Adopting an Agile Methodology in a Software Development Capstone Project amidst the COVID-19 Pandemic

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Abstract: The emergence of the COVID-19 pandemic has transformed lives and has brought societal changes with the "new normal" being the future of doing business. The academic community was not exempted from the implications of the outbreak with undergraduate students having to adjust during research and capstone projects. Even before the global health crisis, project teams have adopted various means to become flexible and be able to continuously deliver results in terms of software development. However, the spread of the novel coronavirus has disrupted the lives of many, which forced the majority to accelerate in adopting different ways to survive and meet study objectives. This study aims to present the benefits of applying an agile methodology in software development. In the course of their capstone project, the researchers adopted the Agile Scrum Methodology in developing a performance management system. Through this, the project team was able to work concurrently and constantly produce deliverables that are aligned with customer requirements. The researchers recommend the adoption of an agile methodology in software development projects as the world moves forward with the new normal.

Key Words: COVID-19 pandemic, software development, agile methodology, scrum, capstone project

1. INTRODUCTION

In the beginning of 2020, the novel coronavirus (COVID-19) had spread rapidly across different countries, resulting in the declaration of the COVID-19 pandemic. (WHO, 2020) The global health crisis disrupted millions of lives globally as well as affected organizational functions and growth chances. Different sectors were affected by the implications of the global pandemic, one of which is the Education sector. This gave rise to online learning as a response to the lockdown and quarantine implementation that brought limitations to people's movement in hopes to reduce the chances of local transmission. Three years after the COVID-19 pandemic emerged, the academic communities, along with the other aspects of the society, have been forced to constantly adapt to the new normal while carrying learnings that will outlast the pandemic. Some educational institutions especially, private universities and colleges such as De La Salle University, were able to adjust as flexible learning programs were practiced, introducing blended learning even before the pandemic through maximizing technologies like learning management systems (LMS). However, there were still several challenges being encountered by teachers and students alike. The pandemic has impacted undergraduates with graduating students having to

proceed with their research and capstone projects in the midst of online learning. In the College of Computer Studies, research groups or projects teams were forced to develop new strategies and to adapt in working remotely in order to complete capstone projects in software development. In the Information Technology (IT) Department of the College of Computer Studies (CCS). Various agile methodologies have been the popular method among capstone projects during the pandemic as it enabled teams to work well even in remote settings.

There are different methodologies applied in software development projects with the Agile Methodology being one of the widely used models.

Agile Methodology

Agile is a highly adaptive approach that facilitates collaboration and coordination during a software development life cycle. Many companies have adopted the Agile Methodology as traditional approaches introduce restrictions, which the former addresses such as the ability to adapt to customer needs that constantly change with minimal to no risks or costs. (Altameem, 2015) It is considered a lightweight method that enables fast response to changes in client requirements during development. (Al-Saqqa, Sawalha & Abdel-Nabi, 2020)

Scrum

Agile approaches are derived from the Agile Manifesto, a document written by several development practitioners in 2001. (Beck et al., 2001) Scrum, one of the most popular frameworks developed to implement the Agile philosophy, is an agile model that emphasizes teamwork and focuses on developing features which are implemented in short iterations at regular intervals. (Heimicke et al., 2021; Munteanu & Dragos, 2021) The methodology enables and increases stakeholder engagement, allowing them to collaborate with the development team in every phase of the life cycle and see tangible results. (Altameem, 2015)
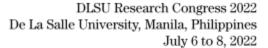
The purpose of this research is to describe the means in which the researchers adopted an agile methodology in a software development project, and present its benefits to future researchers or project teams conducting studies on similar projects.

The study is specific to the experiences of the researchers in which the methodology might have to be altered for other projects.

2. METHODOLOGY

The capstone project of the research proponents is a performance management system consisting of several modules and features based on the needs of a client company. In the process of working on the capstone project, the researchers applied the Agile Scrum Methodology to aid them during the development process. As the pandemic forced the team to work on the capstone project remotely, instant messaging and video call platforms such as Facebook Messenger, Discord, Zoom, and Microsoft Teams were utilized by the team in order to communicate and coordinate. These platforms also allowed the team to hold their scrum meetings, address backlogs, as well as hold meetings with the client to show the system and address their concerns. Online collaboration tools were also used such as Google Docs, Google Sheets, Canva, and Notion which allowed the team to to work together and work on tasks asynchronously despite being on different locations and having different schedules.

In Scrum, small developmental increments are known as "sprints." Dividing long term goals into short term ones aided in focusing on and managing certain backlogs at a given time. Sprints were then created to easily divide the modules that were needed to be accomplished. Depending on the complexity of expected results, the duration of interactions ranges from six to eight weeks. The Scrum team consisted of a Product Owner, the project's key stakeholder; a Scrum Master, the leader of the Development Team; and the Development Team.

