

Implementation of Agile Management In The Construction of Different Infrastructure Projects

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Abstract- Agile methodology is a type of project management process ,mainly used for software development, where demands and solutions evolve through the collaborative effort of self-functional teams and their customers. During the past few decades ,fundamental changes have taken place in project development ,planning and execution .This has taken from with embracing new techniques such as various agile project management ,instead of using the traditional waterfall project management This thesis paper will discuss and finding out the reasons for delay in two different constructions project and apply agile management methodology where the delay is identified in this construction works .Also will prove the scope of agile management in construction industry in future.

Keywords- Construction sites, Agile project management

I. INTRODUCTION

Agile project management has its roots in the software development industry, and it has developed through empirical progress. This methodology's uses are not limited to that industry. It defines values and principles that can be adopted by other industry as well. Moreover, it includes different tools and methods of conducting a project, which willlead to follow its values and principles. The agile methodologies are widely used by the software development industry where the customer recognized his need and improving it by repeated tests.

A traditional concept of management, the responsibilities and authorities are defined in a hierarchy so if a middle level chain is broken than the ground level subjects are failed. In agile concept, the basic belief is to keep all responsibilities & authorities on the same level such that even if there is a failure in single subject, the remaining subject can work efficiently in their sectors.

Utilizing agile methods to develop and implement systems has improved the speed in which companies meet market demands. Given the relative newness of the agile project management approach, some research exists, but much more is needed to understand how the backbone components

of agile project management can be used in a construction project development process

The objective of this thesis is to develop a framework to reduce time overrun in the construction project by applying Agile Project Management (APM) methodology and proves the scope of AM in future.

II. EVALUATION OF AGILE PROJECT MANAGEMENT

Agile project management has its foundations in the management science of Deming but perhaps harks back to pre-industrial revolution times, before decomposition and management-as-planning took a hold. The real progress today lies in the domain of information systems; however, it may be possible to migrate the core attributes to other domains, including construction.

AGILE MANUFACTURING

Iterative and incremental development methodologies were first defined by Shewart in the 1930s and then expanded upon by Deming in Japan (1982), focusing on causes of deviation and acting on those causes. Indeed, the PlanDo-Check-Act (PDCA) cycle is still being used in Toyota product development (Liker, 2004) and conforms to the scientific experimentation model of control. However, in the field of information systems, anarchic ad-hoc code and fix developments of the 1960s led on to the welcome embrace of Royce's sequential (or waterfall) development method in 1970 (Royce, 1970). Unfortunately, the iterative aspects of Royce's paper were largely ignored or misapplied; rigid adherence to early definition and fixing of system and software requirements resulted in errors being propagated and compounded throughout projects, leading to widespread failures in delivered value. Several voices (notably Gilb's and Boehm's) were raised against such an approach to information systems development in the 80s and early 90s. (Futrell et al., 2002) The work of Imai, Nonaka and Takeuchi (1986) was a catalyst to the establishment in 1990 of a US Department of Defense and National Science Foundation funded study at

Lehigh University to investigate the competitive environment of 2005 and beyond. This study was a response to greater efficiencies achieved by Japanese industries, and led on to the development of an Agile Forum for manufacturing in 1992.

AGILE PROJECT MANAGEMENT

Coincidentally, in 1990 DeGrace and Stahl analysed the Waterfall model used in information systems development and found it wanting (DeGrace and Stahl, 1990); in Japan the Waterfall model was reduced to four overlapping phases (as in Sashimi). Sutherland (2001) merged Scrum reactive methodology with his earlier work with other agile processes in 1993 and spread its use to a number of corporations. In 2001 the term 'Agile' was adopted as an umbrella term for advanced software development methodologies which were largely rooted in the early 1990's. The Agile Movement became particularly active within the information systems industry from early 2003. The use of Scrum for software development project management was then popularized through Schwaber and Beedle's book (Schwaber and Beedle, 2002).

WHAT IS AGILE?

Whilst some continued to eschew the information systems waterfall method, it was not until 2001 that a 'Manifesto for Agile Software Development' (Beck and et al, 2001a) evolved through the efforts of leaders in the field and the term Agile became synonymous with a variety of existing information systems development methodologies, under the auspices of the Agile Alliance. The 'Manifesto' (which must be reproduced in full) states:

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

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

That is, while there is value in the items on the right, we value the items on the left more.

