International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 03 Issue: 05 | May -2016 www.irjet.net p-ISSN: 2395-0072

Application of Agile Project Management to Reduce the Time Overrun In the Construction of Infrastructure Project

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Abstract - *Completion of construction projects on time seems to be challenging tasks in large-scale construction. It has been observed that about 90% of government infrastructure projects fail to achieve on time completion in India. Time is a major factor in construction and on time completion will bring about many benefits to the client, contractor and the society. Agile Project Management (APM) is an interactive and incremental method of management which is applicable for highly flexible environment. Agile methodology has been found to improve the reliability of project delivery by decomposing the project into smaller manageable parts and completing these parts with greater delivery value. This paper is about developing a suitable framework for the application of agile methodology in the construction of infrastructure project by adopting data survey and case study analysis.*

Key Words: Agile Project Management, Scrum, infrastructure project, flexibility, Relative importance index

1. INTRODUCTION

On time completion of construction projects is an indicator of efficiency but many variables influence the construction which hinder timely completion. These variables include performance of parties, resources availability, environmental conditions, involvement of other parties, and contractual relations etc. It is seen that on time completion of construction projects is of rare occurrence.

Infrastructure development is one of the backbones of developing countries. However, it is seen that infrastructure project construction is vulnerable to time and cost overrun. This in turn decreases the efficiency of the project in terms of traffic problems, poor safety, affecting the environment etc. Construction industry is prone to inherent risks which contribute to delay. Traditional project management approach seems to be generic and does not hold much to reduce the time overrun. Modern management approaches are being researched and one such approach is Agile Project Management, which is primarily used in information technology. This paper holds the application of agile project management to reduce the delay in infrastructure project by data survey and case study analysis. Questionnaire survey was done to identify the delay reasons in infrastructure projects and find its contributor at each phase of project development and construction, thereby enabling easy identification of various areas for the application of APM. Grade separators projects at Moolakadai and Thirumanagalam, Chennai, India were taken for case study analysis. The delay reasons for these projects were analysed in order to develop a suitable agile framework.

2.AGILE PROJECT MANAGEMENT IN CONSTRUCTION

Application of agile project management is mainly seen in software industry which follows an iterative and incremental method which assures efficiency in the project by reducing the delay. Many researches have been done on the application of APM during the pre-design and design phases of construction projects. It seems application of APM is laborious in the construction phase. The concept of agility is applied by dividing the entire project into smaller manageable parts and completing each part.

Some basic concepts of agility include

- Avoiding inflexible processes that can't be changed
- Using short iterative processes allowing for improvements to be quickly implemented or failures to be identified before the end product
- Emphasizing learning and continuous improvement
- Identifying issues and weaknesses as soon as they occur
- Implementing root cause analysis to determine the cause of problems
- Changing processes to suit specific projects, goals,
- Focusing on continuous training and mentoring

3. OBJECTIVE AND SCOPE

The objective of this research thesis is to develop a framework to reduce time overrun in the construction of infrastructure project by applying Agile Project Management (APM) methodology.

The scope of the thesis includes:

- To study the Traditional Project Management and Agile Project Management principles related to construction industry
- To study the delay factors in the construction of infrastructure projects
- To identify the delay factors in the infrastructure project where agility can be applied
- To develop a management framework based on the study results.

4. METHODOLOGY

Literature study, questionnaire survey and case study analysis methods are followed for this thesis. The step by step methodology for this thesis is:

- Study of literature to identify delay causes in infrastructure projects
- Delay analysis and ranking by survey method
- Case study analysis to identify areas of delay and application of APM.
- Developing a framework to reduce the delay during the construction of the infrastructure projects.

5. DATA ANALYSIS

The delay reasons about 62 were identified from various literatures and analysis and ranking was done by conducting survey from which the relative importance index was found. The delays were then grouped to each phases of the construction project and the major causes were identified. This step forms the basis to know the major delay factors were APM can be applied.

Relative importance index (RII) was found using the formula

$$RII = \frac{\sum W}{A \times N}$$

- ∑W – Weighting given to each cause by respondent ranges from 1 to 5 where '1' is not significant and '5' is extremely significant
- A – Highest weight i.e. '5' in this case
- N - Total No. of respondents

Based on the relative importance index delay due to land acquisition topped the first rank with RII of 0.9421. Based on grouping the delay causes to the phases of the project, it was found that delays reasons were major in construction phase.

