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AGILE APPLICATION IN CONSTRUCTION INDUSTRY

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ABSTRACT

The construction industry is dynamic in nature because it involves a wide number of stakeholders, such as consumers, manufacturers, consultants, regulators and others. Construction projects suffer from many challenges and complex performance issues, such as low coordination, job delays, changes in goals. Study on the contrast of conventional and modern methodologies for project management in construction projects. Introduction of Agile project management approach as modern project management methodology and its framework effects on construction project performance. With the use of Agile software development tools comparison of individuals experts and team solutions will be analyzed and evaluate optimum solutions and their comparison with traditional project management tools. In traditional project management, validation of the results has been done through survey of the experienced experts. However, as agile software development tools Jira and Trello software would be used for managing project. Analysis of the research will compare traditional and agile project management tools and suggest the project management team an optimum solution of any problem occur at construction project.

KEYWORDS: Agile methodology, Kanban, Scrum, Traditional methodology, Waterfall methodology.

1. INTRODUCTION

Among the few prospective sectors of business that gets equal importance worldwide, Construction Industry is one significant operating field. This sector has consistently enjoyed a wide array of contributors to make the productivity of this industry flourish in all respect. From consumer concerns to manufacturer interests, from regulators to the consultants and from builders to the designers all are collectively integrated within the prosperity-oriented field. However, meeting diverse stakeholder opinions with multiple perspectives raises excessive complexity and hassle which ultimately lowers the efficacy and productive outputs of the overall industry of construction.

The importance of the construction industry to economic growth and long-term national development is widely recognized and highlighted, in particular for developing countries. It is necessary to investigate the essence, basic characteristics and unique requirements of the construction industry for the benefit of these countries and to use them to establish programs for its improvement.

According to George Ofori (2015) Construction industry a basic requirement for national development. Every country needs to have the capacity and capability that will enable it to create, operate, maintain and improve over time the constructed items of a wide range of types that it needs. Its capacity and performance do not happen by accident or by right but by planning, design and management strategies, policies and programs must be translated into regulations, initiatives and incentives administrative and enforcement agencies should be replaced by executive entities.

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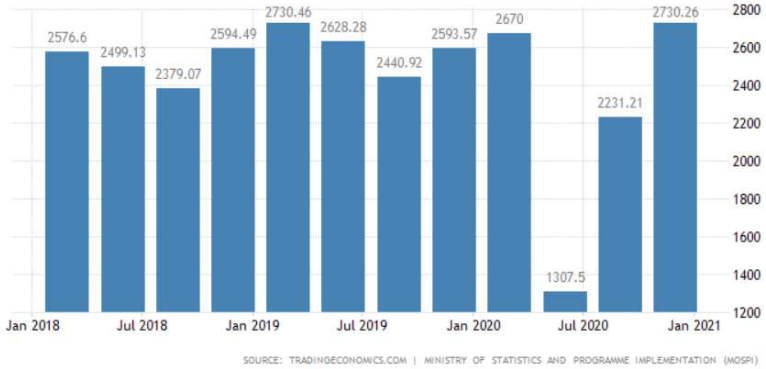

Fig. 1. Indian Construction scenario (Trending Economics)

As fig.1 describe GDP in Construction of India increased to 2231.21 INR Billion in the third quarter of 2020 from 1307.50 INR Billion in the second quarter of 2020. Construction in India is expected to be 2737.00 INR Billion by the end of this quarter. In the long-term, the India GDP From Construction is projected to trend around 2519.00 INR Billion in 2022 and 2682.00 INR Billion in 2023, according to our econometric models. Here, numbers show the importance on construction industries. Success of construction project is too much important for growth of India. To achieve success in any project, members have to manage project in proper manner that led the project to success. The effort of shortening construction project duration usually increases the complexity of the project, creating real problems for the project team. Agile methodology is basically use for smoothing of any project or process but for construction industries its truly new in India.

Agile project management uses an interactive process that helps customers define their needs and requirements. The Agile approach is suitable for complex projects where it is difficult to specify the product in advance. It is widely used in the software industry where the customer detects their needs through means of repeated tests and improvements to a prototype. Here, in construction industries same thing is going to apply by changing objectives as per need of clients in any time during execution phase of project. Agile management allowing the clients to use the product quickly is a form of customer collaboration. It also allows the customer to change his mind in any phase of construction. Agile framework helps to solve any problems at any time of execution phase with flexible manner. Actually, method is inventing to solve problem during production line but now its worldwide use for better execution of any types of work.

