www.ierjournal.org

ISSN 2395-1621



A Review on Prefabrication Technology & Equipment On Profitability

Abhishek P. Deshmukh, Prof. Pratibha M. Alandkar, Prof. Sushma R. Awad

DEPARTMENT OF CIVIL ENGINEERING

RMD SINHGAD SCHOOL OF ENGINEERING WARJE, PUNE-411058 SAVITRIBAI PHULE PUNE UNIVERSITY.

ABSTRACT

Prefabricated buildings and structures are mounted from uniform prefabricated threedimensional units, providing strength, preset thermal properties of structures, dynamic stability, and immutability of geometric dimensions of the prefabricated elements during their manufacture, transportation, and installation in special and difficult conditions. Prefabrication has been widely regarded as a sustainable construction method in terms of its impact on environmental protection. One important aspect of this perspective is the influence of prefabrication on construction waste reduction and the subsequent waste handling activities, including waste sorting, reuse, recycle, and disposal Suggestions for improvement of the industry and study on cost effectiveness of precast concrete construction.

In this project the replacement of non-structural component with prefabrication element is proposed. The cost benefit analysis will be studied including prefabrication element in conventional building.

Keywords: - Prefabricated elements, sustainable construction, environmental protection, profitability

I. INTRODUCTION

Prefabrication has been widely regarded as a sustainable construction method in terms of its impact on environmental protection. One important aspect of this perspective is the influence of prefabrication on construction waste reduction and the subsequent waste handling activities, including waste sorting, reuse, recycle, and disposal. Never the less, it would appear that existing research with regard to this topic has failed to take into account its innate dynamic character of the process of construction waste minimization; integrating all essential waste handling activities has never been achieved thus far. This report proposes a dynamic model for quantitatively evaluating the possible impacts arising from the application of prefabrication technology on construction waste reduction and the subsequent waste handling activities

Aim and Objectives of Project

Aim: The aim of the research is to check the profitability that prefabrication implementation can bring in the construction industry. This topic aims to propose the

ARTICLE INFO

Article History

Received: 2nd January 2023 Received in revised form : 2nd January 2023 Accepted:5th January 2023 **Published online :** 5th January 2023

possible impact arising from the application of prefabrication technology on construction activities. Prefabricated building and structure are mounted from uniform prefabricated three-dimensional units, providing strength, pre-set thermal properties of structures, dynamic stability, immutability of geometric dimension of prefabricated elements during their manufacture, transportation and installation in special and difficult conditions. The main aim of this project is to identify the use of prefabricated elements in construction industries and to carry a comparative analysis of cost and duration on the site using MSP software.

Objectives:

- To study construction process of prefabrication systems.
- To compare prefabrication construction with conventional construction in terms of cost, work breakdown structure and feasibility.
- To identify the cost benefit analysis to change parts of RCC building with prefabrication parts for

instance doors and windows frame, prefabrication walls, w.c., bath.

II. SCOPE AND NEED OF THE PROJECT

Scope of the Project:

- Project deals about the theoretical apparatus defining a classification of prefabrication in construction.
- It deals about the criteria that influence the decision on the deployment of prefabricated elements to the project.
- It also brings the results of survey focused on the application of prefabricated construction methods.

Need for Project

- Prefabrication is one of the key elements of industrialization in construction.
- Prefabricated construction methods are presenting a range of techniques to improve the building construction, quality and how to reduce the negative impact of building production on the environment. Prefabricated structures are used for sites, which are not suitable for normal construction method such as hilly region, and also when normal construction materials are not easily available.
- PFS facilities can also be created at near a site axis done to make concrete blocks used in plane of conventional knick.
- Structures which are used repeatedly and can be standardized such as mass housing storage sheds, godowns, shelter, bus stand security cabins, site offices, fool over bridges road bridges. Tubular structures, concrete building blocks etc., are prefabricated structures.

III. RESEARCH SURVEY

Prefabricated construction, or "prefab," is a method of construction that is becoming increasingly popular all over North America, especially in places like Los Angeles and Arizona. This strategy uses components made off-site in a factory, which are then transported put together on-site to create a structure.

There are a couple different popular forms of prefab with different benefits to offer. Depending on your specific construction project, you may want to consider implementing some of these options. We've pulled together information about the different kinds of prefab as well as the benefits of using this strategy in order to help you decide. 'To Study Impact Of Prefabrication On Profitability Over Traditional Construction- A Review' Nitesh j Ramchandani (2019)

Prefabrication helps in terms of its impact on environmental protection and widely regarded as a sustainable construction method. The goal of prefabrication is to offer a way to get a well-designed building that is at least roughly tailored to resident needs. It could be stated that prefabrication system in building construction have the most effect on time and cost. One important aspect of this is the influence of prefabrication on construction waste reduction and waste handling activities including waste sorting, reuse, recycle, disposal. In recent research this topic has failed to take in to account its character of the process of construction waste minimization; integrating all essential waste handling activities has never being achieved. Prefabrication to be used to create a bland, monotonous landscape is an issue that developed countries" construction professionals must grapple with. Countries such as India are undoubtedly suffering a greater banality in the built environment by embracing prefabrication. Prefabrication is touted as offering a more sustainable solution to building, but developing counties already rely on vernacular practices for design and construction that require relatively low life cycle energy.

