How Agile Development and Its Tools Support Digital Transformation

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Abstract

Digital transformation is the enabler for new reform of businesses, socialites and governments. It is also the platform to the 2030 Vision in Saudi Arabia and in many other countries. Agile Manifesto succeeded to manage software development in a rapid and reliable fashion. Furthermore, incremental delivery of software release ensure that software audiences are engaged while delivering the product, their comments are considered in every function and any changes in requirements are based on imperial use of the software. This ensure the delivery of functionalities matching customer demandsas well as reduce project failure risk.For this reason, Agility has been adopted in most software companies as a guaranteed and easy way to implement the digital solutions for their companies.This paper examines the characteristics of agile frameworks, such as Scrum and XP, and Agile tools, such as Jira, Agilo, and others, that facilitate digital transformation. Then compare productivity and efficacy of agile frameworks with traditional SDLC methods. The paper is concluded with the features of agile framework that enable digital transformation such asincremental development, flexible requirements and customer engagement.

Keywords: Digital transformation, Agile development techniques, Agile development tools, and SDLC.

Introduction

Much attention has been drawn to digital transformation in all fields of business. And in order to address the topic, we must highlight its meaning first.

Some people may misinterpret digital transformation thinking that it is just the use of new programs. While others may focus on the limited meaning of transforming a company from paper-based company to an email-based company! And because the digital transformation is perceived differently by each company, it can be hard to clearly identify a definition that applies to all. However, Mićić attempted to define digital transformation as an "Integration of digital technology into a business that results in, sometimes fundamental, changes in business operation and delivery of value to customers.". [1] Digital transformation is an innovation in the process that companies follow in their business, it aids in reducing dull work and investing the time for planning the Therefore, digital transformation speeds up the daily work in a way that exploits vast technology to serve customers faster and better with fewer errors and more efficient work. It also increases workflow and number of members of your team without having the necessity to hire more.

In a nutshell, digital transformation is a way of capturing and controlling technology to serve people and customers. The rapid change in technology seen in the world in recent years has been one of the most important reasons for companies to keep up with this change, as customers tend to use digital media more. In order for companies to maintain their businesses, they must implement a digital transformation that ensures their business carry on and flourish.

Digital transformation reduces the effort and time of the companies and enables the work team to achieve their goals together easily and provides access for the institution's resources anywhere and anytime.

The importance of digital transformation is noteworthy for many reasons. One of which is the major role it plays in reducing the companies' overhead expenses especially the ones associated with the old solutions. Also, digital transformation helps in increasing the sales and productivity of the company and makes it more flexible and adaptable to meet the requirements of the market. Additionally, digital transformation helps the company to increase and retain customers. Since the company will be able to respond immediately to their requirements and resolve their problems and improve communication with them.

In order to overcome the obstacles of nowadays' business, software companies adopt agility to propose more value to stakeholders. Agility is based on the idea of value-driven development, in which there are frequent feedback and interaction between the stakeholders and the development team. And such interaction will carry values more swiftly. The frequency arises since development is achieved in redundancies, each of which represents a development cycle that lasts for seven to fourteen days. [2]

With agility and its tools. Companies and organizations will be able to save time and money through frequent feedback and development. In addition, there are two features that agility embraces and will help you accomplish a successful digital transformation: swift iteration and excellent outcomes. The use of agile and its methodologies such as SCRUM, KANBAN or Extreme Programming, in the new systems for the majority of companies is an established method since 2008. This is because Agile and its methodologies are adaptable to variable and non-fixed requirements for companies and their customers.[3]

Literature review

Most of the studies showed great emphasis on the importance of digital transformation these days due to the significant change which took place in the business world. For example, the study of Bondar et al. (2017), also the study conducted by Telegescu in 2018.Due to this change in the business world, many important requirements of companies are to be met including rapid responsiveness, adaptability. Consequently, some aspects of business were digitized in order to achieve these requirements. Digital transformation enables work teams to accomplish their tasks in their company easily and allows them to access to company resources anywhere, anytime.[4][5] In the same field, Cots conducted a study in 2018. He asserted the importance of digital transformation since it has a significant impact on the workflow within the organizations. In addition, it enables the organization to perform its tasks better at lower costs. Notably, the most important part of Cots's study is how they can apply the digital transformation with less risky steps that ensure at least the process will not fail eventually.[6]

As mentioned in Cots study, the importance lies in finding a good way to digitize the company. There are many ways to do so, but we will choose Agile as a methodology for digital transformation because we have discovered several features that facilitate this task for companies. Veiga's mentioned (2018) in his study that the majority of companies have adopted the use of Agile and its techniques such as Scrum, XP and Lean programming in their new systems as a method since 2008.

