusing efforts on extensive documentation that will probably be outdated on later stages as the system advances, in this case the documentation should be on what is seen necessary by the project team (Surendra 2009; Fowler & Highsmith 2001). The third one is "customer collaboration over contract negotiation", it highlights the importance of communicating with the customers since the products is aimed to them, it is necessary to understand their needs

instead of viewing them as adversaries (Surendra 2009; Scott Ambler and Associates n.d.), but that does not eliminate the necessity of having a contract, both parties should maintain a good relationship during the negotiation to achieve delivering the business value (Abrahamsson et al. 2002). The last value is “responding to change over following a plan”, the ability to respond to changes and adapt to them is critical, as the business environment is constantly changing the requirements also change, thus, reflecting these changes on the project plan is important otherwise the plan is outdated and will not meet the new requirements (Surendra 2009; Scott Ambler and Associates n.d.).

### 2.3 The Agile Management Principles

The seventeen practitioners had defined twelve principles for agile project management that were formulated from the four values mentioned earlier, the purpose of these principles is to form a foundation for the agile development (Scott Ambler and Associates n.d.). The twelve principles cited from Fowler & Highsmith (2001) are presented below:

1. **“Our highest priority is to satisfy the customer through early and continuous delivery of valuable software”**, the primary focus of this principle is to deliver value to customers instead of focusing on documentation and planning, documentation is important, but customers only interest lies in receiving a working software that satisfy their needs (Scott Ambler and Associates n.d.).
2. **“Welcome changing requirements, even late in developments. Agile processes harness change for the customer’s competitive advantage”**, the need to accept changes is the essence of agile methodologies, the business environment is changing unpredictably and instead of resisting change it can be viewed as an opportunity to deliver continuous enhancements.
3. **“Deliver working software frequently, from a couple of weeks to a couple of months, with the preference for the shorter time scale”**, delivering frequent software for customers insures that customers receive value immediately, it also allows the product developers to receive feedbacks from the product stakeholders, these feedbacks can be used to guide the developers for continuous enhancement for the product (Scott Ambler and Associates n.d.).

4. **“Business people and developers must work together daily throughout the project”**, keeping all the stakeholders and the project team involved in every stage of the project is essential to provide the necessary requirements, as the main purpose of the agile method is to involve all the concerned parties in the development process to achieve the expectation of customers, because customers usually have high expectations of the product and they cannot be fulfilled unless there is frequent communication between the developers and the stakeholders (Fowler & Highsmith 2001; Ondiek 2015).
5. **“Build project around motivated individuals, give them the environment and support they need, and trust them to get the job done”**. This principle emphasize on the importance of the cultural aspect of the project team, the team relationship should be governed by trust as it enables them to work collaboratively and in harmony, relying solely on tools or agile process is not sufficient, the people factor determine the success or failure of the project (Fowler & Highsmith 2001; Ondiek 2015).
6. **“The most efficient and effective method of conveying information to and within a development team is face-to-face conversation”**. Direct communication is very important between the project team such as face to face, as it enables people to express their thoughts and knowledge without barriers, direct communication prevents misunderstanding that could occur using other methods like writing, it’s also a sufficient way to make sure they understand what is required (Fowler & Highsmith 2001; Ondiek 2015).
7. **“Working software is the primary measure of progress”**. Delivering a working software is the project team target, so they must test the software before the delivery in sufficient time, it will provide the team the required time to solve any unexpected problem that will appear, thus, the iterative method provides an opportunity to check project progress and avoid risks (Fowler & Highsmith 2001).
8. **“Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely”**. Product development industry is known for its long working hours, people usually spend long continuous hours and sometimes days working on developing and correcting software errors, this act affects the quality level of their work, it prevents them from being creative and decreases the productivity level because of their lack of energy. Agility provides the opportunity for

sustainable development where the workers can have time and rest (Fowler & Highsmith 2001).

9. **“Continuous attention to technical excellence and good design enhances agility”**, agility focuses on bringing quality softwares, designs can be adjusted throughout the project cycle whenever needed to ensure high quality product is delivered (Fowler & Highsmith 2001).
10. **“Simplicity – the art of maximizing the amount of work not done – is essential”**, agile methods prefers simplicity in development approaches, it simplifies the amendments in later stages or changing specifications.
11. **“The best architectures, requirements and designs emerge from self-organizing teams”**, this principle highlights that the best results can be achieved by two things which are iterative process instead of planning and the interaction between teams.
12. **“At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly”**, agile methods cannot be used in every situation, so the team must adjust the process according to the project requirements (Fowler & Highsmith 2001).

The agile manifesto forms a solid foundation for agile project management, each one of the agile methodologies support these principals by different practices but at the end they all aim to one target. What makes agile management significant is that it emphasizes the importance of involving people in the development process, it strengthens the role played by the users in the development process. Developers and users can collaborate in defining the product functionalities and specifications throughout the project cycle by working as a team, in return the success of the product is assured (Chan &Thong 2009). Agile project management focuses on simplicity and speed by using light methods that is oriented to human communication, it aims to fast delivery of the required functionalities to get the necessary feedback from stakeholders, based on it the development team react and make the necessary adjustments to meet their expectations(Cockburn 2002).

Scott Ambler and Associates (n.d.) has mentioned several principals emerging from the agile methodologies which are as follows, people oriented, minimizing documentation as possible and limiting it to what is important, communication is important with all who are involved in the

project, the use of models is not useful as it was before, and presenting initial designs at the beginning is not required. To conclude, agile project management uses incremental methods in delivering products to simplify the procedures and to provide the required in a fast manner and receive the feedback for enhancements, it is governed by team work and collaboration with effective communication between all who are involved in the project.

#### **2.4 Agile Project Management vs Traditional Project Management**

It's been claimed that agile methodologies overcome the limitation of traditional methods, as mentioned previously agile methods emphasizes people, communication, speed and simplicity (Chan & Thong 2009). Agile project management views change as an advantage and should be managed instead of avoiding it or considering it as a threat (Karlesky & Voord 2008), agile management aims towards achieving customers satisfaction and its naturally for customers to have frequent changes in requirements, therefore developers reflect these changes during the development process through iterative process (Hoda, Noble & Marshall 2008).

Conversely, traditional or plan- driven methods attempt to prevent change as much as possible by planning and documenting in advance, traditional methods follows a waterfall approach where it begins with planning, designing, and implementation, if any change occurred during these phases it is considered as a threat to the development process (Karlesky & Voord 2008). Traditional methods developers believe that customer requirements does not change and remain the same throughout the project, therefore, it does not leave space for changing scope to reflect these requirements in the development process (Hoda, Noble & Marshall 2008).

There are several other differences between agile methods and traditional methods that were highlighted by Highsmith in 2002 (cited in Chan & Thong 2009). The first difference is that in traditional methods developers tend to build the system based on detailed specification concluded from their perception of what the customers want, as they believe that the customers are not aware of what they require, also the developers usually build the system with additional functionalities to face the unanticipated future requirements of customers, which often becomes useless. Karlesky & Voord (2008) stated that a high percentage of traditional projects fails due to not meeting the specified requirements on time and often end up with cost overrun. But with agile methods both the developers and the customers are not fully aware of the requirements but they work together and discover it throughout the development phases. Second is that agile methods and traditional

methods adopt different principals which results in differences in terms of the roles played by the developers and the customers, planning, tools used, control (Chan & Thong 2009).

The below table summarizes the differences between the agile methodologies and traditional methods:

Categories	Traditional	Agile
Development Model	Traditional	Iterative
Focus	Process	People
Management	Controlling	Facilitating
Customer 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

**Table 1: Agility vs Traditional (Hoda, Noble, & Marshall 2008, p 214)**

In terms of projects, teams, and project managers there are certainly differences between the two, the traditional projects has a clear vision of requirements and well defined project scope, features functions, and with extensive documentation of all procedures before commencing the project, at the beginning of the project, and after completing the project (Fernandez & Fernandez 2008; Karlesky & Voord 2008). On the other hand agile projects follow an iterative process therefore they discover the full requirements during the development process, as a consequence agile projects are prone to higher risks but as an advantage they have the ability to respond to changes (Fernandez & Fernandez 2008). In agile projects documentation is limited to when it's needed, as extensive documentation can be a waste due to the short life shelf (Karlesky & Voord 2008).

Traditional project managers plan their projects in advance based on a specified budget and scope, they manage their projects with a fixed time frame trying to meet project deadline by avoiding

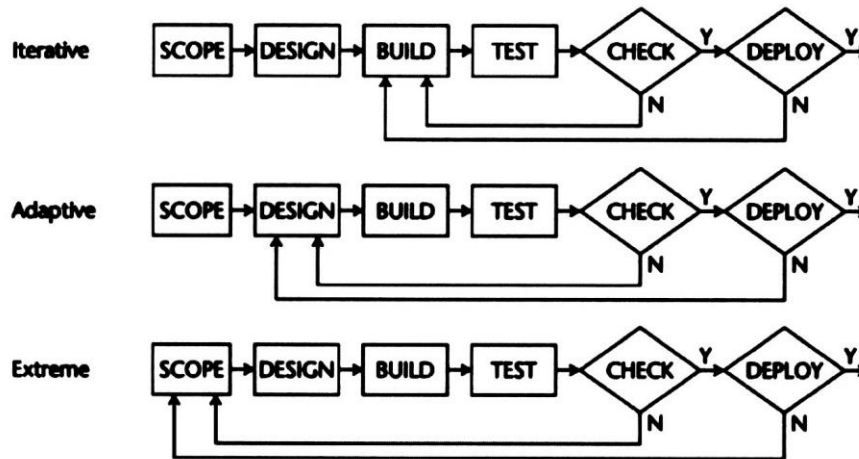
change and risks as much as possible and to maintain the costs within the specified budget, while agile managers gather efforts to deliver high quality products and increase the business value, following a strict plan and process like the traditional manager comes second in priorities (Fernandez & Fernandez 2008).