The Manifesto, together with its underlying 'Principles' (Beck and et al, 2001b) depict a substantial concentration on the early and regular delivery of value, and the use of changes as opportunities to enhance that value. Working practices focus on frequent, sustainable iterative

deliveries by facilitated multi-functional, selforganising intercommunicative teams. Scrum and other agile methodologies add to those overall foci by prescribing numbers for the optimum team size (typically 5 to 20) and iteration periods (typically around 30 days, although varying widely).

The Agile Project Leadership Network (APLN) has a wider focus than just software and focuses on: value, customer, teams, individuals, context and uncertainty. The APLN Declaration of Interdependence (Anderson and et al, 2005) for agile and adaptive management states that, based on the experience of the authors, the following interrelated strategies deliver highly successful results:

- We increase return on investment by making continuous flow of value our focus.
- We deliver reliable results by engaging customers in frequent interactions and shared ownership.
- We expect uncertainty and manage for it through iterations, anticipation, and adaptation.
- We unleash creativity and innovation by recognizing that individuals are the ultimate source of value, and creating an environment where they can make a difference.
- We boost performance through group accountability for results and shared responsibility for team effectiveness.
- We improve effectiveness and reliability through situationally specific strategies, processes and practices.

Whilst not unique, the functional engagement of customers is more explicit here. The value of individuals in value generation remains a common theme. Agility itself is defined by one of its originators (Dove), as follows: 'The Ability of an Organization to Adapt Proficiently (Thrive) in a Continuously Changing, Unpredictable Business Environment. (Dove, 1996) Agile systems are ones that can respond to both reactive needs and proactive opportunities - when these are unpredictable, uncertain, and likely to change.' (Dove, 2005) Dove considers that agility consists of practices and processes for knowledge management, value propositioning and response ability and sees these practices and processes as positioning an enterprise to cope with change. Indeed, dictionary definitions of agility generally include words such as quick, quick-witted and nimble. Whilst some see agility as a state of mind, others focus on methodologies; those who implement 'agile' frequently confuse it with 'lean'. In terms of manufacturing, lean and agile are different, as pointed out below (Sanchez and Nagi, 2001): 'Lean manufacturing' developed as 'a response to

competitive pressures with limited resources. Agile manufacturing, on the other hand, is a response to complexity brought about by constant change. Lean is a collection of operational techniques focused on productive use of resources. Agility is an overall strategy focused on thriving in an unpredictable environment. Flexible manufacturing systems (offer) reactive adaptation, while agile manufacturing systems offer 'proactive adaptation'. To amalgamate the common themes of the various individuals, teams and initiatives set out above; to be agile an enterprise or project must be structured appropriately to proactively and quickly adapt to change, seizing such opportunities to enhance value outcomes. In terms of methodologies, these should depend upon the specifics of the project but common themes should include the use of empowered, multi-disciplinary, small teams to iteratively, incrementally and continuously develop value through the transformation of emergent and evolving requirements, products or processes which involve, and provide early enhanced value for stakeholder(s). Excessive discrete planning or documentation should be seen as waste, indeed it is the recombining of 'thinking' (planning) and 'doing' (following the plan) which leads to agility.

III. METHODOLOGY

3.1 Literature review

For the support of the project of the research several journals have been collected. Each literature explains different aspects that are relevant to the main aim of the project.

3.2 Data collection

The data assessment sheet is collected from the engineers, contractors, project manager, etc.

3.3 Delay analysis

The data's collected is analysed and identify the delay reasons.

3.4 Analysis of data

The data's collected is analysed and identify the area of delay by manually.

3.6 Application of APM

Implement the agile project management where the delay is identified.

3.7 Developing frame work for APM

Develop a frame work the most important enablers are only used in the framework.

3.8 Concluding remarks

The suggestions and solutions are given to implement agile project management in construction.

IV. APPLICATION OF AGILE MANAGEMENT

GENERAL

Agile enablers or activators can be applied which will reduce the delay or time overrun.

APPLICATION

Based on the data survey following agile enablers or activators can be applied which will reduce the delay or time overrun. These enablers were obtained from literatures and modified as per construction projects! and 2.