2. LITRATURE REVIEW

Introduction

According to (Hussien, 2017), the rich information filled sources used the preset research investigation upon the specific area of Agile Application Management upon construction industry is determined. A generalized viewpoint about the key concepts talked about is in need for primary explanation. The understanding about the concept of Agile Application Management would encompass the initial literature review section; construction sector in need for Agile Application Management application endows the next section of this literature review. Followed by this is the section where the comparison between modern and conventional traditional approaches of construction industry methodology practices is undertaken. On the final section, improvements that are expected from Agile Application Management across the construction industry to possibly enjoy re to be specified through recovery in definite areas of shortcomings. The conceptual framework illustrates the mapping of the variables and their relationships to be studied in this course. The chapter summary helps add summative narration to better understand the entire discussion in literature review of the issue.

Living in a contemporary world Agile is a commonly heard terminology popularly associated with project management activities. As per McArthur and Bortoluzzi, (2018), people look for alternative feasible methods to solve problems quickly, easily and more successfully, they come to conclusions like Agile Application

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Management. With the help of collection of different digital solutions, the complicated interplay of multiple domains of activities are interlinked with one another through the presence of agile management approach. It is with the help of this application software function that a series of functions are possible to be established through the course of pre-construction mechanism, the designing, and the post construction activities. There is a definite focal point implied under agile management approach where integrative procedures to work approaches are established to be able to deliver value added product and service outcomes across the selected market sector. There are site plans, mapping and sketches carried out on the basis of customer feedbacks are gathered to propose assurance in fulfilling those requirements.

The critical literature review based on agile project management.

Naylor et al. (1999) proposed the concept of 'leagile' by integrating lean and agile frameworks and provide an ideal balance between trying to respond to unstable requirements downstream while offering level planning upstream from the de-coupling point. The de-coupling point is the point in the flow of material where the clients' orders penetrate. The de-coupling point divides parts of the manufacturing process geared towards meeting the orders of customers from the planning-based parts. [21]

According to **Bashford et al. (2005)** Meeting consumer requirements, which often have fluctuating features in the housing industry, is a great issue faced by construction companies. Here, rising or falling market demands for households are defined as adjustments in demands in terms of house variety and volume variance. When considering fluctuating consumer demands in terms of housing variety and volume fluctuations, the EFC process contributes to broad inventories and low levels of customization. Therefore, some homebuilders turn to sales-driven production (SDP) from EFC, which focuses on responding quickly to fluctuating consumer demands to provide personalized homes while retaining zero inventory in the manufacturing system. Applying SDP, however, contributes to long cycle times, along with high volatility and workload variance in housing construction operations. [5]

C. Larman et al. (2013) describe Basic Large-scale scrum (LeSS) as an approach based to a median execution covering nearly 70 individuals on one product and enormous thousands of individuals with one product at five sites with of about 15 million system software lines for LeSS. LeSS is indeed also articulated as a technique that applies Scrum to significant multisite and overseas process improvement. The organizational changes are defined in the LeSS method, while the standard Scrum does not discuss them explicitly. In addition, by the absence of conventional team lead and project manager positions, LeSS also defines cross-functional, cross part, end-to-end feature teams. [17]

B. Indhu, P. Ajai et al. (2014) concluded that the primary reason for delay in construction project is such as delay in payments, regular transfer of workers, delay in supply of materials and lack of workforce in the small project site. The delays caused by the contractors are most commonly divided into five key things that fail to analyse the design, issues with arrangements, insufficient reasons, bad workmanship. The other delays are like inappropriate material management, lack of efficient routes of expertise, less attention is being paid to the distribution of resources to be called human, financial, and material resources. [13]

Mujahed Staiti et.al (2016) investigate the effect of an order of modification on the project's output in the West Bank in order to minimize the change throughout construction. The main purpose of the paper is to recognize the reasons of improvements in the West Bank and to highlight the consequences of a change of order in the Palestinian construction sector. In these studies, both software such as Microsoft Office Excel and the Statistical Package for The Social were used to analyses the results. The key cause of change orders and time overruns, cost overruns, and significant consequences were disputes between contractual states were financial difficulties, impediments in discover useful and adjustment of project scope. [28]

Piotr Nowotarski et al. (2015) concluded that for the whole project, conventional management under one plan works only under extraordinary circumstances. They describe issues such as lack of coordination, mistakes in documentation and overruns of projects. As problem solving techniques, they implemented agile systems where