Teams in traditional projects are well distributed based on the defined requirements, team members can easily support each other, in contrast agile teams respond to change by co-location of members to develop increments rapidly, co-location help team members to work in any location (Fernandez & Fernandez 2008). Lindvall et al. (2002) highlights that agile management relies to a great extent on tacit knowledge and also on communication, skills, and talent, but 49.99% of the world developers acquire these attributes and they are below the average level, therefore tacit knowledge is essential in agile management. To add, large teams can adapt better in traditional projects as it follows a bureaucratic process, but large teams do not fit in agile projects (Lindvall et al. 2002).

## **2.5 Agile Project Management Strategies**

Agile project management has three types of strategies Fernandez & Fernandez (2008) had briefly described the different types of agile and traditional strategies and has compared each one of them with their advantages, agile project management combines three strategies which are the iterative strategy, extreme, and adaptive. In the iterative strategy a feedback is received after ending a series of stages to allow for adjustments based on the customer request, the advantages of this strategy that it allows for improvements and scope change between iteration. The second strategy is the adaptive strategy, the changes are made after each iteration which allows for constant adjustments for the next iteration, it has the ability to adapt to changes by planning and deliver the desired value within the specified costs and time. But there are some down side of this strategy such as the need for a customer during the development process to provide the necessary feedback, also there is no clear vision of what is the final output of the project. The third one is the extreme strategy, the adaptive and the extreme strategies have some differences in terms of iteration process, the purpose of the process is to find the project goal. The advantage of this strategy is that it leaves opportunity for possible options till the end but on the other hand it does not insure receiving a business value at the end of the project.

Figure 1 illustrates the differences between the iterative, adaptive, and extreme strategies, the figure clearly shows the iterative process adopted in the agile approaches (Fernandez & Fernandez 2008).



**Figure 1: Agile Management Strategies (Fernandez & Fernandez 2008, p.13).**

## 2.6 Methods of Agile Project Management

The practice of agile methods are spreading across the industry and gaining popularity in the recent years (Lindvall et al. 2002), several agile management methods were introduced in the past years like Extreme Programming (XP), Scrum, Crystal, Dynamic System Development Method, Feature Driven, and Adaptive Software Development. In this section of the literature each method of the agile management methods will be reviewed to get a clear understanding of its principles and processes.

### 2.6.1 Extreme Programming (XP)

Extreme programming is a collection of combined practices that were found useful in the development processes that were used back then, they were combined in a way that they can function together in a coherent way and they were took to the extreme levels, as a result a new methodology emerged (Abrahamsson et al. 2002). Hoda, Noble, & Marshall (2008) suggested that extreme programming best suits small or medium projects, it was originally created by Kent Beck to face the changes of requirements and to overcome and challenge the obstacles of traditional method of software development. This method challenges the belief that changing requirement during the development process can have a dramatic effect over time (Beck 1999), it is one of the



greatest aspects of XP method, it can change or remove any requirements like designs or documentation (Shore & Warden 2008). Even though the techniques of XP are not new, the unique combination of principals and techniques makes it successful (Iivari & Iivari 2011), and had proven their way as a software development method (Turk, France, & Rumpe 2005).

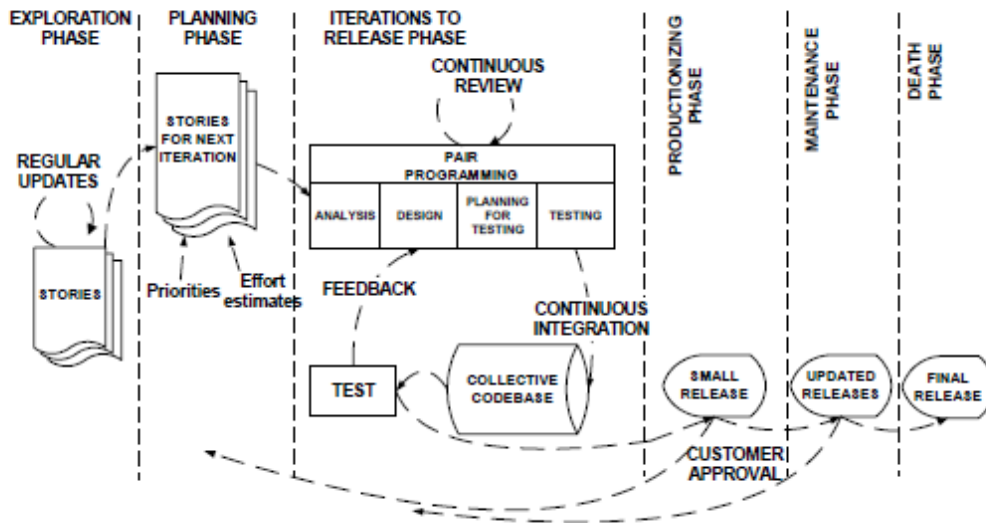
- **XP Values**

Extreme programming is one of the well-recognized agile method and it had helped the other agile methods to gain popularity, its lightweight method gave it the ability to adapt to changes and in return it gained the popularity (Turk, France, & Rumpe 2005). The XP practice supports four values which are communication, feedback, simplicity, and responsibility. Communication between all project parties like developers, customers and managers is essential to ensure the product development process goes smoothly and to receive the necessary feedback during the incremental process in order to deliver a successful product that satisfies the customers (Turk, France, & Rumpe 2005). Projects occasionally faces some problems or obstacles that if they were traced back it would lead to bad communication, it would show that some people like programmers, managers, or customers are not communicating effectively resulting of missing some important information such as changes in the design. Thus, XP reinforce the communication flow by adopting several practices that ensures the presence of communication such as pair programming, unit testing, and task estimation (Beck 1999).

Feedback is received upon completion of a code, it is important to receive feedback as it gives the opportunity to make the necessary changes that satisfies the customers (Beck 1999). Simplicity refers to developing a product that address the current needs of customers instead of designing a complex product with additional requirements that may not be needed, therefore using a simple process in developing is important to satisfy the customers (Turk, France, & Rumpe 2005). In terms of responsibility, the developers are responsible of delivering high quality products that insure the satisfaction of customers, it is their ultimate mission to produce a quality product (Turk, France, & Rumpe 2005).

- **XP Lifecycle**

The XP life cycle consists of five phases, it begins with the explorations phase and ends up with the death phase, figure 2 below demonstrates the five phases which are exploration, planning, iteration, productionizing, maintenance, and death (Abrahamsson et al. 2002).



**Figure 2: Extreme programming lifecycle (Abrahamsson et al. 2002, p.19)**

In the first phase exploration, the project team explores their surroundings including the technology and tools that they will use during the project, every single tool will be tested to make sure it functions well and to explore its specification, testing will be done by developing a prototype of the desired system, the testing could last a week to two weeks. Also in the exploration phase the developers listen to the customers as they write the story cards which are the product features and make sure that everything included in the story cards are sufficient for first release, the whole process of exploration could last from few week till a few months (Abrahamsson et al. 2002).

The planning phase is where the programmer and the customers agree on the specification of the first release by prioritizing the story cards, the agreement will include the time frame in which the first release will be done and the needed efforts to finalize the story cards that were agreed on to be added in the first release, this phase could last till six months (Beck 1999).

In the iteration to release phase stories will be picked for each iteration by the customer, as the agreed plan will be divided into several iteration which will take weeks for each one of them. After

each iteration the customer will complete the functional tests for each stories to make sure they run, after completing the last iteration the production phase starts (Beck 1999).

In the productionizing phase several test will be done to ensure system performance before production starts, new ideas could still be found in this phase but they could be added to the next release (Abrahamsson et al. 2002).

In the maintenance phase the system is still in the production phase while new iterations are running to produce new features. New team members could be added in this phase to deal with the new production which leads to change in the structure (Abrahamsson et al. 2002).

The last phase death is where all stories are implemented and no further changes are made, the customer is satisfied with the results and have no additional stories to add, therefore the project will end and the project team will start documenting the system (Abrahamsson et al. 2002).

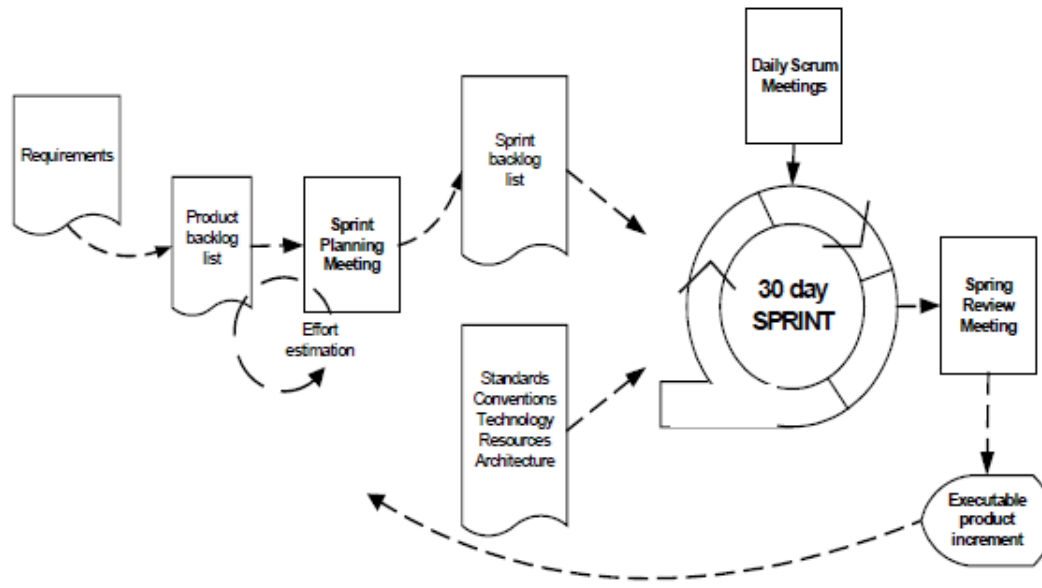
### **2.6.2 Scrum**

It is one of the agile development methods that was originally first presented in the literature by Takeuchi and Nonaka who presented an adaptive product development method in Japan (Abrahamsson et al. 2002). Scrum is a lightweight method that concentrates on product development in a flexible way by managing how the team functions (Abrahamsson et al. 2002). The term Scrum originates from the rugby game, it's when an interruption occurs during the game and the team members restart the game, Cervone (2010) noted that most of the terms found in agile methods are originated from rugby, and both of them share many characteristics such as the increments and iterative process.

