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## Agile approaches in construction project management

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### ABSTRACT

*The Agile project management approach evolved from the software industry. This process to be vivid and continuously updated. Agile project management provides the project manager with methods, tools, and approaches to aid both the project manager and project client to engage in a more efficient manner. The purpose of this study is to investigate the different stages like, can Agile be implemented in the design phase in the construction industry? What adaptation is required? And how could benefit from utilizing Agile approaches from the traditional way, as well as interviewing with experienced senior, project manager for the identification of possible Agile approaches to reduce risk in construction project management.*

**Keywords**— Agile, Agile methodology, Scrum, Project management, Construction management

### 1. INTRODUCTION

Today project management is a current and highly discussed area. How project within the construction industry is managed has not changed significantly during the last decades; however, stakeholder, materials, competition and user requirements are continuously changing. This creates a gap between the current managerial view on how construction project is conducted and how they could be managed to increase efficiency. In the construction industry, one of the biggest challenges when creating a building is to account for the unforeseeable. In order to reduce the number of unforeseeable events, project managers typically use templates, checklists and often models with phases, sub-phases and sub-sub-phases. This so-called sequential project management approach aims to plan the project in detail and tries to carry it out without any deviation.

The creation of this plan often takes up significant resources before the actual construction has even started. In many cases, these processes are so long that by the time the execution phase has started, the plan needs to be revised because of modified project requirements. Constant modifications of the project requirements coupled with occurring problems in defining the original product requirement cause cost overruns and schedule delay and lower the product quality.

As a countermeasure, agile project management was created as "...the ability to both create and respond to change in order to

profit in a turbulent business environment". Instead of trying to predict unforeseeable risks, one should approach them as opportunities to profit. Therefore, the agile approach is advantageous to the traditional one, as resource consuming detailed planning from the start of the project is avoided. At the same time, decisions are delayed as long as possible. Scrum is one of many agile project management methods. It was created by Sutherland and Schwaber between 1993 and 1995 and their work strongly influenced the Agile Manifesto, which sets twelve principles and four key values for all agile project management methods. Similarly, the work by Sutherland and Schwaber was heavily influenced by Nonaka and Takeuchi. In fact, was one of the main foundations for the lean concept?

Therefore, it is important to make the differentiation between lean and agile: "Lean manufacturing [was 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 the productive use of resources.

Agility is an overall strategy focused on thriving in an unpredictable environment. Flexible manufacturing system [offers] reactive adaption, while [agile system offers] proactive adaption." In this paper, gives an outlook for the implementation of Scrum in the construction

### 2. OBJECTIVE OF THE REPORT

The Construction industry, perhaps more than most, is overwhelmed by the outdated version. Due to this, the industry has suffered poor performance as a result. Infrastructure projects being huge in nature and involving a large amount of money, any sort of wastage (either time, resources, etc..) would lead to huge monetary losses. The losses are due to various risks associated with such megaprojects.

These problems are to be identified and mitigated to avoid the losses. This entire process of identification, mitigation and development are termed as project management. Research on APM assessment and management is going to do in various people, mostly in developed countries. In India, only a few research works have been done in this area.

The main objective of this project is:

- To obtain the negative impacts, issues in construction related to management
- To determine the solution from Agile methodologies
- To rectify problems occurred every stage in the construction
- To improve the standard of traditional management using Agile manifesto

## 2. LITERATURE REVIEW

**Jonathan adult, “Applying agile approaches in public construction and civil engineering projects”** This paper deals about the common set-up of a public CandCE project usually follows three categories which are, the project client, has the task to order and prepare the project. In this preparation, a resource requisite is performed in order to determine if the project should be carried out internally or if external support is needed. If external support is needed, the project client must consider incoming proposals by consultancy companies that is best suited for performing the planning and management of the project, Contractors, usually building companies that implements the chosen execution plan for the project and the public/end-user, which consists of all those affected by the intended changes of the project. Within each of the above categories, there are a lot of different stakeholders involved. By this study require to simplify some changes in the methods in projects management according to the guidance of various experts.