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major conflicts are settled by using agile. In the construction industry, agile methodology is a good approach for problem analysis and solution seeking. [22]

Chen Jin et al. (2017) described that Building ventures are very costly and losing large sums of money leads in their failure. It describes agile as a technique for project management, where large projects are subdivided into smaller tasks that are meant to be accomplished in stages. Any advantages of agile use are concluded here. It revealed advantages such as project cost reduction, increased project efficiency, customer quality and satisfaction. [14]

Abitha Varghese et al. (2018) concludes that each variation orders factors in construction industries are ranked using five-point Likert scale, 1 is for " rarely 'and 5 is most often for the chances of incidents. The weighted average assesses and performs each factor in order to rank the causes and effects of the order of change. The cause of change orders differs according to the Relative Importance Index with respect to each project that includes various projects and the location of its site. The key cause was found to be a shift in project scope by the owners and financial difficulties. The key consequence of variance is found to be an increase in project cost and length. Additional design can result in demolition or rework during the execution of the project, which will increase project costs. [32]

Blessie John et al. (2018) concluded that the primary explanation for the overrun of budget and schedule, time in construction projects is changing orders, delay in poor site management of design documents. Agile process has played a role in construction management at the development level in order to tackle change management. Introducing the principles of sprint preparation to solve the issue of management of transition and delay in papers. The participation of clients each and every sprint is higher in these concepts, from preparing, designing, better communication with the contractor, joint risk duties, quality controls using these sprint AFD methods. Not only do these agile methodologies applicable to the IT industry, but also with the management of construction. [15]

The critical literature review based on agile project management frameworks.

S. W. Ambler et al. (2012) suggested the disciplined Agile Delivery (DAD) seeks to help fill the gaps by expanding the lifecycle of Scrum development to address the entire lifecycle of delivery while incorporating other Agile approaches such as Lean and Kanban. Therefore, DAD is a hybrid process that expands the life cycle of SCRUM with validated methods from many techniques, such as Agile Modelling, Extreme Programming, Cohesive Process, Kanban, Agile Software Development, Development Outside, Agile Data and several other techniques. In addition, they highlight that DAD's emphasis is on resolving the life cycle of the project from the point of initiation of the construction project to the release into development of the solution. Together, DAD teams concentrate on achieving repeatable outcomes involving high-quality software delivery; however, they do not strive to pursue the repeatable procedure. [4]

Clement James et al. (2003) concluded that increasing movement of seasoned practitioners is leading a rebellion against weekly management reviews, detailed pacification papers, code reviews, and Gantt charts in the culture of software development professionals. When it first presented to these ideas it can be easy to dismiss such activism as the encouragement of anarchy that would leave computer programmers free to follow their own goals without responsibility to the company. Such confusion, therefore, is a very likely outcome of a software development team eliminating management restrictions. [10]

Rashmi popli et al. (2011) derived that Scrum is a structure that enables iterative and progressive product growth, allows things to be completed at the right time, maximizing the value of what is produced. Tasks are done by self-organizing teams quicker and with greater efficiency. High levels of personality are reached and are the reason why Scrum helps teams to achieve greater efficiency more quickly. In particular, Scrum is designed to wrest functional products from complex problems. Over the past sixteen years, it has been used efficiently on thousands of initiatives in hundreds of organizations. Scrum is not for those who seek quick answers and straightforward solutions to complicated problems or for those who understand that it is only with persistence and wit that complex problems can be faced head on. [23]

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A. Gunasekaran et al. (1999) stated that Agile manufacturing is a modern manufacturing philosophy aimed at enhancing companies' productivity. Manufacturing processes focused on agile development are characterised by an integrated process for product design, manufacturing, marketing, and support services from customer suppliers. In relation to agility in performance, the relationship between competitive bases, such as flexibility, quality, productivity, responsiveness and cost, needs to be examined. In a VE business, knowledge management is a crucial issue and a structure for the elective management of knowledge in AM companies should therefore be created. [11]

Bernardo Vasconcelos de Carvalho et al. (2011) concluded that Scrum is still largely a management tool, indicating that researchers have a theoretical void to fill. Implementing Scrum in small, high-tech enterprises, whether or not they are software-based, could appeal to potential study proposals. [8]