Process, roles, and artifact are the three elements that Scrum is based on, in terms of roles there are three major roles in the development process and they are the Scrum master, the team members and the product owner, each one of them has his responsibility (Cervone 2010; Hoda, Noble, & Marshall 2008). The Scrum master is responsible for enforcing the principals of Scrum and keeping an open communication with the product owner, while the product owner ensures the project continuity within the agreed specifications, on the other hand the project team usually involves seven to ten people, the leadership role within the team shifts between the team members depending on the iteration situation (Cervone 2010; Hoda, Noble, & Marshall 2008).

Processes include sprint planning, daily scrums, and sprint review, sprint is the development method of Scrum that is restricted to a specific time frame which is fixed before each sprint, and it usually lasts thirty days (Schwaber & Sutherland 2013). The sprint planning aims to define what each sprint will achieve, the product owner and the development team set together the objectives of the sprint and the product Backlog items (Schwaber & Sutherland 2013). Daily scrum is a daily meeting between the development team, during the meeting the team review the previous activities and set a new plan for the next days. The meeting usually lasts for fifteen minutes, the purpose of the meeting is to measure the development progress towards the sprint goal and to identify any obstacles for elimination (Schwaber & Sutherland 2013). Sprint review takes place at the end of each sprint and lasts for four hours, its where the development team, Scrum master, and the product owner meet and review the results of the sprint, they present what was completed and the obstacles they faced during the activities including the steps that were taken to remove the obstacles (Schwaber & Sutherland 2013).

Scrum artifacts contains three artifacts: 1- Product Backlog: which is a list of product items that are required for the project such as features, technical work, and bugs, the list is created using MS project and managed by the product owner. The product Backlog is developed during the sprint planning in which the list is prioritized according to importance (Cervone 2010). 2- Sprint Backlog: it is a set of Product Backlog items that were chosen for a specific Sprint to achieve its goals, the Sprint Backlog is managed by the development team and they are responsible of keeping it up to date throughout the Sprint with the completed tasks (Singh 2013). 3- Product Increment: the results of a sprint will be a usable increment that meets the development team specification, the team runs tests to ensure the functionality of the increment, and at the end the development team documents the user operation (Singh 2013). The below figure presents the Scrum practices by Abrahamsson et al. (2002).



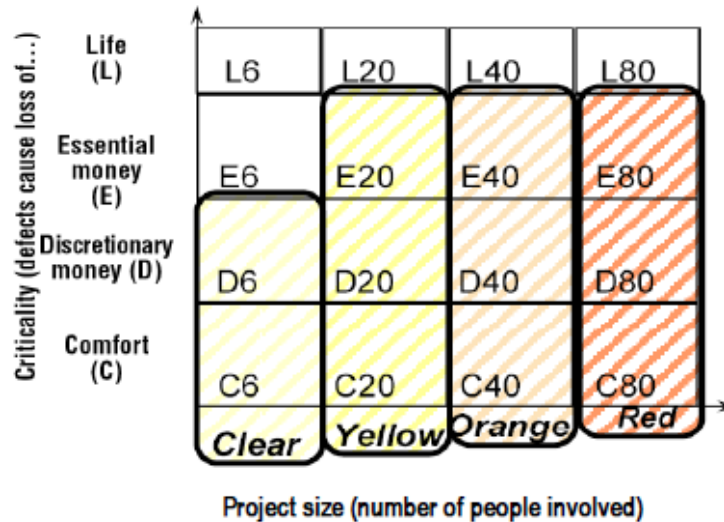
**Figure 3: Scrum Practices (Abrahamsson et al. 2002, p.33)**

### 2.6.3 Crystal Methods

The Crystal methods was presented in 1998 by Cockburn, it is a family of light weight development methods that is based on communication and interaction of people (Ramsin n.d.; McLaughli n.d.). The Crystal methods believes on the principle of addressing the project with a method that best suits its requirements and characteristics, the methods are categorized into several colors, each color represents the weight of the method to choose the appropriate color based on the project criticality, the methods are as follows 1- Crystal Clear 2- Crystal Yellow 3- Crystal Orange 4- Crystal Orange Web 5- Crystal Red (Abrahamsson et al. 2002; McLaughli n.d.). Each method has its own characteristics for example Crystal Clear fits for small project while Crystal Orange fits for medium projects, but they all share some certain aspects, like all agile methods Crystal methods use an incremental process in product development which usually lasts for three to four months, it also emphasizes on the importance of customer participation, higher adaptability and quick development process (Abrahamsson et al. 2002; McLaughli n.d.).

In Crystal methods project criticality is categorized into four categories as illustrated in figure 4 they are: comfort (C), discretionary money (D), essential money (E); and life (L), each letter represents a critical level for example C refers to loss of user comfort if the system crashes, while L refers loss of life, the number near the letter indicates the number of people involved in the

project (Abrahamsson et al. 2002). Even though there are multiple methods in the Crystal family, only three were defined and used and they are as follows: Crystal Clear, Crystal Orange, and Crystal Orange Web (Ramsin n.d).



**Figure 4: Crystal Methods Dimensions (Cockburn 2002 cited in Ramsin n.d.)**

#### 2.6.4 Dynamic System Development Method (DSDM)

- **DSDM Process**

DSDM is based on iterative and incremental process that goes in line with the rest of agile methods (Sani et al. 2013), the development process is done in a controlled environment, it controls time and resources. DSDM consists of five phases and they are feasibility, business study, functional model iteration, design & build, and implementation, in the feasibility phase the project team discusses the possibility of delivering the project and aims and objectives of the project (Sani et al. 2013), the business study analyzes the characteristics of the system and defines the targeted customers to involve through the development process, also in this phase diagrams are presented describing the process (Abrahamsson et al. 2002). The functional model iteration phase is where the project team build a model with high level specifications of the system (Sani et al. 2013), whereas in the design and build phase the project team construct the system and test it, while the implementation is a transitioning phase from development to operational phase where the project team hands over the system to the users (Sani et al. 2013).

- **DSDM Principles**

DSDM adopts nine principles and each one of them complement each other and construct a framework for DSDM, disregarding one of them could jeopardize the project, the first principle is active user involvement, it emphasizes the importance of involving users throughout the project cycle by selecting a small group of users to involve, this principle helps in reducing errors and costs (Voigt 2004). The second principle is empowering teams to take decisions to ensure the project progress goes smoothly without delays resulting from authorizations request, therefore the team must be granted the authority to take the needed decisions but with limitation regarding requirements, functionality in increments, and prioritizing requirements. The third one is frequent delivery of products to ensure the products are free of errors and detect them early to repair them, the fourth one is the compatibility of business requirements with the deliveries as the main aim of DSDM is to satisfy the business needs first and then add enhancements in later releases (Voigt 2004).

The fifth principle is the necessity of continues incremental development which means that the product features must be divided in small packages and release them in each increment until fulfilling the business objective, as a result the project complexity will be reduced and the project will be easy to manage. The sixth principle is the ability to reverse changes during the development process, since the priorities and needs changes it is necessary to reflect these changes in the incremental process to adapt to changes (Voigt 2004).

The seventh principal is keeping the requirements at high level, it is recommended that the development team focus on the initial requirements at the beginning of the development process to keep it simple (Gupta n.d.). The eighth one is testing throughout the project, in some project development methods the testing is delayed until the implementation phase, in this case if any issue was identified it takes time to resolve, thus, DSDM ensures testing through the development process (Voigt 2004; Gupta n.d.). The last principle is cooperation and collaboration among the project team, which is a key factor for project success, having an environment where honesty and trust are prevailed helps developing an effective project (Voigt 2004).

### **2.6.5 Feature Driven Development (FDD)**

It is one of the agile development methods that was developed by Jeff De Luca in 1997, it follows an iterative process that emphasize quality at all phases with frequent delivery (Goyal 2007). FDD consists of five phases begins with developing an overall model, building a features list, planning

by features, designing by features, and building by features, at the first phase the project team builds an object model based on the system requirements that were discussed earlier by the project team, in the build a features list the project team reviews the important features that were added to system with the users and stakeholder to check their validity. Plan by features phase includes prioritizing the features to create a major plan and then assigned to the developers, at the last two phases design and build by features includes selecting the final features for production, teams are formed based on the features and each team is assigned a feature for development (Abrahamsson et al. 2002).

To conclude, each of the agile methods has its own development process and different process duration, but all of them follow an iterative and incremental development method, they focus on deliverables by short iteration with the participation of all project parties. The agile methods emerged from the needs of different projects, as one method can't work for all projects since each project differs in its characteristics and purposes. Moreover, the methods are communication oriented which favors people over processes, it is also based on light development method making the life-cycle short and easy to adapt to any emergent change.