Sprints began with Sprint Planning where the researchers communicated with the Product Owner to be able to lay out the work to be completed. Subsequent Sprint Planning events involved determining the project backlog items to be performed during each sprint. During this scrum event, the researchers also identified the responsibilities of each team member and decided on how expected deliverables will be accomplished. Individual responsibilities were interchangeable to allow the team to increase productivity since there were additional tasks to perform based on client feedback. A project management tool - Notion, was utilized by the researchers which enabled the organization to track and manage the project while working remotely. In the duration of each sprint, designing, implementing, and testing were performed. Stand-up meetings, a scrum event, were also conducted to help the researchers decide the next steps that would be needed in order to make adjustments based on issues being encountered and to consequently, complete the deliverables. A scrum board within the project management tool was used to monitor the progress which were updated based on the discussion during stand-ups. The scrum board consists of (1) project component where the researchers categorize the activities that are needed which are either for wireframe, database, dashboard, development, or for documentation, (2) the activity that is needed, (3) the person assigned to the activity, (4) the deadline, (5) status of the activity, and (6) comments for the tasks. For each activity, there was a To-Do list containing detailed tasks that were needed to be completed which helped in increasing progress visibility. Throughout the sprint the researchers utilized different testing techniques which helped them in ensuring quality deliverables. Some examples of these testing methods include Unit Testing, and Integration Testing to name a few. Weekly remote meetings with the Product Owner were also held through Zoom, in order to demonstrate the progress that had been made, as well as receive feedback regarding the design and functionality of the deliverables. This made applying feedback more efficient as the feedback is received right away instead of delaying the task until the end of the sprint. It was beneficial for the proponents that meetings were held through video call platforms as they would not need to physically visit the client in the office. It allowed the team and the client to be more flexible with their time of meeting. Using the Agile Scrum methodology allowed the client to really be involved with the project. The methodology allowed the proponents to gather feedback from the users and address their concerns. It was also easy for the team to communicate with the client when they would have questions as they can reach the client via online messaging applications. These meetings served as the Sprint Reviews wherein the proponents were able to closely work with the client, receive input, and request for their approval with the output being qualitative User Acceptance Testing (UAT) results. The feedback gathered from the meetings with the Product Owner led to updating the Product Backlog in the scrum board in which the development team integrated recommendations in the development of the system.

After each sprint, the project team conducted Sprint Retrospectives which gave them the opportunity to identify areas of improvement, and discuss changes to be made in order to improve in the next sprints.

For every sprint, the following steps were conducted by the researchers to ensure that the sprint was planned properly and expected deliverables are aligned with client requirements.

1. Sprint Planning
2. Design
3. Develop/Implement
4. Test
5. Sprint Review
6. Sprint Retrospective

A project timeline was developed and followed to map out the amount of time allotted for the completion of the tasks within the period given to the researchers to accomplish the whole project.

3. RESULTS AND DISCUSSION

3.1 Benefits of Agile

Agile methodology was utilized by the researchers and through this method, they were able to plan ahead of time with the stakeholders' different requests. Researchers were able to respond to changes by following a plan, which made the development process more adaptable to improvements and revisions. Based on agile methodology as well, the researchers were able to arrange time frames for each module that the researchers divided based on the requirements and requests of the company.   This in turn, gave the researchers space within their time frame in case certain tasks were not completed. Through agile, the researchers and the product owner were able to fully communicate and collaborate with each other thus improving the quality of the product which was being developed.
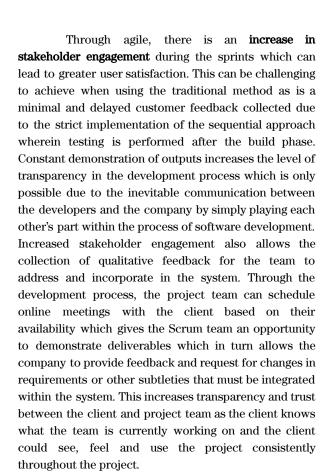
3.2 Agile in Software Development

Software development involves building products based on customer requirements. If the researchers used a traditional methodology such as the waterfall model, the project must have been planned in advance and all requirements must have been initially laid out which will be the basis of design and implementation. (Al-Saqqa, Sawalha & Abdel-Nabi, 2020) It follows a sequential design process wherein planning, analysis, design, building, testing, deployment and maintenance are the phases involved. This is not suitable for the development of a performance management system project due to the nature of the requirements. Thus, adopting a heavyweight approach could produce an insufficient product for the customer. Performance Management is affected by both external and internal factors. With the emergence of the pandemic, the company is continuously being driven to modify targets as well as activities in order to meet organizational goals.

Through using agile methodology, the researchers were able to **welcome changes in requirements** and develop the system in multiple iterations based on the needs of the company. The Business and Livelihood sector, among other sectors, have been impacted by the implications of the pandemic wherein there is the need for them to modify goals as well as strategies, thus, software development projects developed for businesses are also affected by these modifications. Due to the changing nature of the project's requirements, the ability of being adaptive to changes allows the team to produce deliverables for the company's performance management needs. In the traditional method which follows a sequential structure, the requirements are agreed upon in the beginning of the process. Thus, it is not flexible in terms of incorporating new findings once the development process begins, whereas agile embraces unpredictability. Receiving constant customer input is a showcase that the needs of a client can change and that new features can be requested to be added which can be beneficial to their end. Within the research and development stage, the company tasked the developers to not only improve the user interface and user experience of using the software but to also improve and add extra features which were not present within the company's old system. With agile methodology, the project team and the client could identify issues and feature deficits early in the process. This in turn, addresses organizational problems at the same time, avoids wasting resources from both the client and developers.