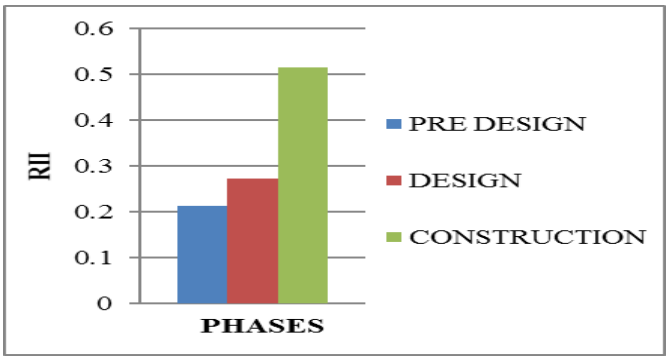

Chart-1: Grouping of delay causes based on the phases involved in the infrastructure project

The parties that usually involve in construction projects are client, consultant and contractor. The level of party contribution to each phase for infrastructure projects were then identified by classifying the delay causes based on the contributor. It was seen that client contributed majorly to the delay during the pre-design phase followed by consultant and contractor majorly contributing at design and construction phases respectively. This is a generic data analysis and the contribution level may vary for different projects based on the conditions and situations.

It was observed that the client contributed for about 70% delay in the pre-design phase of the infrastructure project followed by consultant with 30%. Since the client selection will not be done during this phase, there is no client contribution.

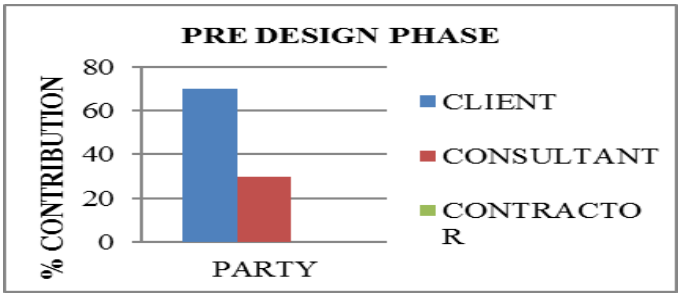

Chart-2: Party contribution in pre-design phase of an infrastructure project

During the design phase, the consultant seems to contribute to delay for about 40% followed by the contractor and client almost equally contributing by 30% each accounting totally about 60% contribution.

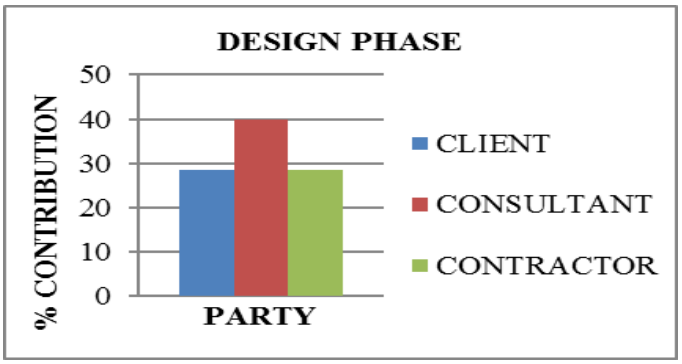

Chart-3: Party contribution in design phase of an infrastructure project

Finally for the construction phase it was observed that the contractor contributed the most to delay accounting to percentage contribution of 62% followed by client with 33% and consultant with almost negligible 5%.

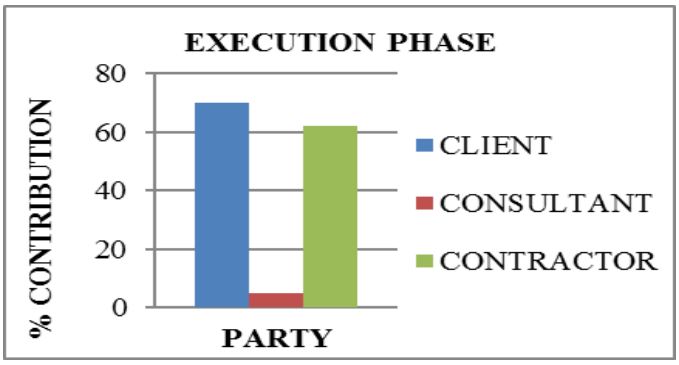

Chart-4: Party contribution in execution phase of an infrastructure project

These analysis have helped to identify the areas where APM can be applied and the delay contributors in each level. It can be seen that contractor is the main contributor to delay during the execution phase. This is more of generic finding and further analysis is done by case study to check the real time delay factors and contributors and finally develop a framework for the application of APM.