## **2.7 The Impact of Agility on Product Innovation**

Since the competitiveness is increasing between organizations most companies are turning to agile management as it allows adapting to the changing environment, as described by Highsmith (2002) agile management creates change in a fast manner leaving competitors gasping for air. It does not only allow coping with the change it also creates and generate it (Highsmith 2002), moreover it focuses on the delivery of business and customer value (Shore & Warden 2008). The agile project management practices and principles such as frequent communication, user involvement, frequent releases, and change responsiveness gives the organization the ability to develop innovative products (Surendra 2009). Agile management requires identifying all the stakeholders who has interest in the project such as users, funders and managers to be involved in throughout the development process and to specify their requirements.

Product innovation is driven by the desire to present value to customers, it is a result of envisioning and exploration by experimenting, agility provides fast and great flexibility for product development. The short development lifecycle enables the project team to develop new product



features and experiment its effectiveness, as a result deliver an innovative product (Highsmith 2004).

A global survey was conducted by Confronto, Rebentisch, and Amaral in 2014 in which over 800 professionals participated and shared their experience regarding agile project management, the survey results in terms of products and innovation indicated that 31% of the product development projects resulted of a new product with innovative features or components that were new to the market or organization, it also indicated that 32% of the studied projects resulted of a software with innovative features or architecture. In addition, the survey report presented some key findings regarding the use of agile management, it appears that the use of agile management is not limited to the software industry, its expanding to other industries such as the financial services by 15%, consulting 10%, education and entertainment by 5% and many other industries. It seems that the challenges faced by the organizations led them to consider other options like approaching agile management since their projects needed innovation.

But relying on the agile practices to be innovative without considering the other factors that contribute to the innovation process is not enough, besides the agile practices there are other factors that are important like competencies and skills, culture environment, project characteristics and experiences (Confronto, Rebentisch, & Amaral 2014). Using the appropriate practices combined with the skills and project characteristics are considered one of the success factors of adopting agile management in organizations. In order for the organization to successfully adopt agile management they need to set guidelines for selecting the appropriate agile method that fits the project context. Several steps were identified by Pikkaranien, Salo, and Still (2005) for deploying agile methods, the steps could help the organization in the transitioning process from traditional methods to the agile methods, these steps are listed below:

- 1) **Selection of the agile method:** the first step aims for selecting the appropriate agile method that serves the organization and the project goal, the selection process is composed of a number of practices the first one is defining the goals of agile adoption, the second is evaluating the existing agile methods to have a better understanding of each one and its benefits and effectiveness, the third is collecting the required agile data through interviews, workshops, or previous history records of agile methods implementations. After the data

are collected, they are analyzed and assessed for weaknesses and strength for the development process with the collaboration of the project stakeholders.

- 2) **Planning the deployment process:** in the planning process the selected method is presented to the organizations software development processes, the method might be tested and deployed to receive feedback.
- 3) **Deployment execution:** in this step a project is chosen to deploy the new agile method, the deployment offers the opportunity to receive feedback of the new agile method deployment, the agile iterative process allows the project team to adapt the new method and tailor it to their need, and through the process an evaluation is conducted to assess its effectiveness.
- 4) **Analyzing:** the last step includes analyzing the data received during the deployment of the method, if the data were found useful an improvement plan will be made and then implemented, at the end the results are stored for future use.

## **2.8 Challenges and Barriers of Agile Deployment**

### **2.8.1 Communication Barriers**

The deployment of agile methods could face some challenges and obstacles that may force the organization to carefully reconsider agile project management as a method for product development, Jammalamadaka and Krishna (2013) highlighted some of the challenges that face agile deployment, one of the main challenges is communication, it could pose a challenge especially if the project team work in a distributed environment and it was decided to use Scrum as a development method or other method. Scrum requires daily Scrum of the team members to have an update of the project progress and to keep the project stakeholder in the loop, if the environment was distributed it would be challenging to locate everyone in a one place due to zone barriers. A suggestion was presented by Jammalamadaka and Krishna (2013) to remove this barrier which is to deploy technical tools such as video conferencing to communicate with the project team on an agreed time. This solution could help setting a communication flow between team members but it's not a substitute to face to face communication as it requires effective planning to make it successful.

### **2.8.2 Organization and Management Challenges**

To add, Nerur, Mahapatra, and Mangalara (2005) categorized the challenges into five categories, management and organization, people, process, and technology, organization must consider these five aspects when transitioning to agile methods as they are the core elements for successful deployment of agility. Organizational culture determines the social norms and values of the organization, in return it is reflected on people's actions, management style, and policies, it requires a great deal of effort to change the culture and people. As mentioned earlier there are differences between traditional methods and agile methods in terms of management, processes, and teams, traditional management follows a command and control style, the project manager's role is planning and taking the decisions while the agile manager's role is a facilitator of his development team, he collaborates with the development team and shares his decisions to reach a final one. This sudden change in the project manager's role is challenging as he has to turn down his authority and shift to leadership and collaboration. Agility relies on tacit knowledge and discourages documentation and limits it to necessary information, whereas the traditional method emphasizes the importance of documentation, having records could be useful for future use and eliminating documentation could be against the policies in most organizations as it shifts the power to the development team instead of the management.

### **2.8.3 People Challenges**

People issues could be summarized in to collaboration, trust, and knowledge sharing, agile methods emphasize on the importance of team work and collaboration through practices such as pair programming and shared decision making, for programmers who are used to work independently or with analysts this might be a change. Moreover, skills and competencies could pose a problem if the project team is not well familiar with the agile methods, it will take time to adapt. One of the agile methods principals is involving customers in the development process, but finding the right customer who is knowledgeable, committed and willing to participate in the development process is hard (Nerur, Mahapatra, & Mangalara 2005).

### **2.8.4 Processes and Technology Challenges**

Agile methods use iterative process therefore it requires changes in work techniques, tools, and roles of people who are involved, a significant time and efforts will be spent to achieve the changes

and transform from standardized processes to a one that fits the project characteristics and people's competencies. In order to adopt agile methods organization must invest in technologies that facilitate the implementation of agile management as they play a major role in a successful implementation, relying on traditional tools will be difficult on the development team to implement the agile methods (Nerur, Mahapatra, & Mangalara 2005).

## 2.9 Conceptual Model

From the above literature a conceptual models was created and presented in figure 5, as illustrated, the agile management emphasize the involvement of the customer and the collaboration between him and the project team throughout the development lifecycle. If the project team acquires the competencies and the right skills with the necessary tools for the development process and choosed the right agile development method that meets the project characteristics then innovative products will result.



**Figure 5: Conceptual Model**

## 2.10 Research Hypotheses

In order to fulfill the research aim and answer the research question several hypotheses were formalized:

**HO1:** There is a positive correlation between product innovation and user involvement in the development process.

**HO2:** There is a positive correlation between product innovation and project team competencies.

**HO3:** There is a positive correlation between product innovation and project management method.

**HO4:** Product innovation is positively correlated with the use of advanced development tools.

**HO5:** There is a positive correlation between product innovation and development process.

**HO6:** There is a positive correlation between product innovation and organizational culture

## Chapter 3

### 3. Research Method

This chapter of the research presents the research method used to obtain the needed data to investigate the relation between the use of agile project management and the organizations ability to present innovative products. The research follows a qualitative and quantitative approach by conducting three case studies of agile projects in a government organization that plays a critical role in developing the infrastructure of Dubai, and by employing an online survey tool to investigate the addressed topic in two other organizations in Dubai. A qualitative approach was adopted for its ability to provide a rich data on a specific topic, it provides a deeper understanding of situations and help the researcher build assumptions of certain phenomena. Moreover, it's useful to provide information on a specific cases and learn about individual experiences to conduct cross case analysis and comparisons, and most importantly it enables the researcher to determine the causes of certain events.

However, the knowledge obtained from a qualitative method could not be generalized to all situations, as the findings are limited to the case studies conditions and stakeholders needs. Therefore, a quantitative approach was also used in this research as it is a helpful method to collect a wide range of data from various respondents, the benefits gained from using a survey such as the ability to develop it in a less time using many of the available tools online like mobile surveys or online surveys, it gives the researcher the advantage of crossing geographical barriers and reaching the hardest respondents and collecting data from a large proportion of respondents. It also enables the researcher to ask various questions and gather a wide range of data, for instance, the data could include the opinions of the respondents, in addition to beliefs and attitudes depending on the questions asked. Furthermore, a survey enables the researcher to statistically analyze the collected data using technical softwares to determine its accuracy, validity, and reliability.

On the other hand, surveys could pose some challenges to the researcher in terms of the number of responses, there is a possibility that the number of responses would be low due to many reasons like lack of encouragement to provide answers, or the respondents might not feel obligated to provide answers. Also the questions presented may lack clarity leading to different interpretation by respondents, as a result the data collected will vary, so the wording of questions should address the issue with clear words that are not complex or unfamiliar.

### **3.1 Research Instrument**

In order to obtain the needed information to conduct the case studies an unstructured interviews were done with three project managers who managed agile projects, the interviews revolved about the projects scope to gain a better understanding of the project goals that needs to be accomplished, roles and responsibilities of the team members and everyone whose involved in the project, reasons of projects initiations, how stakeholders were involvement in the project, and the used development method.

On the other hand the survey questionnaire was divided into five parts, the first part aimed to collect general information about the respondents such as gender, age, education, years of experience, the role of the respondents in projects, type of organization the respondent works in, and the type of method used in the product development process.