1 Kick —off-meeting

Agile management recommends starting the project with project kick-off meeting (face to face conversation) with pre-qualified consultants and client to envision the requirement as the first phase. Pre-qualified consultants are the ones who must have experience in handling the same kind of project in the past and they need not be the same chosen party on the execution phase, but involved to get a better understanding on various perspectives to envision the requirements. This acts as the start of architect's design thinking process. Drawings then are made is discussed with other consultants in the next meeting and updated if necessary. The revised drawings are given for tendering; this process can control the change of design in the middle of the execution and helps in the efficient bidding process. After selection, a contract should be signed agreeing that they abide by the agile management framework by accepting for weekly meetings with consultants and daily meeting with site people.

Kick-off-meeting is the Face to face conversation with pre-qualified consultants and client and drawing are made discussed with other consultants. In these two projects there are many reasons to need this kick-off-meeting. According to these projects delay in producing design documents, unclear and inadequate details in drawing, complexity of project design, slow decision making, late in revising and approving design documents by owner, delaying approving shop drawings and sample materials are indicate the need of a kick-off-meeting. If we use agile management in

these two projects, we can solve these issues and easily move to the construction work. Design drawings are the basics of a construction work, so the agile management method is help to avoid these types of problems.

2 Scrum development

The Scrum Team consists of the Product Owner, the Development Team and the Scrum Master. The team is self-organised and cross-functional. All decisions of the project are taken within this entity and they have all the competencies needed for the project — there are no advisors to the Scrum Team. The management's sole purpose is to assist and support the Scrum Team to the best of their abilities so that the Scrum Team achieves their goal [10]. The size of the team varies depending on the area of operations, but a size of seven (\pm two) members has proven to be successful [6]. The Product Owner is responsible for maximizing the value of the project and is the sole representation of the client. He is in charge of creating, updating, and prioritizing the Product Backlog Items (PBIs; Section 2.2). In addition, other responsibilities include optimizing the work performance of the Development Team, to ensure that the PBIs are clear, transparent and understood by everyone [10]. The Product Owner also takes into account other stakeholders interests and is the only one who can make changes to the PBIs [10]. The individuals that do the actual work are in the Development Team. The members of this team are all equal (no project manager) and although each and everyone has their field of expertise, the team is hold accountable as a whole. The Scrum Master ensures that everyone in the Scrum Team understands what is meant by Scrum. The Scrum Master simply enforces the framework given by Scrum and the changes made considering new information. Additionally, the Scrum Master sets all the Scrum Events (Section 2.3) and explains to individuals outside the Scrum Team how they can (or cannot) interact with the Scrum Team. One of the main task of the Scrum Master is to remove any obstacles brought to the Scrum Team so that the Development Team can focus on their work and are not slowed down by insignificant things [10].

This Section describes the different events in which the Scrum Team can uphold to the key factors of Scrum: transparency, inspection, and adaption [10]. Like in any other project a Kick-Off meeting is held — based on the client's demands — and the Product Owner creates the Product Backlog to fulfil this demand. The Sprint Planning has a maximum duration of eight hours for a Sprint of a month (proportionally smaller for a shorter Sprint) [10]. During this Sprint Planning, the Development Team guesses the amount of work for the most important Items of the Product Backlog with Planning Poker. After that, the Development Team

chooses the Items they think can be done in the Sprint, starting with the most important one; this list is called the Sprint Backlog (see also Section 2.2). While considering all the Items from the Sprint Backlog, a bigger goal — the Sprint goal — must be defined. This enables the Development Team to always ask (inspect) themselves: Is this work I am currently doing really necessary for this Sprint (in order to reach the goal)? When the Sprint Planning is done, the Development Team can start working on the Items during the Sprint. The Sprint is a fixed timeframe in which the Development Team aims to reach the state of done for each Item. During the Sprint no changes are permitted to the Items, unless the value or the scope of the Items — with consultation of the Product Owner — is increased. By the end of the Sprint, the Items that cannot be considered as done are moved back to the Product Backlog and will be re-evaluated in the next Sprint Planning.