In addition, breaking down a project into different sprints can enable the team to **focus and manage tasks in small increments at a time.** In the IT department, capstone projects are divided into two (2) school terms wherein specific functionalities are to be completed for each term. When creating and implementing the schedule and timeline of activities, having sprints is beneficial in allowing the team to reorganize priorities, make necessary adjustments, and deliver results that meet client requirements. Having pre-defined phases during the process may limit the ability of the project to adapt to changes.

Through agile, there is an **increase in stakeholder engagement** during the sprints which can lead to greater user satisfaction. This can be challenging to achieve when using the traditional method as is a minimal and delayed customer feedback collected due to the strict implementation of the sequential approach wherein testing is performed after the build phase. Constant demonstration of outputs increases the level of transparency in the development process which is only possible due to the inevitable communication between the developers and the company by simply playing each other's part within the process of software development. Increased stakeholder engagement also allows the collection of qualitative feedback for the team to address and incorporate in the system. Through the development process, the project team can schedule online meetings with the client based on their availability which gives the Scrum team an opportunity to demonstrate deliverables which in turn allows the company to provide feedback and request for changes in requirements or other subtleties that must be integrated within the system. This increases transparency and trust between the client and project team as the client knows what the team is currently working on and the client could see, feel and use the project consistently throughout the project.

In addition, using the agile scrum methodology can help **determine issues and make necessary changes** in order to resolve them as unsolved problems may hinder the development process. Project team members are also able to work on different tasks simultaneously to complete a Product Backlog and constantly deliver value to the stakeholders. In the case of the proponents being a four-member team, using an agile approach allowed responsibilities to become interchangeable between members wherein there is a **mindset of collaboration and communication** while meeting requirements and resolving concerns during the process.

What also makes adopting the agile approach in software development beneficial is that the **demand** for different products or services are ever changing especially since the products or services being given are technological solutions. The said demand is also magnified due to the spread of coronavirus disease which led to communities being under lockdown with companies having to adopt work-from-home policies. Through the building and improvement of a product within the development phase, less time will be consumed, and costs may be reduced. Customers, such as a company, may be able to use a product in a usable condition after a sprint which will give themselves a competitive advantage and be able to be more productive compared to using outdated systems that do not meet their needs.
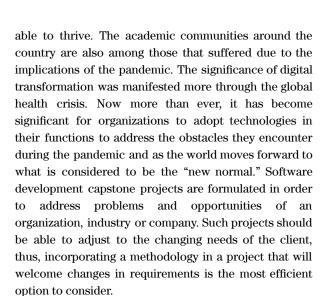
To summarize the differences between the agile and traditional methodologies, see Table 1 Traditional SDLC versus Agile Comparison Table.

Table 1. Traditional SDLC vs Agile Comparison Table

Factor/ Element	Traditional SDLC	Agile Methodology
Structure	Sequential	Iterative
Project Scheduling	Based on pre-defined phases	Project is broken down into sprints
Planning	Performed at the pre-development stage	Incremental, reflecting change in decisions and requirements over time
Approach	Focus is on accomplishing the project	Focus is on delivering value based on client needs and demands
Team Responsibilities	Fixed per member	Interchangeable between members
Adaptability	Fixed scope and requirements, challenging to initiate changes	Flexible, adaptive
Client Feedback	Minimal and delayed	Product is regularly evaluated

4. CONCLUSIONS

The COVID-19 pandemic introduced various challenges to society, with different sectors having to adjust to be

able to thrive. The academic communities around the country are also among those that suffered due to the implications of the pandemic. The significance of digital transformation was manifested more through the global health crisis. Now more than ever, it has become significant for organizations to adopt technologies in their functions to address the obstacles they encounter during the pandemic and as the world moves forward to what is considered to be the "new normal." Software development capstone projects are formulated in order to address problems and opportunities of an organization, industry or company. Such projects should be able to adjust to the changing needs of the client, thus, incorporating a methodology in a project that will welcome changes in requirements is the most efficient option to consider.

The agile approach to software development facilitates continuous delivery of results based on customer needs. It allows necessary adjustments to be made based on the changing requirements while reducing possible risks and costs. The use of collaboration tools will allow project teams to work concurrently without having to be in one location.

In conclusion, this study has presented the valuable learnings of adapting Agile Methodology in the development of a performance management system, a capstone project, even during the pandemic. However, it must be taken in consideration that in order to efficiently manage a project, the project team must select the applicable software development methodology and make necessary modifications suitable to the existing project to gain the best results as each methodology has its own strengths and weaknesses. Further study must be conducted regarding the adoption of agile scrum methodology in other software development projects as the existing method used was based on what was applicable to the project being managed by the researchers.

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