Vasile Dorca et al. (2016) Analyzed Risk management of Information Security can be automated and connected to processes in a software development company using Kanban's Agile methodology. They describe the methodology used to assess by applying particular information security risks to an e-commerce company, the results show an improvement in the effectiveness of the risk management team, better business response, and improvements in the risk management SLAs created. (Service Level Agreement) [9]

M. M. A. Khalfan et al. (2008) stated that Kanban is one of the agile techniques implemented within the industry to extract building materials on a just-in-time basis through their production processes. The purpose of this approach is to manage goods and resources that produce the least waste. [16]

Yingchen liu et al. (2018) concluded that The Agile methodology has benefited greatly from the implementation of IT and software development areas. In the design level, they are predominantly focused on thoroughly investigating and evaluating the benefits of incorporating Scrum in building projects. Through designing and processing the Agile strategy, the customer's involvement will be increased to generate more personalized satisfaction and the customer's early interaction will make the design phase smoother. [18]

Mohammed Neamah Ahmed et al. (2018) described Simplicity is the advantage of agile project management and, especially, the Scrum technique. One of the most successful means of enhancing the development cycle within projects is agile project management. By focusing on eliminating unnecessary procedures and procedure in the management of programmers, the approach makes it possible for both stakeholders to eliminate administrative pressures and ultimately do productive work. [2]

Blessie John et al. (2018) stated Change orders, delay in design documentation and bad site management at the top three positions are the reason for time cost duplication in construction projects. In order to discover its useful effects on minimizing and handling changes during the building project, agile management in the construction execution phase was carried out. [15]

According to **Albert Albers et al. (2019**) Agile procedures for properly planned construction projects are just as inadequate for project execution as they are for the implementation of big data development projects in a plan-driven manner. Core values from literature findings and actual development projects that can help to align the activities of development teams in the sense of mechatronic system design were first identified to assist development teams in determining the required level of agility at various project levels. [3]

N. Zeng et al. (2019) stated For Realtime Material Demand Report and Pulled Replenishment, the Kanban method in construction logistics. The Kanban is described as a visual system for work management as it moves through a process. Kanban's goal is to identify and fix potential bottlenecks in the process so that work can flow cost-effectively at an optimal speed through it. As a JIT control system, the original Kanban system is well known, but its implementation is not limited to the development of JIT. [34]

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Ysmael Ormeno Zender et al. (2020) stated that scrum is very distinct from IT in building. They noticed that the best dynamics would depend significantly on the expertise gained, the preparation of the team members, the endorsement of upper management, and even the customer and supervisor's awareness of providing their complete support to help the work. They concluded that the construction time that offered value to the owner, flexibility for incorporation of improvements, risk management in high uncertainty scenarios and degree of satisfaction for all stakeholders were reduced when implementing the scrum system. [33]

Aa per Sabbir M. saleh et al. (2019) Both systems are of similar significance to Scrum and Kanban. Where XP uses distinct styles of programming-based structure. The comparison between various projects in communication techniques. The same project is being developed by four development teams, whose specifications came from an external entrepreneur, implementing three agile methods and an unstructured procedure. To solve project problems, the team working with Extreme Programming had a lot of one-on-one contact, and the team working with Scrum and Kanban favored community meetings. [24]

Fields	SCRUM	KANBAN	EXTREME PROGRAMMING	DYNAMIC SYSTEM DEVELOPMENT METHOD(DSDM)
Construction	☑	☑		
Automobile Industries	☑	☑		
Medical Suppliers	☑	☑		
Product Marketing	☑	☑	☑	
Production Industries	☑	☑	☑	☑
Manufacturing Industries	☑	☑	☑	☑
Real estate Industries		☑		
Motion picture Industries	☑	☑	☑	
Transportation	☑	☑	☑	☑

Fig. 2. Agile frameworks in different fields

Extreme programming & DSDM are mostly use in IT base companies to developing programs. While in managerial fields Kanban & scrum are used widely.

There are two different methods for the implementation of an agile development or project management framework. Kanban methodologies are continuous and more flexible, while scrum is based on fast, organized work sprints. Scrumban was developed to address the success of the group in minimizing workloads and following a pull-based approach. The hybrid of two Agile approaches allows software development teams the ability to adapt and adjust without overload to stakeholders and output requirements. It provides the complete Scrum structure with Kanban's visualization and versatility.

3. AGILE DEVELOPMENT TOOLS

The Integrated Computer Control System (ICCS) software team built a customized workflow in JIRA to monitor code feedback, document both the developer and the quality control team test results, and manage the product. JIRA offers a mature, versatile toolkit for local customization to meet unique project needs. This includes custom fields, problem forms, workflows, alerts, and user input screens.