Since Agile and its techniques are adaptable to the inconsistent requirements of the companies, which will benefit the gradual digital transformation of the entire company. In 2014, Ming Huo et al. concluded that the use of agile ensures the quality of the product as well as the fast delivery of it. In the unstable environment of the requirements, it ensure that the product reaches the sought quality. And this is accomplished using Agile techniques. Also, Agile processes ensure product quality in the early processing stage.[7]

In his study in 2015, Ambler addressed the modern software processes, including Agile techniques, that help to develop work in a highly collaborative environment, which offers an effective performance to work teams within the organizations. Examples of these techniques are Scrum, Extreme Programming (XP) and Rational Unified Process (RUP). [8] Additionally, Ashraf has suggested (2017) techniques to solve problems related to software engineering, Scrum has been adopted as an effective one in software engineering. That is

due to its features that help increase the productivity of the organizations and helps the teams cooperate with one another. Scrum also has the ability to respond quickly to change and unstable requirements.[9]

Moreover, in their study, Ashraf & Aftab considered (2018) Scrum as one of the most important methodologies adopted by the majority of companies for the efficiency, adaptability to changes that occur later and reduction of the overall cost of change. It is also suitable for the development and the arising needs of software at present. In addition, it helps to strengthen communication and cooperation between the work team members.[10] In 2013, Crawford et al. conducted a study on extreme programming and concluded that using extreme programming has many advantages such as clarity for users and a simplicity of working. Also, it enhances team responsiveness and helps them to communicate with one another. The team can also have full knowledge of all aspects of the project, the current situation of it, the methods used and the responsibilities of each member within the team. XP is also provides a clear distribution of tasks and determine the roles of each member in the team.[11] Moreover, Ahmed also mentioned in study in 2018, that the use of Agile methods, including FDD, is less costly than other methods. It is also characterized by rapid delivery to customers. Furthermore, Agile methods also enhances cooperation within the organization in general and within the working team in particular. It also helps to solve the problems that the system encounters. In addition, it helps in the regular delivery of the product to the customer. [12]

Besides technologies, there are Agile development tools, which also have a role in facilitating Agile processes as well as the digital transformation. Taheri & Sadjadi offered (2015) a feature-based classification approach to help in choosing the best and most suitable tool when they created their comparison tables, focusing on 25 APM tools. In their classification, they considered some key factors which are accessibility, flexibility, responsiveness, features, category and pricing. Based on features of Agile software development tool and companies' needs, they came up with a model based on the cloud to select the best and most suitable Agile tool. They applied the following main Standards 1. the ability of cloud how can cover security indirectly, 2. Proprietary vs. open source, 3. teams in co-located vs. teams in Distributed places. [13]

In 2017 Bajwa & Kaur presented a comparison table of ten Agile project management tools then analyzed these tools based on their features, functionalities, their strengths and weak points. The purpose of their study was to provide a clearer picture of the tools and a brief summary of them. The result indicated that JIRA, BUGZILLA, ASSEMBLA and MANTIS as compared to other tools provided high level of project management features.[14] Another study addressed agile tools by Augustine (2005) offered a comparison between two agile tools: JIRA and Tuleap. Augustine used many related sources and went to experiment which installed the tool on the laptop and used them to have a good understanding of the tools. They advised using Jira for purposes of project management. Also, they asserted that companies invested in JIRA tool for it saved their time, effort and money.[15] Additionally, in another study conducted by Taheri & Sadjadi in 2015. They offered a feature-based classification approach to select the right cloud-based Agile tools. They provided results of 22 agile project management tools classified in a table with solution. Also they presented a case study to select the right Agile tool based on companies' needs and features of Agile software development tool.[16]

In 2012, Leau et al. provided a clearer picture of the tools and a brief summary of them, they conducted a study on SDLC and agile development SDLC. They see that agile SDLC better than traditional SDLC, but also has its disadvantages. They proposed some ways to improve to current agile. They also suggested some criteria to help the development team to choose the right SDLC.[17] Also, Stoica et al. presented (2013) an intensive research in the field of software development from traditional SDLC to agile. They conducted that any software system must be validated and tested before production and customers must be sure that the project functionality is correct and according to the project specifications.[18]

Comparing between Agile development techniques

Agile techniques can help companies in digital transformation by doing that in a faster and better way. In addition, they ensure quality for companies in carrying out the digital transformation process in an effective and safe manner.

