The effectiveness of agile management on traditional projects within public organizations

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Abstract. After the coronavirus pandemic, we must look for the notion of an agile methodology as one of the ways that supports the restoration of our businesses to what they were and even better; this is critical in order to remedy and grow the global economy once again. The notion of agility has been traditionally present, however, it was engaged only for IT and software projects. As this concept has been validated further during the pandemic, this methodology can be increasingly applied in different types of projects, such as construction projects and other infrastructure projects. With the growing adoption of agile methods, project managers at public organizations increasingly need to realize its applicability to their projects and the aspects that drive key project performance features. On the one hand, many firms confirmed that agile methods solved their difficulties during the pandemic, particularly in addressing changes due to unstable and unpredictable needs. On the other hand, some other firms have continued to struggle, arguably because of not practicing agile approaches. Consequently, this paper attempts to examine the effect of agile methodologies on the processes involved in traditional project management within public organizations, which it does through applying a qualitative method. Furthermore, this paper will explore how this methodology can allow project managers to evaluate the applicability of using an agile method within public organizations, especially for construction projects and other infrastructure projects.

Keywords. Agile methodologies, Combined project management, Kanban, Scrum, Traditional project management.

1. Introduction
As business processes are very complicated, opportunities are very dynamic and competition is global and intense, traditional approaches in project management need to be more advanced and new methods need to be developed, such as agile management. This is particularly relevant in terms of agile concepts being practiced in new fields, rather than just the software area. [7] Though agile approaches are gaining recognition amongst traditional systems of development in different organizations, most of these organizations seem to indicate a preference to adopt both methods of development. [8]
Thus, this paper aims to demonstrate that the traditional approaches can be combined with agile approaches in any type of projects, such as those typically implemented by public organizations.

1.1. Aim of the research
The objective of this research is to examine the effectiveness of agile project management within the traditional projects, such as construction or infrastructure projects, within public utilities.

1.2. Motivation of the research
In order to accomplish this research aim, there were some questions that had to be explored, as per the following:

- What is the best way to apply agile methodologies for traditional projects, such as construction or infrastructure projects within public utilities?
- What is the impact of agile methodologies on the processes involved in traditional project management within public organizations?
- What are the roles of project managers within the agile project management?
- How are the agile manager roles different from the traditional manager roles? [1]

2. Theoretical Background
This paper is focused on two main project management approaches, which are the traditional waterfall methodologies and agile methodologies including Scrum and Kanban. Therefore, we need to know more about the traditional and the agile approaches (Scrum and Kanban); to select the best framework that can be used in this research and is most likely to be successful in the public project context. Thus, in the coming section there will be a more detailed discussion about these concepts.

2.1. Project Management
According to PMBOK Guide, project management is the application of knowledge, skills, tools and techniques to project activities to meet the project requirements. [2] pg (10)

2.2. Traditional Project Management (Waterfall) Practice
The traditional approach of project management (Waterfall) is the predictive life cycle of the project, with the bulk of planning occurring upfront, then executing in a single phase; a sequential process (e.g., analyze, design, build, test, and deliver). [3] As a result, project activities are executed in a serial way, as shown in figure 1.

2.3. Agile Methodologies
Agile methods and approaches are umbrella terms that shield a range of frameworks, practices, techniques or methods, in which all of those approaches are considered to be lean, since lean thinking concepts are involved, (e.g., small batch sizes, eliminating waste, focused on value). Moreover, agile life cycle can be defined as an approach that is both iterative and incremental to refine work items and deliver frequently, where the iterative life cycle is an approach that allows feedback for unfinished work
to improve and modify that work, and the incremental life cycle is an approach that provides finished deliverables that the customer may be able to use immediately. [3] According to the Agile Practice Guide Book, there are four values of the agile manifesto, [3] which are:

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

Example of agile methodologies include SCRUM, Lean, XP and KANBAN. There are many differences amongst the traditional method of working and the agile style of working. Table 1 below shows the main differences between them. [1]

### Table 1. Comparison table between traditional and agile methods [1]

| Categories             | Traditional (waterfall) | Agile       |
|------------------------|-------------------------|-------------|
| Development model      | Traditional (Phases)    | Iterative   |
|                        | Predictive              |             |
| Management             | Controlling             | Facilitating|
| Focus                  | Process                 | People      |
| Developers             | Work individually within team | Collaborative or in pairs |
| Customer involvement   | Requirements gathering and delivery phases | On site and constantly involved |
| Product features       | All included or nothing | Most important first |
| Technology             | Any                     | Mostly object oriented |
| Testing                | End of development cycle| Iterative and / or drives code |
| Documentation          | Thorough                | Only when needed |

