

# Study on Prefabrication Technique in Construction and its Barriers

Dinoj K. Tony<sup>1</sup> and R. Kokila<sup>2</sup>

<sup>1</sup>PG Student, <sup>2</sup>Assistant Professor,

Department of Civil Engineering, RVS Technical Campus, Coimbatore, Tamil Nadu, India  
E-Mail: dinoj.ktony@gmail.com

**Abstract** - Prefabrication is a manufacture and preassembly of components, elements or modules before installation into their final location. The prefab industry is the backbone for the development of new ideas in construction business of any country. The face of real market in India has changed rapidly over the past few years. The large projects comprising of Townships, Mass Housings, IT/ITES parks are of common occurrence these days and will only grow exponentially in the near future. Majority of such projects are still being constructed using the conventional methods. Thus the inherent advantage that these projects offer in terms of repetitions and huge volume turnover remain unexploited. In addition, these large scale projects constructed using conventional methods complicates the Project Management in terms of speed and quality of the construction. This project aims a study about prefabrication technique in construction productivity and major barriers that restricts the entry of in India. This is going to achieve by analyzing various literature reviews related to the prefabrication technique, its impact in construction industry and barriers that restricts the entry of prefabrication technique in India and also a formal research method is adopted for the case studies.

**Keywords:** Prefabrication, Construction

## I. INTRODUCTION

Construction industry is largest economic expenditure in India. According to 11<sup>th</sup> 5 year plan, it is the second largest economic activity after agriculture. Investment in construction accounts for nearly 11% of India's GDP (Job et.al 2013). In the current era of globalization where speed is the essence for meeting tight and demanding deadlines to complete projects on schedule various sectors including construction and real estate to give an edge in the emerging world scenario. Many less developed countries do not value time as western counties do.. The construction boom in India is developing at a fast rate of growth. It provides wide opportunity in India for a new entrant in prefab sector. With cities growing fast, the construction of houses and commercial buildings using prefabricated-concrete components made in factories offers significant convenience. Prefabricated construction offers multiple benefits such as savings on cost, time, material and labour, apart from consistent quality.

Prefabrication is a manufacture and preassembly of components, elements or modules before installation into their final location. The prefab industry is the backbone for the development of new ideas in construction business of any country. The practice of prefabrication is popular in foreign countries and the interest in prefabrication in India has been increasing in recent years, India still shows reluctance towards this adoption. But it is gradually being adopted by a lot of developers, builders and contractors because of obvious advantage.

Prefabrication definitely has advantages over conventional technology in construction, but it has not really been able to compete with the conventional forms of construction. Prefabricated materials have made construction work easy and bring down the construction time by as much as 50 percent. Though using such materials is more common in abroad, prefabricated structures are used in India in only large construction projects, in a few metro cities like the elevated expressways and metro rail projects and large housing and construction companies like Tata Housing and L&T has built residential projects in Bangalore, Pune and Mumbai. But it is not common in rural areas.

This project deals with the views of Indian construction industry on prefabrication and the barriers that are restricting it to enter the industry. It includes questionnaire survey to uncover the barriers to the development of this technology.

## II. OBJECTIVES OF THE STUDY

1. Offsite construction benefits
2. Impact of Prefabrication
3. Analyse prefabrication policies adopted in foreign countries.
4. Address Indian construction industry on prefabrication.
5. Pointing out the major barriers which hinder the progress of prefabrication technique in India.

### III. METHODOLOGY

#### A. Literature Review

A literature survey is done on the prefabrication technique, its impact in construction industry and barriers that restricts the entry of prefabrication technique in India. And it is being analyzed well and found out various findings that could overcome the barriers and how the construction productivity does improve. Also found out how different countries affected the impact of off-site construction.

#### B. Case study and Visits

Case studies can be produced by following a formal method. These case studies are likely to appear in formal research venues, as journals and professional conferences, rather than popular works. The resulting body of 'case study research' has a prominent place in many disciplines, professions in construction field A questionnaire survey of construction organizations including client, designers, contractors, offsite suppliers and manufacturers is prepared.

#### C. Questionnaire Design

The questionnaire comprises of 3 parts.

The first part was designed to collect the basic information regarding the respondents' company type, position, years of experience, whether they had been engaged in prefabrication projects.