The second part is the organizational culture where it investigates 1- the management style by asking the respondents about the project manager's leadership style and whether the decisions are taken independently by him or with the collaboration between the project team. 2- The team member's competencies by questioning if the team is experienced in the product development field and trained well. 3- The teamwork, this variable intends to question the teamwork environment in terms of collaboration, communication self-organization and trust. 4- Experimentation, which intends to question whether the organization provide support for product experimentation to be innovative.

The third part examines the projects development process in terms of 1- user involvement in the project development and whether the selection of the user is based on a knowledgeable user. 2- The tools used in the development whether they are advanced or not and if they are able to invest in new tools if required. 3- Communication between project team members and stakeholders, 4- change acceptance, it questions whether changes are accepted even in late stages. The fourth part examines product innovation in terms of projects results, earned value, and user satisfaction. The fifth part gives the respondent the chance to add their comments on the topic.

The first part of the questionnaire was designed as a multiple choice questions allowing the respondents to select the answer that best suits them, while the rest parts were designed as a 7 point Likert scale questions starting from strongly agree to strongly disagree, the questionnaire can be referred to in appendix 1. Some of the variables were adapted from the global survey conducted

by Confronto, Rebentisch, and Amaral in 2014, while the rest were concluded from the literature, the survey questions the respondents on products development projects they've had. The questionnaire and the case studies aims to investigate the use of agile methods in product development projects, and whether they have achieved innovation.

### **3.2 Targeted Audience**

The questionnaire was distributed in IT departments in two organizations in Dubai targeting IT practitioners such as project manager experts and project team members to examine their thoughts and experience on product innovation in their projects.

### **3.3 Analysis Tool**

In order to analyze the collected data from the survey a software called Statistical Package for Social Sciences (SPSS) was used for its wide applicability, SPSS is employed in many government organizations for surveying purposes, it has many functionalities that could be useful for quantifying the data such as graphs, charts, median, and standard deviation.



## Chapter 4

### 4. Data Collection

This chapter of the research presents three case studies of agile projects followed by a data analysis of the collected data from the survey questionnaire.

#### 4.1 Case Study 1: Smart Mobile Transformation Strategy Project (SMTS)

Following with the Smart Government initiative that was launched by his Highness Sheik Mohammed Bin Rashid Al Maktoum in May 2013 that aims to transform into a mobile government in order to provide all government services available to citizens 24/7 wherever they are, comes in line the Smart Mobile Transformation Strategy project (SMTS) that was established by a government organization in Dubai who has embraced the Smart Government initiative and embarked their own m-Government transformation journey.

By setting the direction of the planned transformation, the smart government committee in the organization has endorsed the transformation roadmap with the engagement of the organization business and key stakeholders, current back end vendors, integration vendors and crossed verified with the best practices in other cities with similar projects. The committee has identified, evaluated and selected 212 services and 15 innovative services to be delivered via smart mobiles, 48 services were excluded from the project due to the nature of service requirements or due to duplication or merging of services.

The services were prioritized based on business impact and technical complexity assessment, the business impact criteria involved the strategic importance of the service, average monthly usage, current adoption of the service, and incremental benefits of mobile transformation benefits, the technical complexity criteria involved technical interfaces, data volume size and attachments, technical readiness, complexity of services fulfilment, and the presence of digital channel.

##### ▪ Key Business Objectives and Drivers

The transformation plan aims to enable all the selected organization services on mobile devices by May 2015 and achieve a 100% presence on mobile devices with a high percentage of public adoption of the services by providing continuous enhancement to the services and answering to customer feedbacks. It also aims to develop a sustainable mobile transformation beyond May 2015.

- **Key Business Performance Indicators**

The following table explains the performance indicators for the transformation roadmap:

<b>N.</b>	<b>KPIs</b>	<b>Definition</b>
<b>1</b>	<b>Mobile application download</b>	Increasing the number of application downloads for example from 25,000 to 100,000.
<b>2</b>	<b>Mobile application rank</b>	Increasing the organization app’s ranking on Apple Store or Google play, like going from #55 to #25, ranking will have strong effect on the total number of downloads.
<b>3</b>	<b>Active users</b>	The number of users who are using the application on a daily or monthly basis, and can be used as an indicator of app survival in the market.
<b>4</b>	<b>User experience</b>	User reviews and ratings in app stores provide a real user experience and could be used to get information on bugs and app crashes, in return enhancement could be made.
<b>5</b>	<b>Support cost</b>	The number of estimated production defects or enhancement asked by the user exceeds the initial estimation?

**Table 2: Key Performance Indicators**

- **Transformation Roadmap**

The main elements of transformational roadmap were broken down into 3 phases in order to meet the specified deadline, the phases as follows:

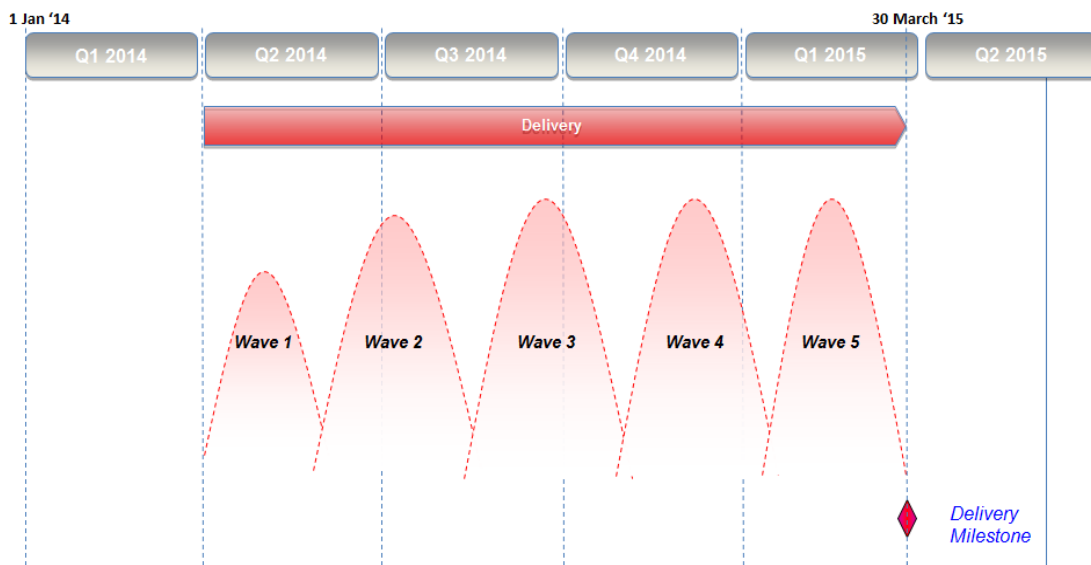
- **Enablement:** which is the initial phase where the technical and organizational foundation were placed for effective delivery. The enablement phase tasks included selecting the main implementation vendor, establishing security framework, developing mobile development skills, creating program wide user experience standard, designing and developing the UI shell for mobile application.
- **Delivery (pre-May 2015):** its where the implementation is done through the waves (or iteration) with a staggered approach, in this phase the main implementation vendor defined the requirements for the services and assigned them to the appropriate implementation

vendors, and in their turn they developed the front end services and integrated them with the back end. The main implementation vendor developed in parallel with the service design the test scenarios and test data, and then developed the test automation scripts to do the testing on all specified devices by gathering the development artefacts together with the automation test scripts and perform the testing in cloud or premise. Once the User Acceptance Test (UAT) was signed off, the organization and the main implementation vendor signed the app for release to the app store. In parallel, any requirements for server side components for production release for Wave 1 are deployed by the main implementation vendor.

- **Delivery (post-May 2015):** during this phase the main focus is to gain a deep understanding of user experience of services, and set the appropriate measures to optimize the existing services. The key tasks in this phase consists of ongoing service improvements based on customer’s feedback, as well as analyzing user activity to introduce new services in future.

- **Delivery Framework**

Due to the time constraints the delivery roadmap was broken down into 5 waves (iterations), the duration of the first wave was 2 months while the subsequent waves were 2.5 months. The first wave was designed to be short to enable learning and fast mitigation of teething problems.



**Figure 6: Number and Duration of Waves**

As explained earlier, within a wave the main implementation vendor provided the requirements to start a wave, assigned the implementation vendors, undertake the UAT, and then released the app to the app stores which normally takes 2 weeks minimum. The deployment process responsibility was handed over to the mobile app vendors post wave 1. This multi waves and iterative approach was chosen because it allows of quick implementation and an ongoing delivery of service. It produces a high quality solutions in a cost effective and timely manner, and performed in a highly collaborative and self-organizing manner, with an active participation of stakeholders to address their needs and maximize the business value delivered.

The agile teams which were consisted of the project manager, service analyst, mobile architect, service visual designer adopted the right amount of work and deliver it in milestones, the output of each Sprint session is a set of services that is almost developed, after testing it for defects or missing functionality the team starts a new development cycle.

- **Best Practices and Customer Collaboration**

In order to provide the best mobile services, several approaches were undertaken to gain an understanding of best practices criteria, first a customer focus groups were done to gather feedback regarding the current organization's mobile apps, they were asked of what kind of services they would like to have on mobile channels, and their ideas of user experience on these services. Second, an overview was taken of best practices in other cities such as Hong Kong, London, Melbourne, and New York to see what type of mobile apps exists and what are their future plans. Third, a review of mobile phones capabilities, software currently available and the capabilities of the organization to grow such as mobile payments.

- **Risks and Challenges**

Several risks and challenges were identified that could affect the transformational roadmap, the below list summarizes the main points:

- Time constraints: all activities should take into consideration the deadline which is May 2015, therefore, all activities were scheduled to end by March 31<sup>st</sup> 2015 to allow for buffer time in case defects were found. A wave approach was adopted to so that a clear visibility on progress can be established.