#### 2.3.1. Characteristics of hybrid life cycle

A hybrid method is a combination of predictive, iterative, incremental, and agile methods. It is very important to know which approach to utilize for achieving certain goals. [3] Therefore, if the waterfall approach is too inflexible, and the agile too liberated, maybe the hybrid method can work better for the project team. Especially as the hybrid method made it easier for the project team to identify the critical development path, and still complete tasks in ‘sprints’ while maintaining product quality. [3][4][5]

A hybrid approach in project management with both traditional and agile practices may be the most valid approach as concluded by Fernandez and Fernandez [6] in their study; moreover, the agility is the way to improve productivity, reduce production costs, customer satisfaction and product quality. [6]

#### 2.3.2. Combined agile and predictive approaches

Another approach to consider is the combined agile and predictive approaches during the project life cycle. In which, a combined agile and predictive approach practiced simultaneously, or a small agile approach is used within a largely predictive approach, or vice versa as shown in figure 2.
2.3.3. Scrum method

The Scrum method is one of the agile methodologies developed by Jeff Sutherland and formalized by Ken Schwaber in 1995. [1]

Scrum is an agile framework that supports providing the desired business benefits in the shortest time. It repeatedly and rapidly reviews actual work of the product. It emphasizes iterative progress of the product and highlights teamwork. Its aim is to provide a new product every 2-4 weeks. [10]

The product owner, scrum master and the team are involved in the scrum process. The product owner’s role is to maintain the right business perspective; the scrum master works with the product owner and facilitates the team, and the team should contain five to 11 members (+ two). [1] [10]

In the scrum approach, the activities include sprint planning, sprint meetings and scrum review. A sprint normally lasts two to four weeks. The scrum master leads a daily 15 minute meeting where each team member briefs about their progress and challenges. The sprint review meeting reviews the previous sprint in terms of achieved activities and the coming sprint details are defined. [1]

The artifacts developed are called product backlog, sprint backlog and burndown chart, where the product backlog is a list of product features and it is maintained by the product owner. On the other hand, the sprint backlog, is about the developed tasks, which are required to implement a feature and is a subset of the product backlog. Finally, the burndown chart is a chart used for showing the total work remaining in the sprint. [1] [3]
2.3.4. **Kanban method**

Kanban is a visual system for managing work which was introduced by David J. Anderson in 2004. It pictures both the actual work and the process for small IT teams. The key goal of applying Kanban is to identify possible struggles in the process and fix them. Kanban aims for a workflow that should progress well and at optimal efficiency [10]. The core practices of Kanban are the following [9] [10]:

- **Visualize the flow** of work via using cards or software, as shown in the Kanban board in figure 4.
- **Limit work in progress** (WIP) by encouraging the team to finish current work first, before taking up new tasks.
- **Manage and measure flow** by noticing the work as it flows through the swim lanes and addressing any bottlenecks.
- **Make process policies explicit** via diagraming the process rules and guidelines.
- **Apply feedback** loops during the work process and reviewing team and customer feedback.
- **Continuous improvement** by expanding collaboratively and experimenting, as a team joins enhancement initiatives.

![Kanban Board](image)

**Figure 4. Kanban Board [9]**

2.3.5. **Comparison between Scrum and Kanban methods**

The comparison between the Scrum and Kanban methods can support the agile team members in their choice for a multitude of purposes. Therefore, the threat of project delays can be reduced. The same can be tacked via some major factors like the method prescription, roles and responsibilities, team size, adoption time, feature size, batch, prioritization requirements, lead time, technical practices, quality and cost. In sum, the key points are as per the following [10]:

- Scrum is an agile process that allows us to focus on delivering business value in the shortest time, while Kanban is a visual system for managing software development work.
- Kanban method raises continuous enhancement, efficiency and productivity.
- Scrum is focused on the backlog, while Kanban on a dashboard.
- The scrum master acts as a problem solver, while Kanban encourages every team member as a leader and sharing responsibility amongst them all.
- Scrum prescribes time-boxed iterations, while Kanban focuses on planning a different duration for individual iteration.
- Both Scrum and Kanban have no technical practices.
- Scrum avoids cost saving, but focuses on knowledge, decision making and experiences, unlike Kanban, which focuses on cost cutting.
- Predefined roles and responsibilities are required for Scrum, but Kanban does not need predefined roles and responsibilities.