**Agnieszka Dziadosz, Mariusz Rejment “Risk analysis in construction project-chosen method”** This study examines the current risk factors acquiring in the various construction field and how would it be reduced effectively, it depends mainly on risk categorised by its size and damage. It explains details about Risk assessment in construction, Multi-criteria decision-making method and static approaches by its flexibility and disciplinary action, it will make great changes in risk management which are also utilised in the agile manifesto. Static approaches will be more effective approaches in Agile approaches for the risk management

**Owen, R. Koskela, LJ, Henrich, G and Codinhoto, R” Is agile management applicable to construction?”** The main aspect of this study is to answer whether agile is applicable or not, by using lean and agile production and ‘leagile’ construction.it states ‘a response to competitive within the limited resources on another hand, is a response to complexity brought about by constant change. Lean is a collection of operation technique focused on productive use of resources, it comparing the lean and agile project management in productivity. Agile relies on incremental and iterative development with continuous learning being important to the evolution of the optimal value. This study investigates every phase in construction like design phase, execution phase etc, their remedies and measures in every single step and also the possible flexible solution and methodologies within the project without affecting the productivity or value delivery.

**Mattias Yllen, johansson “Agile project management in the construction industry-an inquiry of the opportunities in construction projects”** In this paper, mostly what opportunity and benefits will come from implementing Agile project management in the design phase of construction project and what possibilities are there to implement in the design phase of construction projects? It deals with the advantages of the agile project management and possible methodologies most suited for design phases in the construction industry, moreover case studies about ‘Grontmij AB international technical consultant firm that has operation in range of disciplines , such as planning design ,

transportation mobility, water and energy, monitoring and testing by 2012’ and it is used to gain knowledge on what benefits and possibilities that come with Agile management but also the constraint and weakness that Agile management can bring to the table in comparison to the traditional way of conducting projects.

**Joao Carlos Ferreira, “AGILE approaches in project management”** this paper is discussed about the numerous advantages over the Agile project management which is usually applied in software industry, this paper deals with only in the management sector but not in the construction field, however they conclude that the Agile approaches are not only used only in IT sectors also the non IT sectors ‘if any project under complexity than it can be utilized by the Agile project management’.it identifies for the areas of computer engineering and Civil engineering several good practices that lead to the increase of efficiency of the project, the good practices were regular deliveries of the product to the customer, planning and discriminated definition of the requirement to implement and manage the project.

**Saini, M, Arif, M and Kulonda, DJ, “Critical factor for transferring and sharing tacit knowledge within lean and agile construction processes”**, this paper is discussed about to investigate the Critical Success Factors (CSFs) associated with the effectiveness of transfer and sharing of tactic knowledge in lean and agile construction process.it describes about the lean construction management, construction supply chain and organizational learning in detail. Discussion of 10 critical success factor, 1. Trust basis organization within a CSC, 2. Motivation, 3. Leadership capabilities, 4. Business strategies, 5. Organizational capabilities, 6. Individual capabilities, 7. Identification of process improvement opportunities, 8. Identification of the type of knowledge to share, 9. Identification of the source of knowledge, 10. Identification of the recipient of knowledge. However, to make an initial success within the lean and agile process, people and organization require skills and training in developing their capabilities in order to ensure the smooth transferring and sharing of tacit knowledge.

**Thomas STREULE, Nino MISERINI, Olin BARTLOME, Michael KLIPPEL, Borja GARCIA DE SOTO, “Implementation of a scrum in the construction industry”**, this paper is discussed about the SCRUM which is a framework for product development where different processes and technique can be applied to a complex project. It defines some scrum rules, the scrum team consists of the product owner, the development team, and scrum master, the team is self-organized and cross-functional, all decisions of the project are taken within the team members and so. The following actions occur during the Sprint Review:

**R.L. Owen, L, Koskela, “Agile construction project management”**, This study talks about how the agile theory gives benefit to project management for the software industries by uncovering better ways of developing software by doing it and helping others do it. Through this work, we have come to value: 1. Individuals and interactions over processes and tools, 2. Working software over comprehensive documentation, 3. Customer collaboration over contract negotiation, 4. responding to change over following a plan. 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, self-organizing inter-communicative teams. Scrum and other agile methodologies add to those overall

**R A Bahama and S I Doh, “A review of risk management process in construction projects of developing countries”**, This paper investigates the important risk management process with accordance with some case studies, risk analysis is the most tasking procedure in the managing risk. By the past studies, different sources of construction risk were identified and various approaches were investigated to improve the situations. this analysis is held by, Risk Retention, Risk reduction, Risk sharing, Risk control, Risk avoidance, Risk transfer. According to this techniques, risk has been identified, processed and declined.

**Gould, F., Joyce, N. “Construction project management”** in this paper, an experimental investigation and various case studies were examined to give a suitable solution for the project management effectively. It mainly focused on software and computer engineering problems in a great manner. But it accounts with some common project management risks will applicable for non-IT- sectors also.

**3. METHODOLOGIES**

**3.1 Analysis using Chi-Square method**

A chi-squared test, also written as a  $\chi^2$  test, is any statistical hypothesis test where the sampling distribution of the test statistic is chi-squared distribution when the null hypothesis is true. Without other qualification, 'chi-squared test' often is used as short for Pearson's chi-squared test.