The second and third part consisted of list of factors of advantages and barriers for adopting prefabrication. The fourth part consisted of strategies to overcome the barriers to prefabrication and it was divided into two; 1<sup>st</sup> part consisted of list of factors of strategies and supports from Government to (benefit company's utilization) promote prefabrication, and the 2<sup>nd</sup> part consisted of list of factors of logistical barriers to prefabrication adoption.

The fifth part was designed to know the current uses of prefabrication in the respective organization such as how often they used prefabrication technology in their projects and also what forms of prefabrication were used by the company.

### IV. ANALYSIS METHOD

In this research Likert scale was used. Likert scale is used to gauge attitudes, values and opinions. It allows the individual to express how much they agree or disagree with a particular statement. The respondents were asked to evaluate the degree to which the factor

was advantage and barrier to prefabrication in India using five-point Likert scale.

The multi-choice answers comprised ratings from 5 to 1 on the level of importance.

- (a) Most important = 5
- (b) Important = 4
- (c) Neutral = 3
- (d) Less important = 2
- (e) Least important = 1

A snowball sampling technique was adopted to obtain responses. Similar technique was used in the studies by This method enables the collection of information from respondents through social networks.

The questionnaire quantitative data analysis was done by using Microsoft Excel and the following statistical tool was used

#### A. Mean score method

It was used to rank the relative importance of specific factors). In this research it is used to determine the relative ranking, as perceived by the respondents. If two or more factors happened to have the same mean score, the one with lowest standard deviation (SD) was assigned a higher rank.

#### B. Cronbach's coefficient alpha

It was used to measure the internal consistency among the various factors to evaluate the reliability of the five-point scale. The value obtained if higher than 0.5 thresholds, indicating that five-point scale measurement was reliable at 5% significance level.

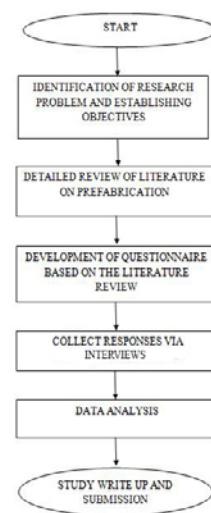


Fig. 1 Methodology

## V. RESULTS AND DISCUSSIONS

A total of 155 questionnaires were distributed. All questionnaires were sent to the respondents with a request for them to forward the questionnaire's link to their colleagues or to other experts who are experts with basic knowledge and understanding of prefabrication technology. Valid opinions were gathered using this approach to data sample collection.

Out of the 155 questionnaires sent out, 65 were returned with valid responses, accounting of response rate 42%. Of these sample group responses were from contractors (52%), consultants (architectural and structural) (28%), client (11%), manufacture and suppliers (1%) and others include builder, real estate firm and project management consultants.