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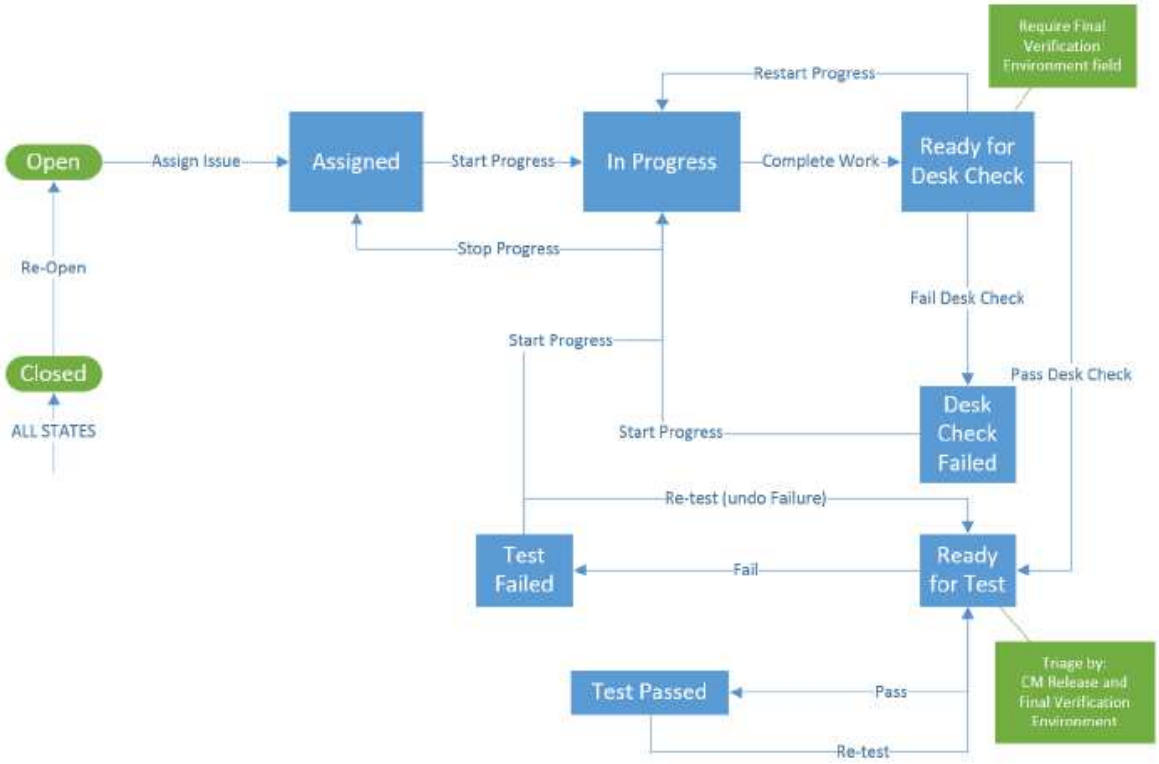

Fig. 3. JIRA Workflow

When the issue of JIRA is first entered into the system, the reporter specifies the software project and the type of issue. When an issue is submitted, the team leader associated with the specified component automatically receives an email notification and becomes the default assignee. Fig. 3. shows the workflow for all program problems where the boxes are states and the arrows are transitions. When each transformation happens, the Reporter will receive an email notification. The team leader is responsible for sorting out these incoming JIRA problems with the Assign Issue Transition. The assignee will receive an e-mail notice of the assignment. The Start Progress transfer is used as soon as the work starts. When the work is finished, the phases of quality control will begin via the Complete Work Transfer.

4. MAJOR FINDINGS FROM LITERATURE REVIEW

From the literature review, following are the conclusion.

1. Firstly, the requirement is understood, and then simplest solution is generated to fulfil the requirements.
2. In agile management, developers work together for better understanding and productive work output. Agile Accepting stakeholder changes, even in the development phase.
3. Trust and support of the team is required to complete project objectives.
4. Agile monitoring of project progress at each iteration and finding gives solutions wherever it required.
5. Agile is faster and gives continues delivery in short time period between planning and delivery to increase efficiency of work and satisfy the stakeholders.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
7. Scrum tools is generally used to clean up confusion and giving optimum solution of the problem, while saving time.
8. Scrum & Kanban framework of agile gives better coordination with team members.

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