### Table 2. Comparison table between Scrum and Kanban methods [9]

|          | Scrum                                      | Kanban                                    |
|----------|--------------------------------------------|-------------------------------------------|
| **Origin** | Software development                        | Lean manufacturing                        |
| **Ideology** | Solve complex problems while delivering valuable products | Use visuals to improve work flows and processes |
| **Practices** | Sprint planning, Daily scrum, Sprint review, Sprint retrospective | Virtualize the flow of work, Limit work in progress, Manage flow, Make process policies explicit, Improve, experiment |
| **Roles** | Product owner, Scrum master, Development team | No formal roles                           |
| **Metrics** | Velocity, Throughput                        | Cycle time, Throughput                    |

### 2.4. Introducing agile in traditional project management
A study done by Danijela Ciric et al. [7] addressed all the strategies and actions needed to implement agile project management into a traditional method from multiple studies. The study concluded them as followings [7]:

- How Agile really works: agility methods do not necessarily fit every project, thus we need to understand it very clearly, and to learn the common software projects characteristics.
- Tailor the agile approach wisely: not every firm is similar in its nature, they have their own challenges during deploying the agile method. Accordingly, every firm needs to reflect upon its own environment, when choosing an agile method to apply.
- Build up processes instead of tailoring them down: via defining the project’s needs and choosing of only those processes that appear crucial.
- Piloting: it is recommended to start small when introducing an agile method and gradually introducing it into small processes or departments rather than making a complete change; to be more effective.
- Commitment to changes and team autonomy: the right people, dedication and commitment and acceptable authority are the most important factors to be an agile team and should be defined from the start.
• Leadership success: a leader’s personality profile is essential for agile project management; since it needs to focus on people and collaboration, especially with embracing changes.
• Roles and responsibilities: define all the roles and responsibilities that will be addressed with agile approaches.
• Set architectures: architectures shall support classification of traditional and agile teams.
• Redefine and realign traditional milestones: traditional milestones to be redefined and realigned with the iterative approach.
• Risk evaluation: risk is a key element to be considered during the project implementation, especially the risks of too much agile and to little traditional or vice versa.
• Flexibility: flexibility is a very important factor when change is frequent. Therefore, it needs to be applied to projects selectively, to deal with uncertainty.
• Keep the looping back: for projects beyond software development, it is very difficult to deal with changes, thus, it is required to find a way to modularize the tasks and work iteratively.
• Negotiation and setting expectations: in agile methods the team along with the client need to test the product after each iteration and gather feedback; thus, negotiation and setting expectations are very important elements in the agile approach.
• Critical options: the ‘last responsible moment’ technique is very important in helping make a better decision by the time the last responsible moment arrives, as this tool allows project managers to define a decision that is uncertain at the moment and that might change later on.
• Agile top-management: top senior and executive support is a very important element to successfully implementing the agile approach.
• The barriers: it is recommended to destroy the barriers for better agile behaviors, since agile needs changes as all stakeholders to be on the same page.
• Learning mode: coaching and training teams during agile method implementation is a crucial factor in change.

2.5. Agile and traditional project management reasons and challenges
According to a study done by Danijela Ciric et al. [7], a number of facts are defined; for instance, there are a number of industries utilizing agile project management beyond software applications. Moreover, there were a number of reasons to implement agile methods in and beyond software projects, where the most common reasons were accelerating project/product delivery and enhancing ability to manage changing priorities. While most significant challenges faced by the utilization of agile methods were work prioritization, long feedback loops, alignment among stakeholders on what to build next, incompatibility of agile methods within organizational functions and insufficient time for testing. In sum, there were a limited number of different reasons and challenges in and beyond software projects, as shown in figures 6 and 7. Thus, the study recommended to do further empirical research on the use of agility methods outside IT projects. [7]
Figure 5. Reasons to introduce agile project management [7]

Figure 6. Challenges in agile project management application [7]
In additional, another study done by Vinekar et al. [8] mentioned that there were obstacles in using both agile and traditional methods; this is because client features and project features vary, and it is hard to change the systems development of a firm’s own features from project to project. The main challenges can be addressed at four levels: the management and organizational level, people level, process level and finally at the technology level. Table 3 shows the summarization of the characteristics of these two methods. They concluded that organizations could earn more benefits via utilizing both agile and traditional systems development. Moreover, the explorative and exploitative ability are very high in case of use of both agile and traditional approaches in project management, as shown in figure 7. [8]