The Scrum Master is responsible that during these 15 minutes only these three questions are answered and that the entire Development Team is present. If needed, a follow-up meeting can be set between the involved members. This meeting is also used for inspection: The members of the Development Team are seeing their own progress and everyone knows what the others are working on. Further, through the constant interactions between experts of different areas everyone starts to gain new knowledge outside their expertise. After each Sprint, the Increment is inspected by the Scrum Team during the Sprint Review and, if needed, adaptations are made to the Product Backlog based on new information. The Sprint Review has a maximum duration of four hours for a one-month Sprint [10]. The following actions occur during the Sprint Review:

- The Scrum Master has a first-hand contact with all the members of the Scrum Team and checks that all are present.
- The Product Owner explains what Items reached the state of done and which did not.
- The Development Team discusses what went well during the Sprint, what did not, and how the problems were resolved.
- The Development Team presents the Increment and answers questions if needed.
- The Product Owner discusses the Product Backlog and guesses a completion date.
- Considering the newly updated Increment, the Scrum Team decides what is important for the next Sprint and therefore sets a preliminary Sprint goal.

After the Sprint Review, the Sprint Retrospective meeting is usually held. The goal of this meeting is to critically evaluate involved parties, the processes and

techniques used, as well as their relations and interactions. Therefore, "what was done?" is not inspected, but "how was it done?". In doing so, the Scrum Team can suggest improvements to the process and gradually improve their performance. The framework displayed in Figure 1 uses incremental steps on a daily basis (Daily Scrum), as well as on a weekly/monthly basis to complete the Sprint and corresponding Product Backlog. The crucial benefit of this incremental approach is that by focusing on one Task, less distraction arise, leading to expedited completion of work: No matter how good one person may be, multi-tasking is always slower [6]. In general, the use of Scrum has proven to be very valuable in complex projects, especially those where the requirements and/or the vital technology are not yet very mature [12], and it is, amongst all the different agile methods (e.g., Extreme Programming, Adaptive Project Management, Dynamic Project Management), the one most frequently used . In these two projects have to identify the main problem is presence of unskilled labours. If we applying agile management method in these two projects, we can avoid these types of issues created in the construction site. Scrum development can help to avoid these problems. scrum development is a self supporting team with scrum leader /head. These team contains full of skilled workers. Workers involved in planning, executing, controlling, monitoring and reporting to the scrum leader. Scrum team should try to follow iterative method.

3 Sprint meeting

With response to the scale of the project, the schedule is divided as "Sprints" in the size of two to four weeks (14 — 28 days) duration with a respective task which is discussed and agreed by consultants. This integrates five chosen principles of agile management like Short term planning, Client involvement, Reconciliations, Required reflection & adaptation, and Business people & developers work together which can address all the causes for the delay. The timing for sprint meeting with consultants will be 45 to 60 minutes. Meetings should be headed by Scrum master who can be a project manager exclusively for handling agile framework.

In the meeting, evaluation of work of a completed sprint (previous weeks' work) as per product backlog is carried out. If qualified work with respect to the specification given by the contractor is completed then it is marked as "closed"; if not done with anticipated quality then it will be added to next sprint, additional to the work allotted for the upcoming sprint. Doing this, ambiguity and uncertainty of client about quality is avoided thus giving them satisfaction. As the quality test is done at every sprint by the quality tester, rework is avoided resulting in no loss of time and cost. Simple and necessary

documentation is only done for future reference by project managers thus avoiding overloading.

Daily Scrum meeting at the site has to be conducted by the Scrum master cum project manager with employees who are involved at work the same day for 10 to 15 minutes. The first meeting should be conducted three weeks before the commencement of work on site. On the first meeting of Sprint, Approval-Finalisation- Discussion of sprint 1, 2, 3 respectively should be done. Procedures for handling changes, the time limit for freezing the design converse, agreed and fixed.

Changes are allowed only for the 3rd sprint work i.e. tasks in the discussion. This will control the change during execution phase and necessary actions can be taken in the weeks before commencement or any comments can be discussed and the decision can be taken in the common forum. If changes are required, the justification and negotiation of the change are to be done by the consultant followed by written approval of the client. As signed in the contract, "Exchange Request" is given in place of "Change request" in the traditional method.