Following are the main findings from above:

• Evidence from several studies showed that precast concrete construction, besides the improvement of a building's sustainable performance, include shortened construction time; overall reduced costs; enhanced quality and durability; improved health and safety, conservation of materials and energy; waste reduction; and finally reduced environmental emissions.

'Evolutionary Analysis of Prefabrication Implementation in Construction Projects under Low-Carbon Policies' Qianqian Shi et.al. (2022)

In prefabrication, building components are manufactured in factories and transported to the construction site for installation. This approach improves construction efficiency and quality, and reduces labor requirements and resource consumption. It is found that prefabricated buildings achieved an average of 15.6% embodied carbon reduction and 3.2% operational carbon reduction compared to conventional buildings. However, little attention has been paid to evaluating the influence of the mixed low carbon and subsidy policy from the government on prefabrication implementation.

Following are the main findings from above:

- In different periods of market development, the government should adopt different policies.
- The subsidy policy should be biased towards the prefabricated market that needs to improve its maturity.

An Analysis on Promoting Prefabrication Implementation in Construction Industry towards Sustainability, Zezhou Wu (2021).

The construction industry contributes significantly to global economic growth. However, its rapid development also

www.ierjournal.org

produces adverse effects on the environment. According to the International Energy Agency, the most energy consumption and CO2 emissions come from the building industry. Besides severe environmental damage, conventional construction methods could also cause economic and social issues, such as long construction periods, low labor productivity, and a high frequency of safety accidents.

Following are the main findings from above:

- The findings of this study help readers holistically understand the current status of prefabrication implementation, including its technology development, impacts on the sustainable development of the construction industry, promotion strategies, and future research directions.
- The study makes contributions to both the body of knowledge and various stakeholders.

Prefabrication Technology - A Promising Alternative in Construction Industry Shubham D. Auti et.al. (2018)

The construction industry is growing exponentially day by day and it makes a remarkable contribution in escalating the pace of development of the nation. Refinements are adapted and analyzed at each and every stage of construction. The reason of assessing all these refinements is to enhance the overall ease and feasibility of the work cycle. These refinements also make a significant change in the total cost of the project. Prefabricated components are increasingly becoming an eminently improving technology to achieve cost effective and speedy construction in the construction industry. This increasing trend for prefabricated components has now turned into numerous applications as they can provide a much faster output for the ever increasing urban construction demand. In addition to this, adopting prefabrication technology also promoted mechanization in the construction industry and created new areas of employment. The study emphasizes the effect of prefabrication technology on the profitability and its effect in the construction work cycle.

Following are the main findings from above:

- Prefabrication construction technology generates less waste on site because building elements are cast in the warehouse and then transported to the site for final erection and installation.
- The better quality control may be achieved if this technology is adopted for repetitive type of works.

Impact of prefabrication technology on profitability in construction industry (2021)

The construction industry is growing exponentially day by day and it makes a remarkable contribution in escalating the pace of development of the nation. Refinements are adapted and analyzed at each and every stage of construction. Prefabricated components are increasingly becoming an eminently improving technology to achieve cost effective and speedy construction in the construction industry. This increasing trend for prefabricated components has now turned into numerous applications as they can provide a much faster output for the ever increasing urban construction demand. In addition to this, adopting prefabrication technology also promoted mechanization in the construction industry and created new areas of employment. A house for residence is basic need for human being.

Following are the main findings from above:

- This paper proposes a dynamic model for quantitively examining the profitability concern, when conventional construction technology is replaced with prefabrication technology (EPS core panel technology).
- Prefab construction technique is much more efficient and sustainable. The better quality control may be achieved.

Buffer space hedging enabled production time variation coordination in prefabricated construction. et.al. (2019)

This paper investigates an on-site production time coordination problem, which focuses on coordinating logistics processes among independent entities in a prefabricated construction supply chain. Prefabrication brings lots of benefits to the construction industry, such as safer and cleaner building environment, faster erection, and cost saving. One key perspective in the prefabricated construction supply chain management is to coordinate independent contractors to overcome uncertainties that always exist and thus hamper on-time delivery of a prefabricated building within budget.

Following are the main findings from above:

- A prefabricated construction supply chain is investigated and the interaction between the building contractor and the general contractor is considered.
- A basic model without any hedging method and two costsharing enabled hedging coordination models are studied as benchmarks. Later on, the BSH enabled OPTVR coordination mechanisms are explored.

Evolutionary Game of Government Subsidy Strategy for Prefabricated Buildings Based on Prospect Theory. et.al.