| Management and organizational | Agile Subunit | Traditional/Stable Subunit |
|-------------------------------|--------------|---------------------------|
| Management and organizational | Leadership and collaboration | Command and control |
| People                        | Cooperative  | Autonomous                |
| People                        | Flexible     | Disciplined               |
| People                        | Manager as facilitator | Manager as planner |
| People                        | Tacit knowledge | Explicit knowledge |
| People                        | Team reward systems | Individual reward systems |
| People                        | Collaborative work | Individual work |
| People                        | Multidisciplinary skills | Specialized skills |
| People                        | Pluralist decision making | Managerial decision making |
| People                        | High customer involvement | Low customer involvement |
| People                        | Small teams   | Large teams               |
| Process                       | People centric | Process centric |
| Process                       | Speculative   | Standardized             |
| Process                       | Assess progress | Measure progress |
| Process                       | Evolutionary development | Life-cycle development |
| Process                       | Write tests prior to code | Write code prior to tests |
| Process                       | Individual approach to projects | Unified approach to projects |
| Process                       | Adaptable     | Preplanned               |
| Process                       | Iterative     | Linear                   |
| Process                       | Short durations | Long durations |
| Technology                    | Object oriented | Structured or object oriented |
| Technology                    | Tools for iteration | Standardized tools |

**Table 3.** The ambidextrous system development organizations [8]

**Figure 7.** The association between explorative and exploitative abilities for systems development organizations [8]
3. Research Framework

According to the literature background and after knowing most of the possible types of methodologies in detail that can serve project management, and whether to select agile or flow like waterfall approaches in managing projects, all depends on the objectives and goals of a certain project. As per the literature that no methodology is perfect and they have their advantages and disadvantages. Therefore, advanced organizations are increasingly leaning toward the combined approach, which combines the benefits of both.

However, the agile-waterfall framework aims to maintain the dependency tracking and systematic approach of waterfall, whereas at the same time integrating the powers of the ‘agile’ methodology – flexibility and transparency are required for regulating the customer’s fast-changing desires. [4] [5]

Therefore, this study examines the impact of the combined agile and traditional waterfall approaches on the ultimate project gained outcomes.

Moreover, the framework proposed for this study includes Scrum and Kanban that can be used together along with the combined agile and waterfall approach, as shown in figure 8. Where, both the Scrum and Kanban (Scrumban) frameworks have emerged. Adding Scrumban influences both frameworks can complement each other to better embrace agility, to enhance what is missing in each method, to facilitate higher performance in teams and enabling continuous process improvement. This is particularly relevant as Scrum provides a way for iterative and incremental development process, whereas Kanban ensures more visibility of the workflow and the quick identification of possible bottlenecks. Furthermore, by applying both frameworks many benefits can be secured, mainly from a people perception (e.g., fostering improvement and collaboration via feedback and concentrating on delivering business value). [11]
4. Research Methodology Outline

This paper intends to make use of qualitative research method with the following major elements [12]:

1. The data can be taken from various sources as well as interviews and the most common observations.
2. Using different analytic and interpretation procedures can be used to reach theories.
3. Written and verbal reports.

4.1. Agile project management experts
In this part, interested parties will be identified (e.g., agile experts) for interviews and observations, and for companies, project teams, and firms that work in agile communities.

4.2. Interviews
For the interviews section, we need to gather information about the research topic, wherein we will conduct interviews with them. The research plan is to follow projects with 6 to 24 months, and embrace interviews at important phases/milestones of the projects; in order to capture the holistic view of agile project management during the entire project life cycle.

Figure 8. Collaborative (Hybrid) model (source: http://www.softwaretestinghelp.com)
4.3. Data collection
The data collection part will be done after collecting the data and analysis of this data will begin to set the grounded theory for the study. All the data collected will be dealt confidentially.

4.4. Developing the theory
The study was built based on a qualitative method; to develop the grounded theory. Accordingly, there will be in depth analysis of all the information gathered to reach the study theories. All the research methods are to be applied (e.g., validating data).

Conclusions and future work
According to many research projects conducted on agile approaches and from growing practices of agile methods in many organizations, all that leads us toward thinking about the importance of the agile approach and the needs to explore agile project management. This study wishes to examine the proposed combined framework and check the impact of the agile methodologies on the processes involved in traditional project management within public organizations, and if there are benefits of using the agile approach within traditional methodology, beyond software projects. Finally, as many organizations are adopting agile methods, the authors of this paper have to develop a deeper knowledge and a comprehension awareness about the benefits of using a combined method of agile and traditional project management and serious issues - if any - to be addressed during utilization of the similar approaches.

Acknowledgements
We thank all those anonymous referees for their useful suggestions and helping to publish this work.
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