Agile has several technologies that share the basic features of using Agile in digital transformation such as flexible, efficient and adaptable to changes... etc. However, they have a couple of differences between them. Each one has its own features and drawbacks. In this section, we will compare the most widely used techniques of Agile. (table1)

4.1. Scrum

Scrum is characterized by its high flexibility in implementation in projects. Since it focuses on the incremental delivery of the product. Also, it focuses on the work team itself so that it can adapt to changes that occur during the implementation of the system. [7]

4.1.1. Distribution of Roles and Responsibilities in Scrum

There are three roles in Scrum: product owner, development team, and scrum master.

- Product owner is responsible of product backlog, and he is the only one who can make change in product backlog.
- Development team is responsible of delivering incremental product.
- Scrum master is responsible for assisting and training the development team. Additionally, he is responsible for supporting them by eliminating what hinders the progress of their work.

4.1.2. Processes

- Development. The development in Scrum occurs in a repetitive manner. In this process, we define the new requirements that need to be modified in the system. Accordingly, tasks are distributed among the team members.
- Release. This process includes the final delivery of finished product releases.

4.2. Extreme Programming (XP)

XP divides medium or large processes into smaller parts so that they can be processed more easily and quickly. This process facilitated the completion of the project as a whole. Thus, less time is spent if it is on smaller parts instead of working for a long time on a complex process. In addition, it clarifies the distribution of roles and makes it easy to understand. [9]

4.2.1. Distribution of Roles and Responsibilities in XP

XP has several key roles: customer, coach, programmer, tracker and tester.

- Customers are responsible for making decisions when the project needs them. They write the user's stories and determine priorities. They also communicate with the team and write functional tests.

- Coaches have full knowledge about extreme programming in the project. They are prepared to solve problems and monitor the team performance.
- Programmers are responsible for coding all project tasks.
- Trackers are responsible for monitoring. They detect any problem that could face the software.
- Testers test the quality of the software.

4.2.2. Processes

- Planning. In this process, planning is usually done once a week in each release start. It includes the identification of requirements and the time of completion. It also includes the modification of requirements in this process.
- Exploration. In this process, the system requirements are converted to user stories to illustrate what to do and determine the duration to complete the story.
- Iterations. This process is a comprehensive review of the team progress. Accordingly, we modify what needs to be modified. In addition, we receive new user stories from the clients and discuss them.
- Maintenance. The performance of the system is monitored in this process. Additionally, changes in the system or business requirements are observed and processed.

4.3. Dynamic Systems Development Method (DSDM)

This technology aims to develop to the required quality. To achieve this, DSDM focuses on the interaction of customers and end users. It also focuses on independent development teams and comprehensive testing throughout the process, prioritizing the customer's requirement and incremental delivery of the product. [19]

4.3.1. Distribution of Roles and Responsibilities in DSDM

There are various roles that manage the project and solve the problems that face the project. These roles include Business Sponsor, Business Visionary, Technical Coordinator, Project Manager and Business Analyst.

- Business Analyst is responsible for analyzing the business and determining its requirements.
- Team Leader is responsible for supporting the team.
- Business Ambassador is responsible for setting and prioritizing the requirements.
- Solution Developer is responsible for converting the requirements into a format that meets the organization needs.
- Solution Tester is responsible for quality and testing in the project to ensure that the work meets the requirements.
- Business Advisor is responsible for guiding the project with enough knowledge in business.

4.3.2. Processes

- Feasibility study and Business study. The first process in the DSDM involves the study of the project. It is carried out in two consecutive phases: feasibility study and business study. It includes the preliminary study of the project and its requirements. In addition, it studies the general budget

for its implementation. Also, it studies the business requirements of the project and determine its priorities.