After bidding the contractor should be signed agreeing that the agile management framework by accepting for weekly meeting (40-45mins) with the consultants and daily meeting (10-15mins) with site people. In these projects many problems are noticed by delaying the projects. Mainly delay in site mobilization, suspension of work, delay to furnish and payments of completed work by owner. These issues can be reduced by conducting sprint meetings in these construction works.

4 Backlogs

Site kick-off meeting should be held on site with selected consultants by signing the second contract with prepared product backlog. Product backlog shows the milestones to be achieved like excavation, column, and ground floor roof etc which acts as the base for Sprint meeting. This need not have complete work breakdown structure but only the milestone to avoid ambiguity in handling project. Product backlog acts as the skeleton of the sprint meeting. The interval between the sprint meetings will be decided up on the time taken for a milestone to get completed or in the middle. Status of each milestone should be updated in the meeting as open or closed or on the process with respective color codes. This is placed at site office as well as in the work environment as a medium of visual communication. This aims at motivating the employees and keeps them informed about the progress of work.

The Product Backlog is a prioritised list of different Items (e.g. creating floor plans, defining the fire protection concept, designing load bearing elements). Each Item is divided into Tasks and represents a simple and detailed description of what needs to be done by the Development Team. A task is a work package addressed by one or more members of the Development Team and ideally can be completed during one or two days.

The Sprint Backlog contains a number of Items which are selected by the Product Owner and the Development Team from the Product Backlog. This list (i.e. Sprint Backlog) contains the Items that the Development Team believes can reach the state of done during a Sprint.

The entity of the Scrum Team defines a state of done. When an Item from the Sprint Backlog is considered as done, it is removed from the Sprint Backlog and is then part of the Increment. Therefore, the increment is the sum of all Items considered done.

To be able to estimate how many Items from the Product Backlog can be worked off within a Sprint, Scrum suggests the use of Planning Poker, by which each member of the Development Team receives several cards with the numbers zero, one, two, three, five, eight, thirteen, and so on (following the Fibonacci sequence) that will be used to estimate the amount of work needed for a certain Item to reach the state of done by the end of the upcoming sprint. That includes for example that an architect makes an assumption for the water sewage system even it is not his/her field of expertise. If the returned card have numbers further than three numbers apart in the Fibonacci sequence, the people with the highest and lowest number must explain why they picked their number and the game is repeated until all the cards are within a range of three numbers in the sequence. The average is then used as an estimation of the effort for a given Item. Throughout Scrum the Development Team estimates the amount of needed work using points instead of time (e.g., man-hours). This is done because suggests that Gantt-Charts are never accurate and therefore there is no point in trying to assume a number of hours for a task if it is not going to be met. For example, these points merely stipulate that an Item with an eight is more work than an Item with a three or five. However, this information could be used at a later time by the Product Owner to estimate project durations (i.e. completion dates).

In these projects have some issues according to the construction work. They are low productivity, delay in subcontractor work, poor site management and supervision by contractors, etc...These problems can be reduce by using agile

management methodology. Backlogs are help to inspire the workers and head of the works. Frame backlogs shows he milestone to achieve, which act as a base of sprint meeting. Status of each milestone should be updated in the meeting like open, closed and processed.

5 Fixed time

The use of agile management that the project delivers a quality product much earlier than would happen on traditional projects. The product will not yet have all of the required features but, on the pareto principle, the delivery of the most important 20% of the features is likely to deliver around 80% of the benefit because of fixed time. The customer should be giving a fixed to complete the project in agile methodology.

In this projects have many problems noted because of the absents of fixed time to give the contract from the customer. Delay in sub contractors work, insufficient planning and scheduling of the project by the contractor, improper construction method implemented by contractor, slow decision making, and unrealistic contract duration are main problems noted from these two projects due to the absents of fixed time giving by the customer. The agile management can be help to avoid these type of problems and also help to complete the construction projects quickly with goo quality. Fix a restricted time limit within the time limit provided by the client. The float between the restricted time limit and expected finishing time is flexible time. Create fixed milestones following same restricted time limit for each milestone providing float.