6. CASE STUDY ANALYSIS

6.1 CASE STUDY 1

The case study adopted for this thesis work is the grade separator at Moolakadai junction. The grade separator is located at the junction of the Grand Northern Trunk Road (GNT) i.e NH-5 Madhavaram High Road located at the North-Western side of Chennai city. The client for this project was The Tamil Nadu Government as it was a state infrastructure project and the department involved was the Tamil Nadu Highway Department. The main contractor was CCCL (Consolidated Construction Consortium Ltd). The project was completed with a delay period of three years and the delay reasons were identified as follows:

- Land acquisition
- Encroachment
- Rehabilitation for affected people
- Political issues
- Delay in changing the alignment of metro water line
- Payment delay from client
- Work paused by the government
- Traffic congestion issues
- Planning issues
- Labour problem
- Incompetent staff
- Lack of advanced techniques in management aspects

These delay causes were found to be affecting the project during the execution phase. The major delay reason was land acquisition. Land acquisition was not made before starting of the project and issues were brought up by the people of that area regarding the governments land acquisition policy and thus the delay period extended for about three years. The other mentioned problems also aided to the major problem and the client is found to be the major contributor. This is in contrast to the data analysis finding that the client is the main contributor even during the execution stage but the main reason still remains to be land acquisition. It is found that land acquisition is a major delay contributor to most of the infrastructure projects. The fishbone diagram for the delay reasons of Moolakadai grade separator is shown below.

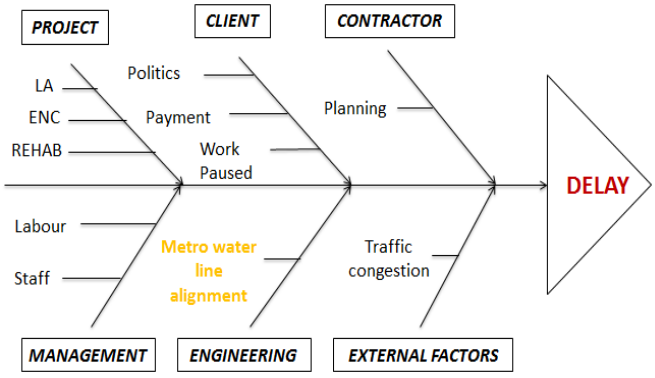

Fig-1: Fishbone diagram for delay reasons in Moolakadai Grade Separator

6.2 CASE STUDY 2

Another similar case study was analysed which was Thirumangalam fly over at Chennai. The flyover is about 800 m long located at Thirumangalam. The flyover connects important stretches including Ambattur Industrial Estate Main Road, Second and Fourth Avenue

Roads with J.N. Main Road. It was originally sanctioned in December 2010. The delay period for this flyover was about 3 years from the original 24 months duration. The reason for delay for this flyover is almost similar to that of Moolakadai flyover.

The delay reasons are as follows:

- Land acquisition
- Encroachment
- Traffic problem
- Political issues
- Rehabilitation for affected people
- Interference of the underground metro rail project
- Improper planning
- Work paused by the government
- Payment delay from client
- Labour problem
- Lack of advanced management aspects

Here interference of underground metro rail project is a major delay reason next to land acquisition. Improper forecasting and planning and delay in planning contribute to this aspect. The fishbone diagram of the delay reasons for Thirumangalam flyover as follows

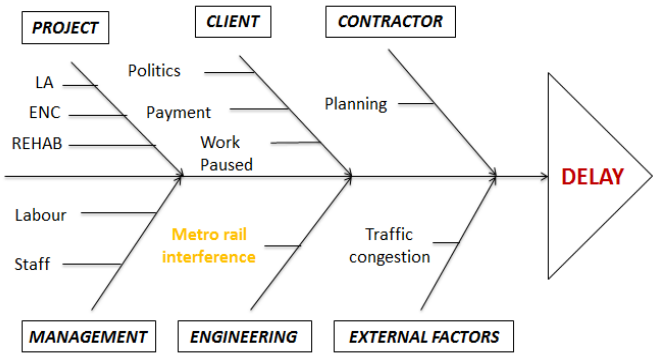

Fig-2: Fishbone diagram for delay reasons in Thirumangalam Grade Separator

7. APM APPLICATION

From the case study, it was analysed that client contributed more to the delay reason during execution in contrary to the contractor from survey. The delay is mainly due to land acquisition which shows improper planning by the client followed by changes in metro water line alignment, interference by underground metro rail, traffic congestion etc. The overall delay causatives were identified as

- Improper planning
- Lack of communication
- Lack of integration
- Improper management
- Incompetent staff

Based on the data survey and case study 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.