- Functional Model Iteration. The final determination of the requirements shall be made and arranged according to their priorities in this process. Also, we develop a workflow plan to deliver tasks on time.

- Design and build iteration. The built-in functions are reviewed and compared with the requirements that provided by the customer in this process. We also review the functions' effectiveness and their compatibility with the work environment.

- Implementation. In this process, the product is submitted for testing by the end user. After training users to use the product, their feedback is collected to ensure the quality of product and its effectiveness.

4.4. Feature Driven Development (FDD):

The of Feature Driven Development (FDD) in organization's projects ensure the quality. They are adaptable with new requirements as well as the highly flexible.

4.4.1. Distribution of Roles and Responsibilities in FDD

FDD contains six key roles as well as a number of other roles:

- The project manager who is responsible for managing the project from all its aspects.

- The chief architect who is responsible for designing system.

- The development manager whose responsibility is guiding and solving daily problems that come across the project.

- The chief programmers are responsible for analyzing and designing. They also manage the teams in the project.

- Class owners are responsible for creating the system including designing, coding, and testing.

- The domain experts are responsible for guiding the developer in the project.

4.4.2. Processes

- Develop an overall model. This process includes the initial identification of the project and its requirements. It also includes a full project review.

- Build a features list. In this process, the project is analyzed, and the functional requirements are identified therein. Then we start the project building. This process focuses on the customer in the analysis.

- Plan by feature. In this process, the features of the project are divided and arranged according to priority upon customer request. In addition, we set the due date of completion.

- Design by feature. This process takes one to two weeks. During which the project is designed, and work plans are developed.

- Build by feature. This is the last process in FDD. It includes coding and implementation of the project and testing the project after completion.

4.5. Adaptive Software Development (ASD)

This technique has been developed following the continuous change in the organizations to be able to adapt quickly to changes. It is used in large and medium organization sizes. [20]

4.5.1. Distribution of Roles and Responsibilities in ASD

- Facilitator is responsible o for controlling the meetings within the project.
- Producer is responsible for the development process of the project.
- Recorder is responsible for recording any notes that faced the project.
- Reviewer is responsible for testing the product and making the necessary changes. He also detects the errors in the product.

4.5.2. Processes

- Speculation. This stage includes a full understanding of the project to be implemented and an understanding of all that relates to it.
- Collaboration. This process focuses on cooperation between the team and the customer. It is interested in the communication within the team members, as well as with customers to complete the project effectively with higher efficiency and less risks of making mistakes.
- Learning. This process includes the final review of the product and the quality. It will be given to the end users to be tested. Then we collect feedback to evaluate the product.

	SCRUM	XP	DSDM	FDD	ASD
Project Size	All sizes	Small	All sizes	Large	Small
Team Size	3-9	2-10	2-10	4-20	Small to Large
Daily Meeting	Yes	Yes	No	No	Yes
Iteration Duration	4 weeks	2 weeks	-	2 weeks	4-8 weeks

Table 1: Compare Between the Most Widely Used Techniques of Agile

Comparing between Agile development tools and traditional SDLC tools

In recent years, with the increasing use of technology, software companies have become increasingly necessary for development. Most companies have turned to agile software development methods that facilitated a lot of work. The challenge remains in how companies can select the best tools to help them in the development process. The success of a project depends on the proper choice and right use of project management tools. Therefore, companies and organizations must select appropriate tools, according to their requirements, which will lead to better project performance [13][14]

There are many reasons to use APM tools, such as tracking the progress of workflows and defects effectively, increased productivity. Furthermore, if company has different works, it does not need to use different tools; an agile project management provides one tool with every feature. [14]

Through our review of many papers, we have found that a variety of APM tools exist, each with completely different functionalities, even if they share some common features. Therefore, companies absolutely rely on tool features when trying to choose.