- High number of vendors: which requires time and governance to manage the high numbers of vendors for the mobile transformation. A governance structure was formed in a form of program management to mitigate this risk.
- Limited resources and skills within the organization and its vendors: resources were planned in advance and communicated with the vendors in order to hire the needed skills.

- **Project Results**

The project was delivered on time and within scope, the apps were delivered successfully and without any major defects or failures, and as part of the learning curve the project team keeps looking for enhancements and upgrades to be up to date with the latest technologies and standards. The apps achieved high user adoption across all platforms and the download rates were high which indicates that these app were anticipated by the customers, the satisfaction rates were high and based on customers feedback and requests to add additional features the project team has taken these requests into consideration and were added to future development plans.

#### **4.2 Case Study 2: Smart Enterprise Inspection Management System (SEIMS)**

The second case study takes place at the same organization of the first case, this project is about an enterprise solution system to manage inspections, audits, and compliance. The project is in line with the Smart Government initiative, it aims to advance the organization by accommodating and automating the changing and growing business requirements related to inspection in line with the organization's corporate governance standards and policies.

The main deliverables of the project is 1- develop additional requirements for business stakeholders and they are the organization agencies and departments such as the Finance department 2- automation of manual inspection processes 3- technical documentation as per the standards 4- online connectivity enablement to reduce human intervention 5- enhance integration and architecture.

- **Stakeholder Engagement**

In order to design a system that serves the needs of the stakeholders, a workshop was done to gather their requirements, the session included stakeholders and expected users of the system. The session included a discussion of ideas and developing solutions for business requirements.

- **SEIMS Project Phases**

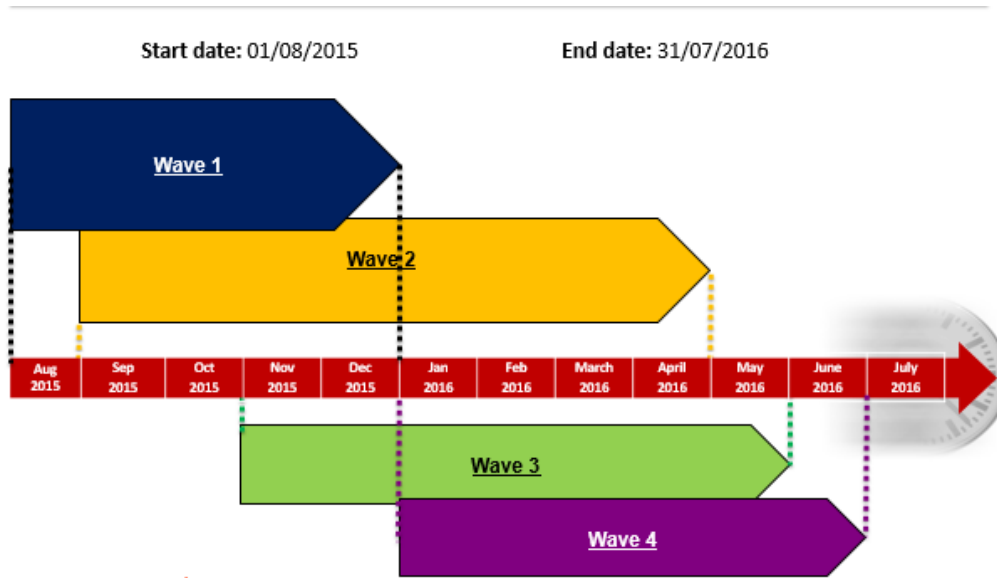
The project is divided into five phases described in the below table:

<b>Phase</b>	<b>Activities</b>
<b>Plan &amp; setup</b>	This phase includes gathering requirements, validating pre-requisites, planning & review. The deliverables include the project management plan.
<b>Design &amp; build</b>	It includes developing solutions as per business requirements. The deliverables include a prototype and integration design document.
<b>Test</b>	This phase involves testing the system by the stakeholders for acceptance and approval. The deliverables includes testing plan, test cases, test logs, UAT sessions & support, staging deployment.
<b>Train</b>	Training sessions for the concerned users will be done. This phase deliverables is user manual.
<b>Deploy</b>	Activities includes Application Deployment on production environment & post go-live support.

**Table 3: SEIMS Project Phases**

- **Delivery Framework**

The project was scheduled to start in Aug 2015 and end on July 2016, the delivery framework was divided into 4 waves, the first wave started in Aug 2015 and ended on Jan 2016 while the subsequent wave started in Sep 2015 and will end in May 2016, wave 3 started in Nov 2015 and will end in Jun 2016, the last wave started in Jan 2016 and will end by Jul 2016. As illustrated in figure 7 the four waves are scheduled in parallel to allow multiple tasks to be completed at once and deliver a completed project. The project is still in development process, wave 1 has been completed successfully without emerging requirements while the rest of the waves are still in process, some additional requirements were requested by the stakeholders during the development process, so the project manager has decided to add them in the last 2 waves since there was no chance to add them in the first 2 waves due to the number of tasks assigned.



**Figure 7: SEIMS Project Delivery Milestone**

### 4.3 Case study 3: Smart Mobile Application

The third case is a sub project of SMTS program, it aims to develop a smart payment application that enables the user to pay for parking fees within Dubai, the application design and requirements were defined with the participation of the organization’s key stakeholder. The key objectives of the project was to 1- achieve customers satisfaction 2- provide a smart mobile payment channel for customers 3- achieve the organization strategic objectives of excellency and people happiness 4- support the government initiative of transformation to m-government.

- **Roles and responsibilities**

The following table explains the main roles and responsibilities of the people who were involved in the project:

Role	Responsibility
<b>Project manager</b>	His main role is resource management, communicate with vendor and stakeholders, and clarifies dependencies.
<b>Service group owner</b>	Arranges priorities and define scope for each sprint.
<b>Service analyst</b>	Documents requirements, develops use cases, and translate requirements into equivalent designs.
<b>Mobile Architect</b>	Defines mobile solution architecture such as tools, frameworks, integrations.

<b>Service visual designer</b>	Develops visual designs, themes and component.
<b>UAT tester</b>	Performs the final User Acceptance Test.

**Table 4: Roles and Responsibilities**

- **Delivery Framework**

The project initiation took place in the second wave of SMTS, the project duration lasted two months and was divided into four phases, the main tasks included requirements definition, implementation, and quality assurance and transition. The first phase included requirements definition and scope of work for each phase and technical solution design, the second phase included building the application over several sprints where each sprint last two weeks, each sprint begins with a planning phase, at the end of each sprint unit and integration testing is done, defects found are placed in the backlog for the following sprint. The third phase included cloud testing on devices to check the app functionality, also the UAT is performed. The final phase is the deployment, it's where the app is released to the app stores.

- **Project results**

The application was released to the app stores and received high rates from customers, the number of downloads on all platforms has exceeded the expectations, some users provided their feedback in the comment section of the app store about their experience, the feedbacks were taken into consideration by the development team and were added to their next enhancement.

#### **4.4 Data Analysis**

This part of the research presents an analysis of the survey collected data, the analysis includes a demographic analysis, descriptive analysis, reliability test, in addition to a correlation analysis that was preformed to determine the significance between the variables. The total number of the received responses is forty three (43) in a period of fourteen days, out of the 43 responses 8 of them were disqualified for not completing the survey, so the total number of analyzed responses is thirty five (35).

##### **4.4.1 Demographic Frequency Table**

The following table presents seven demographic variables of the respondents and they are gender, education, age, years of experience, organization type, and their role in projects. Table 5 shows that the sample consisted of male participants (n = 18) 51.4 % more than female participants (n =



17) 48.6%, and as per table 5 most of the respondents ages ranged from 25- 35 years and they consisted of 60% of the sample, while the remaining respondents ages ranged from 36 – 46 years and 47-57 years. In terms of education the majority of the respondents hold a master degree or above and they formed 40% of the sample, next comes the bachelor degree holders and they formed 28.6% of the sample while the high diploma holders formed 17.1% followed by high school holders 14.3%.

The table reveals that the majority of the respondent’s experiences ranged between 2 - 7 years forming 34% of the sample, only five respondents had 20 years or above of experience and they were 14.3%. Also based on the results most of the respondents were project team members and they formed 42.2% of the sample, followed by project managers and they formed 22.9%. In terms of the used development method the table reveals that 40% of the respondents did not know what type of method they are using in the software development process, while the rest of the respondents were using traditional, Crystal, and hybrid methods. Moreover, by observing the table it seems that the rest of the development methods included in the questionnaire did not score any points such as Scrum, Extreme programming, Feature Driven Development.