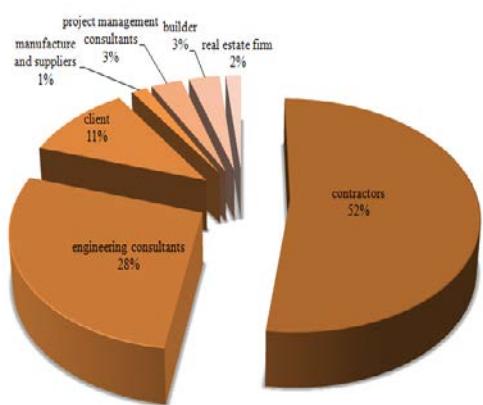


Fig. 2 Participants demographic representation

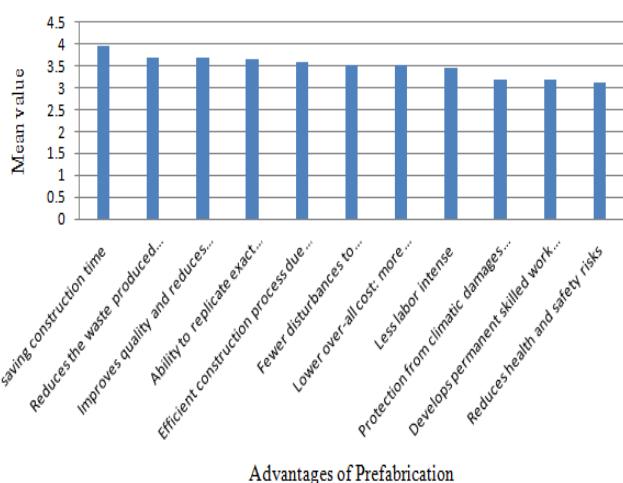


Fig. 3 Advantages of Prefabrication

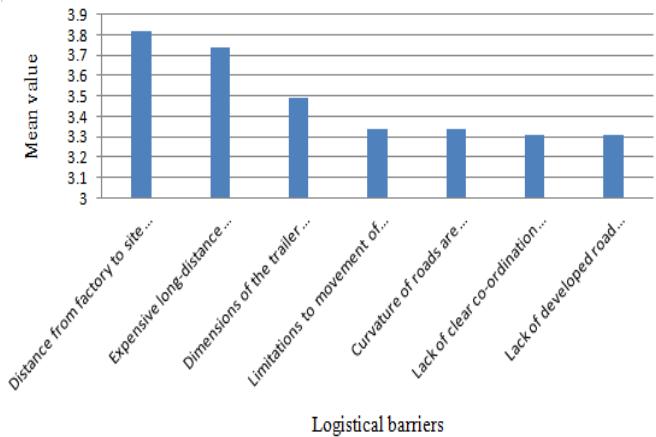
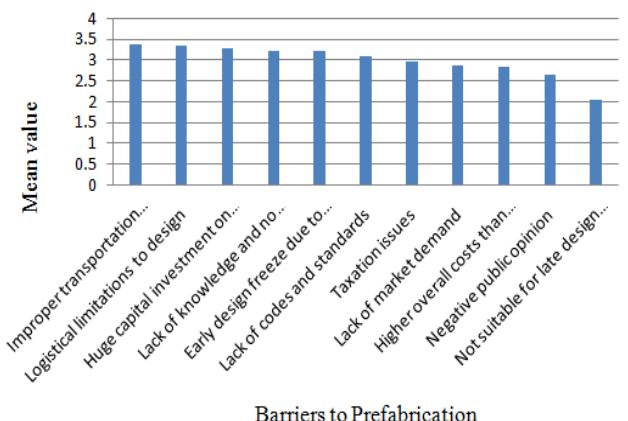


Fig. 4 Barriers to Prefabrication



Barriers to Prefabrication

Fig. 5 Logistical Barriers

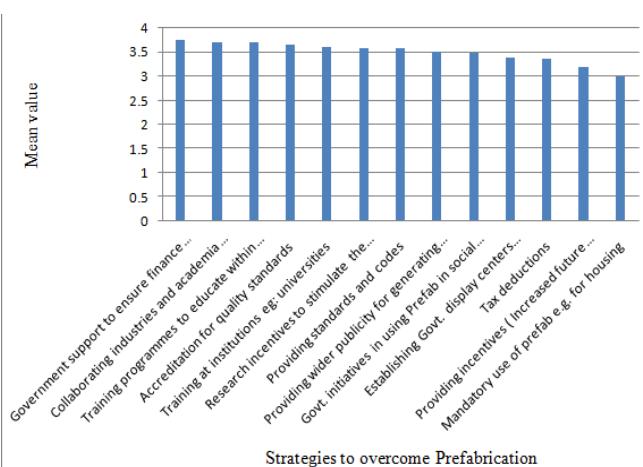


Fig. 6 Strategies to overcome prefabrication

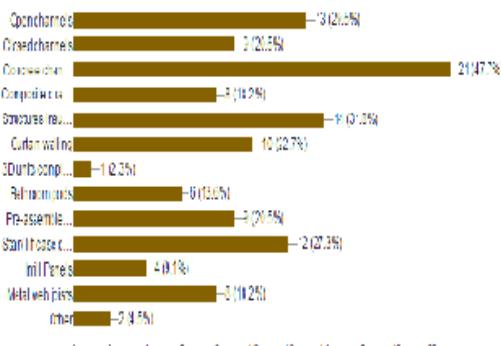


Fig. 7 Current uses of Prefabricated Components

## VI. CONCLUSION

Prefabrication is a manufacturing process; generally taking place at a specialized facility, in which various materials are joined to form a component part of the final installation. This thesis presented the views of the respondents working in construction industry on prefabrication. Survey conducted for this thesis was mainly answered by respondents from Kerala and rest was from L&T, Total environment building systems, Shapoorji Pallonji Constructions etc. Majority of the respondents of this survey have experience between 2 to 5 years and also out of 65 respondents only 16 respondents said yes to the experience in prefabrication field. This indicates that there is no much significant usage of prefabrication technology in less developed areas. But from various news articles it was found that there is considerable progress in prefabrication even though the progress was very few, such as incorporation of prefabricated housing in government own buildings, hospital, school etc.