6 Short cycle planning

In order to get quick response to unexpected changes, agile work teams should be organized as self-motivated and empowered cells. Project manager as a leader but not taskmaster should facilitate agile teams to continuously adapt to improve their methods as they incorporate lessons learned from the previous cycle into the next iteration. in addition, agile work teams should consist of multi-functional crews, which can largely save time for deploying people from other teams in case of unforeseen tasks.

In these two projects having issues like delay in site mobilization, improper construction method implemented by contractor, slow decision making, unrealistic contract duration etc... Short cycle planning is an important principle in agile management because that helps to manage the whole work in construction within a short period and also help to provide a better performance. In short cycle planning principle, Prepare a flexible short cycle plan e.g for every milestone or major

activity instead of detail full plan. Expect uncertainties and plan.

7 Flexibility

Short-term planning is considered as one of best methods to maintain flexibility in a highly-fluid construction site. Frequent review of original plans can keep all project participants in communication with each other. Timely adjustment to plans can effectively diminish the risks of time delay due to unexpected events. In addition, delay is usually related to a productivity issue in terms of idle time and resource waste. Thus, overlapping independent construction activities can effectively reduce this waste of time for creating a flexible, efficient and streamlined work flow.

Flexible planning to achieve flexibility. Proper forecasting of uncertainties. In these project have some issues like late in selection of finishing material, unavailability of water, environmental restrictions are present. If proper forecasting is doing in construction site can help to avoid such type of issues happens in the construction work. And also help to reduce the lags in the construction work

8 Communication

The communication worked well within the project management teams and communication vertically was functioning fairly well however the horizontal communication was almost none existing between different design areas. The reason for why it worked well for the project management group could be that they usually sat together with the client which enabled them to have continually communication on a daily basis (informal communication). However this was not the case for the designers who sat at their own offices on different locations, thus the communication between them did not work.

In one of the projects the project management did a kick-off activity at the start of the project where everyone who would participate in the project was invited. This activity was done to promote group collaboration and enhanced communication, though it turned out to not reach the wanted rate of communication and knowledge transfer between the designers. One design manager said "rather often people do not speak with one and another between the technical areas outside the meetings we tried to avoid this by having a startup work shop. When the whole organization had been procured we invited everyone to a work shop that we had on one of the project sites and visited the other one so that everyone would have seen what we were going to work with [...] partly was the thought that everyone should have seen each other because it

is much easier to send an e-mail or call someone that one have met [... everyone was really positive about this but we have anyway not really got the communication going" (author's translation). Further on the communication between designers only took place when someone is in need of a delivery. This according to a design manager's expression "I believe it is because everyone has a lot to do and if no one screams, nothing happens thus those who screams the loudest get its delivery" (author's translation). The communication with the client seems to mostly be informal because the project management team sits at the same location as the client in all of the studied projects.

The Agile Manifesto values "customer collaboration over contract negotiation." A more traditional way of doing things would be to lock-in the system requirements early on in the project. Any subsequent change in direction will require contractual changes for "added scope" or "scope change", and formal CCP (Contract Change Proposal) negotiations. Although this type of project control mechanism helps keep the size of the project in check (and thus helping limit growth in costs and schedule) in the end it may mean that a very long time could be spent up front developing, refining, and validating requirements, but the customer may not get the best product.

In these projects have some issues like problems with neighbors, mistakes and discrepancies in design documents, insufficient data collection and survey before design, delay in site mobilization, poor communication and coordination by contractor with other parties, owner interferences etc... These issues happens due to the lack of communication in the whole project member .the agile management help avoid this types of problems. AM provide good communication in the whole project. Develop proper communication flow between the client, contractor and consultant/designer. Develop inter and intra department communication_ Matrix communication for easier and faster communication.

9 Integration

Follow integrated pattern. No department should work alone. Client, contractor and consultant coordination and integration is of key importance. In these two project have low productivity, delay in subcontractor's work, delay in site mobilization. These problems are mainly happens due to the lack of coordination between the different departments of the construction work. The integration concept can motivate the all members work in that project to work together. The agile management can help to reduce these type of issues in the work site and also helps to improve the productivity.

10 Iteration

Another principle of the Agile Alliance is to "deliver working frequently, from a couple of weeks to a couple of months." In this approach, development will start with a simple implementation of a subset of the requirements and iteratively enhance the evolving versions until the full system is implemented. With each iteration, design modifications are made and new functional capabilities are added. Most value is derived when iterations are designed such that early tasks help resolve uncertainty later in the project. re product.