		Frequency	Percent	Valid Percent	Cumulative Percent
<b>Gender</b>	Male	18	51.4	51.4	51.4
	Female	17	48.6	48.6	100
	Total	35	100	100	
<b>Age</b>	25-35	21	60	60	60
	36-46	13	37.1	37.1	97.1
	47-57	1	2.9	2.9	100
	Total	35	100	100	
<b>Education</b>	High school	5	14.3	14.3	14.3
	High Diploma	6	17.1	17.1	31.4
	Bachelor Degree	10	28.6	28.6	60
	Master Degree or Above	14	40	40	100
	Total	35	100	100	
<b>Years Of Experience</b>	one year or less	8	22.9	22.9	22.9
	02-Jul	12	34.3	34.3	57.1
	Aug-13	9	25.7	25.7	82.9
	14-19	1	2.9	2.9	85.7

	20 years or above	5	14.3	14.3	100
	Total	35	100	100	
<b>Type of Organization</b>	Public	19	54.3	54.3	54.3
	Private	16	45.7	45.7	100
	Total	35	100	100	
<b>Role in Projects</b>	Portfolio Manager	2	5.7	5.7	5.7
	Project Manager	8	22.9	22.9	28.6
	Team Member	15	42.9	42.9	71.4
	Other	10	28.6	28.6	100
	Total	35	100	100	
<b>Type of Development Method</b>	Traditional (waterfall)	8	22.9	22.9	22.9
	Dynamic System Development	2	5.7	5.7	28.6
	Hybrid Methodology	6	17.1	17.1	45.7
	Crystal Methods	5	14.3	14.3	60
	Do not know	14	40	40	100
	Total	35	100	100	

**Table 5: Demographic Table**

#### 4.4.2 Descriptive statistics

The following table presents a descriptive statistic of 3 demographic variables of the questionnaire and they are organizational culture, development process, and product innovation. As presented in table 6 the total number of valid responses is 35, and the analysis indicates that there are no missing values in all variables. The mean, median, and mode provide a central tendency measure which indicates a description of the data location, the table reveals the mean which is also called the average, in the organizational culture category the mean is higher than product development which is 44.44, while development process has scored 27.5 and product innovation category scored 21.55. The median measure the ordered distribution of values, in the organizational culture it is 41.5 but in product innovation category it's 24.0 and in the development process category it's 27.0, the mode which is the value that occurs frequently shows in the organizational culture it's 48.0 and in development process it's 24 which is the same as product innovation. In terms of standard deviation it measures the variation of individual responses to a question and whether it's concentrated near the mean or not, the standard deviation in the organizational culture category is 12.7 while in the development process and product innovation its 8. Since the standard deviation

scores in the three categories were little high it indicates that the responses varied and the scores to the questions were not consistent.

		Organizational culture	development process	product innovation
N	Valid	35	35	35
	Missing	0	0	0
Mean		44.4412	27.5588	21.5588
Median		41.5000	27.0000	24.0000
Mode		48.00	24.00	24.00
Std. Deviation		12.73552	8.42864	8.06110

**Table 6: Descriptive Statistics Table**

#### 4.4.3 Reliability analysis

In order to determine whether or not the items are grouped together statistically and to ensure validity and reliability of the score scale, a Cronbach Alpha test was employed for all questionnaire items to check the consistency between them. Table 7 reveals the Cronbach Alpha for the three variables in the questionnaire, the results indicated a very high and strong consistency internally among all variables since all variables scored over 0.90, which is considered very good. The values means that respondents who tended to select high score for one item did the same for the other items in the same variable.

Category	Cronbach's Alpha	N of Items
Product innovation	.929	9
Development process	.922	16
Organizational Culture	.934	27

**Table 7: Reliability Test**

#### 4.4.4 Correlation Analysis

A Bivariate Correlation analysis was performed in order to measure the strength and association between two variables, in this case it was used to test the hypotheses. Table 8 reveals the results of a correlation test for HO1 between product innovation and user involvement, the results indicate

that there is a positive correlation between the two variables where  $r = 0.639$ ,  $p = 000$  which indicates that it's statistically significant, and  $n = 35$  which is the sample number.

		Use involvement
Product Innovation	Pearson Correlation	.639**
	Sig. (2-tailed)	.000
	N	35

**Table 8: HO 1 Correlation Test Results**

Based on the results we can conclude that there is a significant positive correlation between product innovation and user involvement since  $p = 000$  and it's less than  $0.05$ , which means the more the user gets involved in the project process the more likely the project will result of innovative product therefore the below hypothesis is true:

**HO1:** There is a positive correlation between product innovation and user involvement in the development process.

The test results of HO2 shows that  $r = 0.521$ ,  $p = 002$ ,  $n = 35$ , so there is a positive and significant correlation between product innovation and the team competencies since  $p \leq 0.05$ , so the higher the project team is competent and acquire high skills the more likely the project will result of innovation.

		Team competencies
product innovation	Pearson Correlation	.521**
	Sig. (2-tailed)	.002
	N	35

**Table 9: HO 2 Correlation Test Results**

Therefore the following hypotheses is true:

**HO2:** There is a positive correlation between product innovation and project team competencies.

The third hypotheses test results shows that there is no significant or positive correlation between the two variables, table 10 reveals that  $r = -0.102$  and  $p = 564$  and since  $p \geq 0.05$  it indicates that there is no statistical correlation between product innovation and the development method used.

In other words, the chosen development method does not significantly contribute in the ability to deliver innovative products. Based on the results the below hypotheses is not true.

**HO3:** There is a positive correlation between product innovation and the development method.

		Development Method
product innovation	Pearson Correlation	-.102
	Sig. (2-tailed)	.564
	N	35

**Table 10: HO 3 Correlation Test Results**

The correlation between product innovation and the use of advanced development tools is significantly correlated, table 11 shows that  $r = 0.516$  while  $p = 002$ . To conclude HO 4 is true because the value of  $p \leq 0.05$  and the correlation value is strong, hence, the use of advanced development tools contribute positively in product innovation.

**HO4:** Product innovation is positively correlated with the use of advanced development tools.

		Advanced tools
product innovation	Pearson Correlation	.516**
	Sig. (2-tailed)	.002
	N	35

**Table 11: HO 4 Correlation Test Results**

In terms of HO 5 the test results reveals that there is a strong positive correlation between the two variables, the correlation value is  $r = 0.733$  and the significance value is  $p = 000$ . Testing the hypothesis reveals that there is a significant and positive correlation between product innovation and development process, so the development process factors such as communication and accepting changes in plans are positively related to product innovation, so HO5 is accepted.

**HO5:** There is a positive correlation between product innovation and development process.

		Development process
Product innovation	Pearson Correlation	.733**
	Sig. (2-tailed)	.000
	N	35

**Table 12: HO 5 Correlation Test Results**

The final hypothesis test reveals that the correlation between product innovation and the organizational culture is significantly correlated since the correlation value is 0.637 and the significance is less than 0.05, which means the organizational culture factors such as team work and management type are positively related to product innovation. Thus, the below hypothesis is true

**HO6:** There is a positive correlation between product innovation and organizational culture.

		Organizational culture
product innovation	Pearson Correlation	.637**
	Sig. (2-tailed)	.000
	N	35

**Table 13: HO6 Correlation Test Results**

#### 4.5 Discussion

In the first case study the project management team has decided to follow an agile approach, and divided the delivery framework into several iterations, which allowed them to manage and execute different tasks in parallel, the decision indicates that they were well aware that agile management will enables them to accomplish their objectives. Their decision resulted of producing high quality applications in a timely manner performed by self-organizing teams in disciplined and highly collaborative manner, with the active engagement of stakeholders. Agile teams deliver results in a repeatable manner by adopting the right amount of work to address the situation they face. Their action to involve the customers and the stakeholders in the requirements definition phase shows that they realize that in order to develop successful applications their needs and expectation must be taken into consideration. Therefore, they conducted a focus group with students from two universities to explore their ideas and inspect their needs, the focus group resulted of many needs and ideas for instance, some has commented on the application interface as they needed a consistent color scheme, better display of icons, and a modern and friendly app. Others has requested to add an option for activating and deactivating the GPS in the navigation functionality and also they needed to add more comprehensive information, while the rest has specified that they need more security assurance on credit card payments through remote channels. The key

findings were documented and prioritized based on importance and forwarded to the technical team to be added to the development plan, the findings played a major role in the acceptance of the applications by the public.

Through the data collection and interview process, the interviewees were asked regarding the type of agile method that was selected for the delivery process for the three projects, their answers were not expected as they did not know the type of the method they are using, and they were not familiar with all the agile methods but they did confirm that the examined projects were agile as they followed an iterative and incremental approach. Therefore, based on the examination of the three projects and through the interviewee's explanation of the development process it seems that the used method is Scrum, they have customized it to match the projects requirements. The process matches the reviewed literature, as sprint is the development method of Scrum and its limited to a specific time frame that could last a month to two months, the projects had a sprint planning phase to define the requirements for each sprint and they were placed in the backlog which is a list of product features.

Moreover, in the first case the management has taken the approach of mobile app owner to minimize the potential risks and limits the number of directly involved vendors in the mobile transformation, since the number of services needed to be transformed within the stipulated time requires a high numbers of vendors to be managed, the product owner role is one of the identifiable roles within the Scrum method, each product owner in the program was responsible of his project in terms of controlling and deciding the tasks of the backlog list. The approach has enabled them to successfully govern the program and gave them a clear visibility on progress.

The customization of the method included the daily scrum meetings, the number of meetings were minimized to weekly meetings to measure the progress, the communication flow in all three cases were consistent as part of the management style weekly reports were raised to the higher management and to stakeholders to inform them of the progresses made and if there were any obstacles. Also documentation was a necessary part through the development process and it included technical outcomes.

The second and the third case followed the same approach in the development process, the delivery was divided into several iterations, which has enabled them to focus on the priorities in each iteration. No major challenges were faced in the second case since it's still in the development

process, the stakeholder were involved during the planning phase which has contributed significantly in defining the requirements to develop a system that serves the needs of its users. Based on the results of the first and third case, there is high possibility that the project will be successfully developed and user satisfaction will be achieved.

Furthermore, the survey conducted resulted of receiving 43 responses, 8 of them were disqualified since they only completed the first section only which is not enough to be included in the study, what is interesting to point out is that 40% of the sample did not know the type of method they used in their projects which indicates that the agile methods are not very well known. To add, the 8 responses that were disqualified all of them stopped at the used method question, some of them answered it as they don't know while the rest left it without an answer, this is also could be an indication of unfamiliarity of the methods, however there is a possibility that they are using it without knowing it. The rest of the sample were distributed between the traditional methods which formed 22.9% and the agile methods such as the crystal method, dynamic system development and hybrid methodology.