Fixed time

- 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

Scrum team development

- Self-supporting team with a scrum leader/ head
- Team of skilled workers
- Workers involved in planning, executing, controlling, monitoring and report to scrum leader
- Scrum team should try to follow iterative method

Short cycle planning

- Prepare a flexible short cycle plan e.g for every milestone or major activity instead of detail full plan
- Expect uncertainties and plan

Flexibility

- Flexible planning to achieve flexibility
- Proper forecasting of uncertainties

Communication

- Develop proper communication flow between the client, contractor and consultant/designer
- Develop inter and intra department communication
- Matrix communication for easier and faster communication

Integration

- Follow integrated pattern
- No department should work alone
- Client, contractor and consultant coordination and integration is of key importance

Iteration

- Follow iterative approach using scrum team wherever possible to check the defects and apply corrections in order to avoid rippling effects

Technology

- Use of computerization
- Use of software for design and management
- Use of building management systems

Continuous learning and updating

- Continuous learning from each step to identify flaws and defects and apply in related methods in future
- Keep updated records of each work for future reference

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 to reduce time overrun in infrastructure project is

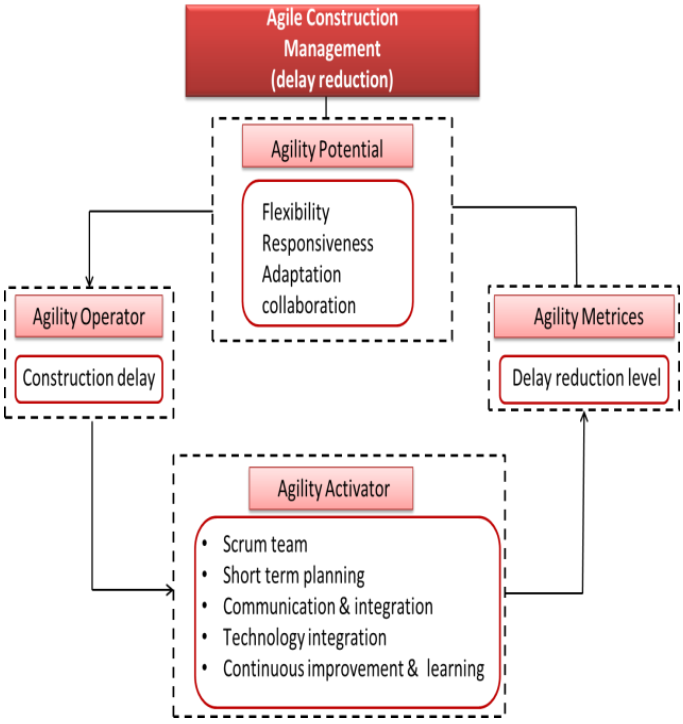

Fig-3: Agile Framework to reduce time overrun

8. CONCLUSION

The developed agile framework is likely to reduce the time overrun in infrastructure project as per the literature studies. APM is said to reduce the delay for about 60% to 80% as per various literatures in software industry and this framework can help to achieve the same in the construction. 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.

REFERENCES

[1] Robert Owen, Lauri Koskela, Guilherme Henrich and Ricardo Codinhoto, "Is agile project management applicable to construction? (2006)", Salford Centre for Research and Innovation (SCRI), University of Salford,

[2] Daniel Adjei and Peter Rwakatiwana, "Application of traditional and agile project management in consulting firms" Umea School of Business (2009)

[3] Mattias Yllén and Johansson, "Agile project management in the construction industry- an inquiry of the opportunities in construction projects", Stockholm (2012)

[4] Selim Tugra Demir, "Agilean PM– a unifying strategic framework to manage construction projects," Liverpool John Moores University (2013)

[5] Derya Bahceci and Linnea Holmgren, "Agile perspectives in construction projects – how to improve efficiency in the design phase" Master Thesis number: 299, Stockholm (2014)

[6] João Carlos Ferreira, "Agile approaches in project management", Av. Rovisco Pais, 1049-001 Lisboa, Portugal, (2014)

[7] S.K. Patil, A.K.Gupta, D. B. Desai and A.S.Sajane, "Causes of delay in Indian transportation infrastructure projects", Dr. J. J. Magdum College of Engg, Jaysingpur, Maharashtra, India eISSN: 2319-1163 | pISSN: 2321-7308