The Iterative-Incremental concept is not novel or unique to agile methodologies. There is well documented evidence of extensive Incremental Iterative Development (IID) for major software development efforts dating back to the sixties. Software historians seem to agree that Royce's original work on the Waterfall has been misrepresented as calling for a single iteration of the waterfall.

In these project have a main issue is delay site mobilization, these happens due to the absents of proper planning in the construction work. The agile enabler iteration can help to maintain these problem .in iteration processes the whole time of the project is divided in to equal periods. Follow iterative approach using scrum team wherever possible to check the defects and apply corrections in order to avoid rippling effects. In this method, if the first iteration is completed ,then it deliver to the customer and then the customer gives the feedback. According to that feedback give changes to the first iteration.

11 Technology

Fluent project execution is built on smooth communication between all project entities. Following this logic, the communication can be more agile as inputs from different parties are integrated to one interface. Accordingly, the emerging Building Information Modeling (BIM) technology is conceived of as a platform for managing change and coordinating all project information. BIM literally allows more flexible information sharing and performs efficiency calculations on "what-if" scenarios, which indirectly reduces delays due to misunderstanding and ineffective communication of tasks and objectives.

In these two projects have some technological problems like material fluctuation, delay in recruitment of technical and managerial persons etc...the proper use of technology can help to maintain these type of problems. Using agile management in these projects can reduce the technical problems. The technology can help to easily identifies the

material price difference and good quality materials and also to identifies the qualified persons for the work .Use of computerization and Use of software for design and management. Use of building management systems

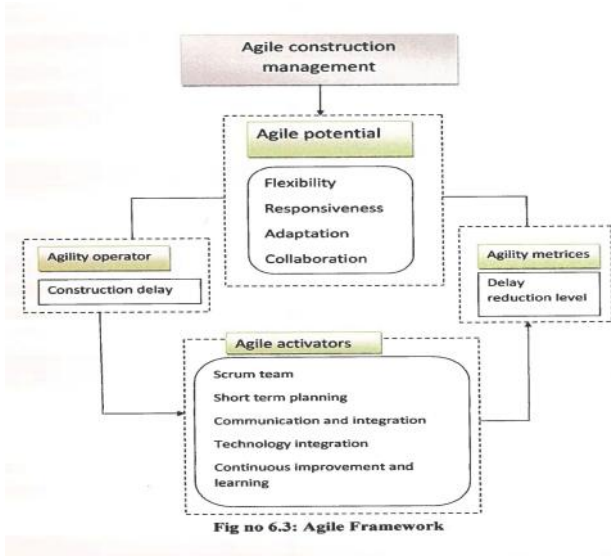
12 Continuous learning and updating

Agile management emphasizes learning from changes, which is an enterprise-level strategy. This learning is a collaborative process with all project stakeholders actively working together to capture constant feedback, and learning lessons from the previous iteration. An iterative process of planning, changing, evaluating, and learning can drive agile work teams to improve the entire performance. Consequently, it makes teams more responsive to changes and less sensitive to associated negative impacts

In these two construction works have mainly some problems are happens on and out the sites due to the lack of proper leaning and studying,that's are environmental restrictions, changes in government regulation and law, slow permit by the government, unavailability of water. When we start a project we have to learning about the texture of site, climatic condition, availabilities of all needed things, agree mental features, etc...If using of agile management can easily identifies these important data as the agile enablers. Agile management can help to reduce these types of unwanted issues in projects.

13 Framework

Based on these above agile enabler suggestions a framework was developed which is likely to reduce the delay in infrastructure projects. The most important enablers are only used in the framework. Other enablers can be used according the project conditions. The framework is given below



V. CONCLUSION

Agile project management is the advanced type of method used for construction project management instead of the traditional waterfall method. It can reduce the construction delay and uncertainty in the construction projects and also give better customer satisfaction. It also reduces the time overrun in construction work. Agile project management reduces the delay for about 70% to 80% as per the study based on survey in the two different infrastructure projects. Further studies on actual implementation of the framework can be done. This modern management method can bring about reduction in delay, achieving greater efficiency in construction projects.

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