The performed correlation analysis on the hypothesis revealed that 5 out of 6 were true, the first one hypothesized that there is a positive correlation between product innovation and user involvement in the development process, product innovation is measured based on whether the produced product is new to the organization or the market, it also measures if there is a value received and customer satisfaction. The analysis showed that there is a positive correlation between the two variables, it also shows that product innovation is positively correlated with project team competencies, the use of advanced development tools, the development process, and the organizational culture. However, regarding the third hypothesis the analysis revealed that there is no correlation between product innovation and the project management method, which means that the management method does not play a major role in the innovation process without the availability of the other variables such competencies and advanced tools.

Therefore, based on the case studies and the survey results we can conclude that agile management results of innovation if it was combined with best practices such as involving the users in the process with the effective communication between all project parties and using the right tools and technologies that facilitate fast development. Moreover adopting the leadership style by the project



manager instead of the command and control style that emphasize collaboration and shared decision making facilitates the project process.

## **Chapter 5**

### **5.1 Recommendations**

- In order for the organization to prosper and continue with their innovations on the organization's level and on the Dubai's government level, it's suggested for them to explore more options for the development processes, as each method has its own advantages and capabilities that could help in achieving the set targets. Limiting the development method to one will not be effective on all projects as each project differs in its requirements. Exploring other methods would be beneficial for future projects therefore the organization have to try different agile methods on small projects to test it and see if there are difficulties.
- Face to face communication is very important as it eliminates any possible misunderstanding and it ensures information flows smoothly, in the three projects all stakeholders were updated with the project progress through periodic reports, it would have been better if face to face meetings were done to allow questions and discussions to be raised.
- To achieve high user satisfaction and innovative products, its recommended to conduct focus groups and workshops with high numbers of expected users, as it is an effective way to gather large amount of ideas of what they are expecting from the product and add enhancing features. This approach has helped the project managers in the three case studies to pay attention to details that were missed or not given the required attention, as a result the project achieved high satisfaction and were innovative. Therefore, organizations should consider this approach as a way to achieve innovation, this approach also supports the agile principals by communicating with the users.
- Conducting a workshop or a focus group with users after releasing the product to gather their thoughts and ideas on the product would have a great impact on user satisfaction and would give an opportunity for future improvements, hence, it's recommended for organizations to conduct post product release workshop.

## 5.2 Conclusion

To conclude, agile project management emerged from the need of finding a flexible development process that enables the project team to continuously add improvements and change requirements during the product development process. The new emerged agile management opened the opportunity for organizations to gain the competitive advantage in the market, therefore, organizations are starting to shift from traditional project management methods to agile project management that offers them the ability to adapt to changes.

Three case studies were conducted in a government organization to examine three projects in which the agile methods were employed, with the support of an online survey that was also conducted to answer the research question which is “does agile project management enables organizations to deliver innovative products?”, the survey was distributed in IT departments in two other organizations in Dubai and targeted IT practitioners. The three projects examined for the case studies were a result of the government initiative to transform Dubai into a Smart Government to provide the citizens with non-stop services, in line with the initiative a transformation roadmap was endorsed to transform and deliver the organization services via smart mobiles.

The three projects examined adopted the agile management to enable them to meet the deadline and adopt the needed amount of work to deliver it in milestones through Sprint sessions, the output of the sessions were a set of services ready to be released to the app stores. The project managers engaged the key stakeholders in the defining requirements phase which was considered a critical step and indicates the recognition of the importance of their contribution in delivering innovative products that satisfy the end user. Their embracement of the agile principles even though not knowing which method they were using has contributed to the successfully achieving innovative products. The studies revealed that innovation can be achieved by using agile management with the implementation of best practices such as the effective communication with all who are involved in the project specially the customers, and with the collaboration between the project manager and the team members.

On the other hand the survey analysis revealed that five out of six hypotheses were true, the possibility of achieving product innovation is high if the following variables were available and they are user involvement in the development process, competent project team members, using advanced development tools, an organizational culture that promotes a leadership style

management, and a development process that emphasize communication, user involvement, and change acceptance during the development process.

### **5.2.1 Future Research Topics**

This research have sought to investigate the impact of agile management on the effective delivery of product innovation, it aimed to address the lack of research on agile project management and product innovation. Through the research a number of possible opportunities for future research extension are raised, such as the possibility of using agile management in sectors other than information technology as there is a lack of research evidence on the ability to use agile management in other fields. The research could focus on the challenges and barriers of adopting the method and presenting successful cases. Furthermore, the research could investigate how the project managers were able to implement it and what are the techniques that were used.

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## **Appendix**

- **Questionnaire**

Dear Sir/Madam,

Thank you for agreeing to take part in this important survey, your contribution is highly appreciated. This survey is conducted for academic research purposes which aims to study the relationship between agile project management and product innovation, therefore we seek your assistance to provide us the required data to fulfill this research.

The survey results will be used strictly for research purposes only, and no individuals will be identified through their responses, it will take 5 to 10 minutes to complete the survey. .

The survey consists of four part:

1. General information
2. Organizational culture
3. Product development process
4. Product innovation.
5. Additional comments

Thank you,

**PART 1: General Information**

*Please tick one box for each question:*

**A. Gender**

- (1) Male ( )
- (2) Female ( )

**B. Education:**

- (1) Less than high school ( )
- (2) High school ( )
- (3) High Diploma ( )
- (4) Bachelor degree ( )
- (5) Masters degree or above ( )
- ( )

**C. Age:**

- (1) Less than 25 ( )
- (2) 25 - 35 ( )
- (3) 36 - 46 ( )
- (4) 47 - 57 ( )
- (5) 58 or above ( )
- ( )

**D. No. of years of experience in IT:**

- (1) One year or less ( )
- (2) 2 - 7 ( )
- (3) 8 - 13 ( )
- (4) 14 - 19 ( )
- (5) 20 years or above ( )
- ( )

**E. Type of organization**

- (1) Public ( )
- (2) Private ( )
- ( )

**F. Role in product development project :**

(1) Portfolio manager ( )

(2) Program manager ( )

(3) Project manager ( )

(4) Team member ( )

(5) Other ( )

( )

( )

**G. Which type of methodology do you use in product development projects?**

(1) Traditional (Waterfall) ( )

(2) Scrum ( )

(3) Extreme Programming (XP) ( )

(4) Feature Driven Development (FDD) ( )

(5) Dynamic System Development ( )

(6) Hybrid Methodology (mix of the above) ( )

(7) Crystal methods ( )

(8) Do not know ( )

( )

( )

( )

<b>PART 2 : Organizational culture</b>							
<i>Please tick one box for each item:</i>							
	Strongly agree	agree	Somewhat agree	Neutral	Somewhat disagree	disagree	Strongly disagree
1. The organization provide financial support for experimentation.							
2. The organization encourages							

experimentation to be innovative							
3. The organization believe on the importance of innovation.							
4. The project manager follows a command and control management style where he plans and take the decisions.							
5. The project manager follows a leadership management style, where he acts as a facilitator for his team.							
6. Decisions are taken by the project manager with the collaboration of all team members.							
7. Decisions are taken independently by the project manager.							
8. The project team is authorized to take quick decisions to meet the deadline.							
9. Interaction and communication between team members are based on trust.							
10. The sense of trust and support is dominated between the project team members.							

11. The majority of our team members have strong interpersonal and communication skills.							
12. The project team is well trained and experienced for executing projects.							
13. Most of the project team has experience in product development.							
14. Most of the project team believe on their ability to deliver innovative products.							
15. The competencies of the team significantly influence the project delivery in terms of time and quality.							

<b>PART 3 : product development process</b>							
<i>Please tick one box for each item:</i>							
	Strongly agree	agree	Somewhat agree	Neutral	Somewhat disagree	disagree	Strongly disagree
1. The project team ensures selecting a knowledgeable user about the product contents to check the results and provide feedback.							

2. The project team does not emphasize the importance of involving users during the development process.							
3. The project team insures involving the user throughout the development process.							
4. The project team emphasize on the importance of face to face communication between team members.							
5. The project team and the user work closely allowing frequent face to face communication.							
6. The project team deals with changes positively during the project lifecycle, even in the final phase of the development process.							
7. The project team reflects all the needed changes expressed by the user in the development process, even in the final phase of the development process.							
8. The project team prevents changes of requirements as much as possible during the development process.							

9. All project team members work in one place allowing frequent and direct communication.							
10. The project team is self-organizing.							
11. The project team believes on the importance of investing on tools and technologies as they play a critical role in project success.							
12. The project team employs tools/technologies that facilitate fast development process							
13. The project team employs collaborative practices such as pair programming and unit testing to reinforce communication and knowledge sharing.							
14. The project team follows a strict development plan that does not allow any additions later on.							
15. The project team follows an iterative and incremental development process.							
16. The project team selects the development method							

based on project characteristics.							
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**PART 4 : product innovation**  
*Please tick one box for each item:*

	Strongly agree	agree	Somewhat agree	Neutral	Somewhat disagree	disagree	Strongly disagree
1. Our projects resulted of products/ software totally new to the market.							
2. Our projects resulted of some components or features new to the market.							
3. Our projects resulted of products/ software totally new to the organization							
4. Our projects resulted of some components or features new to the organization.							
5. Our projects deliver high value to the user.							
6. Our projects deliver high value to the organization.							
7. Our projects deliver high financial value to the organization.							



8. Our projects resulted of high user satisfaction.							
9. Our projects resulted of high quality products.							

<b>PART 5: additional comments</b>