The main advantage of prefabrication is saves construction time, reduces construction waste, together with increased quality. The main barriers obtained from the survey were improper transportation facilities, logistical limitations to design and also prefabrication is more expensive than traditional construction method. This is because our society is mainly focused on cost effective construction and the fact that ‘time is money’ has little weight in less developed areas. Since the technology is not widely used we had to depend on factory sites which are far, as a result transportation cost increases, logistical limitations for design comes, and simultaneously construction cost also increases. For prefab more skill and advanced technology is required, and also proper training is to be given. The main innovative ways to improve the up taking of this technology is by creating awareness, for this Government, bureaucrats; all have to come forward. By ensuring finances and insurance, collaborating

industries and academia for training, training within the industries, standardization of components which also increase the confidence about prefabricated components among Indian construction industry and public.

## REFERENCES

- [1] O.R. Baghchesarai, H.H. Lavasani and A.Baghchesarai, “Behavior of Prefabricated Structures in Developed and Developing Countries”, *Bulletin de la Société des Sciences de Liège*, Vol. 85, pp.1229-1234, 2016.
- [2] N. Lu Year, “The Current use of Offsite Construction Techniques in Unites States Construction Industry”, *Seattle, WA*, pp. 946-955, 2009.
- [3] A.G.F. Gibb, “Offsite Fabrication”, *Whittles Publishing*. Scotland, UK, 1999.
- [4] P. Lubsy-Taylor,S. Morrison, C. Ainger and R. Ogden, “Design and Modern Methods of Construction”. *The Commission for Architecture and the Built Environment*, London, 2004.
- [5] C.I. Goodier and A.G. Gibb, “Future Opportunities for Offsite in UK”, *Construction Management and Economics*, Vol. 25, No. 10, 2007.
- [6] Langdon and Everest, “Cost Model: Offsite Manufacture”, 2004.
- [7] R.E. Smith, “History of prefabrication: A cultural survey”. In *Third International Congress on Construction History*, 2009
- [8] N. Blismas, “Off-site manufacture in Australia: Current state and future directions”, Cooperative Research Centre for Construction Innovation, 2007.
- [9] N. Blismas, and R. Wakefield, “Drivers, Constraints and the Future of Offsite Manufacture in Australia”, 2007
- [10] L. Jaillon and C.S. Poon, “The evolution of prefabricated residential building systems in Hong Kong: A review of the public and the private sector”. *Automation in Construction*, Vol. 18, No. 3, pp. 239-248, 2009.
- [11] Sherfudeen, P. Arifullah, Nitish Kumar, N. Raghavan, G. Radhakrishna Pillai and N. Satyanarayana Kalidindi. “Promoting precast concrete for affordable housing – An overview on promotional policies worldwide and challenges and possibilities in India”, *The Indian Concrete Journal*, Vol. 90, No.5, pp. 13-25, 2016.
- [12] W. Thanoon, L. W. Peng, M. R. A. Kadir, M. S. Jaafar and M. S. Salit, “The Essential Characteristics of Industrialized Building System”, *Proc., Proceeding of International Conference on Industrialized Building Systems*, pp. 283-292, 2003.
- [13] M.N.A. Azman, M.S.S. Ahamad, and W.M.A.W. Hussin, “Comparative study on prefabrication construction process”. *International surveying research journal*, Vol. 2, No. 1, pp.45-58, 2012.
- [14] C.I. Goodier and A.G. Gibb, “Barriers and opportunities for offsite in the UK”, pp. 148-158, 2005.
- [15] W. Pan, A.G. Gibb and A.R Dainty, “Perspectives of UK house builders on the use of offsite modern methods of construction”, *Construction management and Economics*, Vol. 25, No. 2, pp. 183-194, 2007.