The chi-squared test is used to determine whether there is a significant difference between the expected frequencies and the observed frequencies in one or more categories.

**3.2 Questionnaire Structure and Design**

The questionnaire was tested with a pilot survey for clarity, ease of use, the value of the information that could be gathered. The questionnaire survey is divided into two parts. The first part consists of Agile factors and how it could be helpful in project management and the second part consists of general information like the type of company, experience, the value of their project etc.,

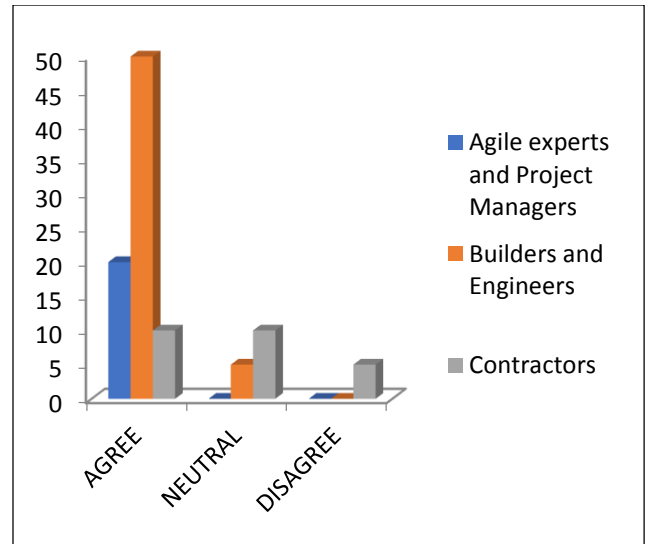
This study classified into four categories, namely: cost and time, on-time delivery, productivity, design and construction and project teamwork. The survey questionnaire survey is designed to probe the cross-sectional behavioural pattern of construction risks construction industry.

The questionnaire was prepared for the pilot survey was formulated by seeing the relevant literature in the area of construction risk and field test from Engineers the interviewer was free to ask additional questions that focused on issues arising during the course of the interview.

**Table 1: Position of Respondent**

Work position	No.of. respondent	%
Engineers	25	25
Builders	30	30
Contractors	25	25
Agile experts	9	9
Project managers	11	11
<b>Total</b>	100	100

**3.3 Position of Respondent**



**Fig. 1: Position of Respondent**

**Table. 2: Showing the Agile can reduce cost and time**

	Cost and time reduction	Agile	Total	
Agree	80	85	165	0.825
Neutral	15	15	30	.15
Disagree	5	0	5	0.025
Total	100	100	200	
	82.5	82.5		
	15	15		
	2.5	2.5		Chi square value=0.076096

**Chi-square test**

Table value = 0.5

Calculated value = 0.076096

Therefore, accept the null hypothesis

Thus, there is no significance difference between cost and time reduction in the agile method.

This investigation from the literature Questionnaire survey is to examine major advantage or benefits in implementing Agile approaches in construction project management. In this phase yet to take problems occurring in construction and survey could take place from agile experts for its solution. To identify agile approaches like lean, scrum will be helpful in design, process and success of the project with increased efficiency.

**4. CONCLUSION**

New advances and updates in technology are becoming more popular in the construction sector but the cost and timely delivery are perceived as a negative term in project management techniques. By applying Agile approaches, it is possible to identify potential risks in an easier way and it leads to on-time delivery, in turn, bringing about effective cost utilization. Moreover, it gives the possibility to detect which of the identified risks has the biggest impact on time, cost and quality which helps us to mitigate risks. The research proves that Agile approach is an attempt towards risk minimization with improved efficiency and it is proven that the probability and impact may differ among projects due to the fact that each project and its scope are unique. The results obtained in this study shows that risks are mainly caused by improper decisions made due to lack of information and unrealistic expectations in project schedule leading to a risk of cost escalation is identified as the major dispute. It is recommended that Agile management can be made as an integral part of the project management in construction industries to

avoid major risk factors. The identification and assessment of project risks are the critical procedures for making a project successful. Thus, the ability of the chi-square method to deal with inexact and vague information and its ability to explain the reasoning process made it apply in this study to accept an Agile approach.

Thus, the study is anticipated to convey endorsement to project managers about assessment methodology and proper response to Agile strategies should be selected which balances the costs and efforts of implementation against the benefits derived.

Hence, it can be concluded that Agile approaches like lean, scrum will be helpful in design, process and success of construction projects with increased efficiency

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