In this paper, we selected and then compared seven tools from many papers, classifying those tools in two groups: modern APM tools (i.e., Jira, VersionOne, Rally, and Agilo) and traditional SDLC tools (i.e., Microsoft Project, Google Docs, and Excel). (table 2)

	Agile Modern Tools				Traditional SDLC Tools		
	JIRA	VERSION ONE	RALLY	AGILO	Microsoft project	Google docs	excel
Handle multiple projects	yes	yes	no	No	No	no	no
Time tracking	yes	yes	yes	No	Yes	no	no
Integration with other programs	yes	yes	yes	No	No	no	no
Native mobile App	No	no	yes	No	No	yes	yes
Bug Tracking	yes	yes	yes	Yes	Yes	no	no
Email notifications	yes	yes	yes	no	No	no	no
Dashboards	yes	no	yes	yes	Yes	yes	yes
Open source	No	no	no	yes	No	no	no
Lifecycle Coverage	Excellent	Excellent	Excellent	Good	Bad	Good	Bad
Simplicity & Ease of Use	Good	Good	Good	Good	Excellent	Good	Excellent
Collaboration	Excellent	Excellent	Good	Bad	Bad	Good	Bad
Analytics, and Reporting	Excellent	Excellent	Excellent	Good	Good	Bad	Good
Workspace and Process	Good	Good	Good	Good	Bad	Bad	Good
Program Management	Excellent	Excellent	Excellent	Bad	Bad	Good	Good
Deployment, Integrity and Security	Excellent	Good	Good	Good	Bad	Bad	Bad
Scrum & Kanban Supported	Excellent	Excellent	Excellent	Bad	Bad	Bad	Bad
Popularity on the web	Excellent	Excellent	Bad	Bad	Excellent	Good	Bad

Table 2: Compare Between Modern APM Tools and Traditional SDLC Tools

Many agile project management tools are available in the market. In this study, we chose four agile tools and three traditional SDLC tools for comparison. Tool selection was made based on our review of many papers. The tools reviewed are Jira, VersionOne, Rally, Agilo, Microsoft Project, Google Docs, and Excel. These tools have been compared on the basis of their features and functionalities.

Through this comparison, we conclude that modern agile tools have more support features than traditional SDLC tools have. Thus, modern agile tools are more suitable to use and provide more support for digital transformations in companies.

Agile vs SDLC in digital transformation

Agile methods and SDLC models are different. Agile methods (Scrum, XP …etc.) are based on adaptive software development methods, while traditional SDLC models (waterfall model, Incremental model…etc.) are based on a predictive approach. SDLC is a structured process in which it can't start a new phase until the previous one has been completed. While, Agile is a flexible process, it allows us to move through the project. SDLC often includes pre-defined requirements. On the other hand, requirements in Agile change and evolve. In SDLC , changing things that were done in a previous phase is impossible, but Agile is fixable to changes anytime. [18][17]

Nowadays, many companies have shifted from SDLC to Agile, they wanted to eliminate the stagnation phase which appear in SDLC. Companies are encouraged to use Agile Model, which has characteristics that make them a strong competitor in the market. We will mention some of these characteristics:

1. The Agile model uses an adaptive approach where there is no detailed planning and only clear future tasks are those related to the characteristics that must be developed.

2. The team adapts to dynamic changes in the product requirements. And the product is frequently tested, to minimize the risk of major flaws in the future.

3. Interaction with the clients is a strong aspect of Agile methodology.

4. Open communication and minimal documentation are typical characteristics of the Agile development environment.

5. Teams collaborate closely and often are located in the same geographical space. [18]

We found that Agile method can serve more efficiently in field of Digital transformation than traditional SDLC. We will be able to obtain the identified success factors in digital transformation like:

1. The creation of innovation areas.

2. Networking across company boundaries.

3. The motivation to try out new things and the active management of digital transformation in the company.

4. The ability to reduce the total IT employment, making the organization more frugal and allowing resources to be diverted into other (potentially revenue generating) parts of the business. [21]

Conclusion

In recognition of the importance of the digital transformation of companies at present, this paper examined the useful methods of companies that come to their aid in the implementation of digital

transformation. This paper particularly presented a comparison between the use of traditional SDLC tools and the use of Agile development methods. It has also compared the most widely used Agile development methods and tools. The study proved that using Agile will save a lot of time and effort for companies that implement digital transformation. It enables companies to perform operations flexibly without having to wait for the completion of the previous phase as it is in the traditional SDLC tools. The study also detected that the use of Agile development methods and tools provides many advantages due to its flexibility to help companies adapt quickly to the changes of the requirements, and to ensure its survival in competition with other companies.

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