Compared with the traditional construction method, the prefabricated building can achieve reduction or savings of about 70%, 60%, 55%, 25%, and 20% in construction waste, wood template, plastering mortar, construction water, and construction energy consumption, respectively. It has great practical significance for realizing the sustainable development of the construction industry and promoting the process of new urbanization. According to the requirements of the State Council and the Ministry of Housing and Urban-Rural Development, by 2026, China's prefabricated buildings will account for 30% of new buildings. However, due to the imperfect standard system of prefabricated building standards in China, insufficient integrated design capability, and low-scale production efficiency, its production cost is high. According to relevant calculations, the incremental cost of the total cost of fabricated construction projects is about 260 yuan/m2, the construction unit is more resistant to the high cost of prefabricated buildings, and consumers are not willing to pay for this,

restricting the prefabricated buildings' promotion and application in China.

Following are the main findings from above:

- The government's work should shift from subsidies to incentives for construction units to reduce the cost of prefabricated construction.
- The incentive process may involve information asymmetry, risk preference, and consumer factors.

2.8 Impact of Prefabrication Technology and Equipment On Profitability. Mrunali Neskar et.al. (2020)

Prefabrication is the Practice of assembling components of a structure in a factory or other manufacturing site and transporting complete assemblies to the construction site where the structure is to be located. 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. At present precast concrete buildings are the advanced construction techniques available over worldwide. Being its wide applicability, the total precast concrete buildings systems are becoming a popular choice for many construction. Precast concrete available in many shape, sizes, including structural elements and unreinforced pieces. The prefab industry is the backbone for the development of new ideas in construction business of any country; Factory buildings, residential buildings and the industrial township are needed practically by all the sectors, either to support the manufacturing or services of any industry.

Following are the main findings from above:

- The main advantage of prefabrication is saves construction time, reduces construction waste, together with increased quality.
- It is remarkably seen that the cost of building constructed using prefab technology is significantly less and duration of construction is also much lesser as compared to traditional method.
- The prefab construction method helps in reducing the adverse impacts on the environment and offers an environmental friendly construction.

'Implementation and Profitability of Prefabricated Rammed Earth for the Maun Science Park' et.al. (2021)

With the upcoming problems of the 21st century, people are faced with new challenges. The world population is growing, food is becoming scarce and the environment is being destroyed. The construction industry is a major contributor to environmental degradation, causing severe air pollution through high CO2 emissions as well as being one of the largest producers of waste. To develop solutions to the problems of overpopulation, waste of resources and climate change, a housing project is being designed in Botswana in the city of Maun. This aims to provide resilient housing in increasingly difficult times. By applying modern technology and using sustainable materials, the project aims to counteract climate change and environmental degradation as well as resource waste. To build the project, environmentally friendly building materials are being sought and examined for their suitability. Especially natural building materials like rammed earth have great potential to meet these requirements. Their production is characterized by a small ecological footprint and offer the advantage of being easily disposable.

Following are the main findings from above:

- Addresses the use of rammed earth for the project and investigates the implementation of prefabrication of this building material on the profitability.
- The advantage of using rammed earth as a building material is
- Mainly due to its environmental friendliness using excavated earth for production and its small CO2 footprint.

Comparison of Cast-In-Situ and Prefabricated UHTCC Repair Systems under Bending Bing Wang, Ph.D.1; Qinghua Li, Ph.D.2; Fei Liu3; Shilang Xu, Ph.D., M.ASCE4; Hougui Zhou, Ph.D.5; and Kaiyan Tan

Ultrahigh-toughness cementitious composite (UHTCC) is a new type of cementitious repair material. It is also termed engineered cementitious composite (ECC), strain-hardening cementitious composite (SHCC), highperformance fiber-reinforced cementitious composite (HPFRCC), pseudo ductile cementitious composite (PDCC), ductile-fiber-reinforced cementitious composite and (DFRCC). It is a type of fiber-reinforced cementitious composite with macroscopic pseudo-strain-hardening behavior in tension. This new cementitious composite has been receiving significant attention worldwide such as in the United States, Europe, Japan, China, South Africa, and Korea. With regard to micromechanical principles and fracture mechanics, the UHTCC is prepared with ultrahigh ductility and excellent crack control capability by carefully tailoring the fiber, matrix, and fiber-matrix interface.

Following are the main findings from above:

- Ultrahigh-toughness cementitious composite (UHTCC) is a new type of cementitious repair material
- This new cementitious composite has been receiving significant attention worldwide such as in the United States, Europe, Japan, China, South Africa, and Korea.

IV. CONCLUSION

The study of prefabrication process is done which founds that prefabrication reduces activities related with repetitive body movements, ergonomic challenges & ergonomic problems & workers reported that use of prefabrication preassembly reduce hazards related to material handling on site & that reduction of scaffoldings through use of prefabricated preassembly or precast components would lead to less fall on site.

The comparative survey of conventional construction with prefabricated construction found that conventional construction requires 1.95 Cr rupees & 1375 days to complete construction while 1.73 Cr rupees & 1090 days required for prefabrication construction which shows that

www.ierjournal.org

prefabrication process reduces time and cost required to construction for completion.

In this way we found that prefabricated material reduces time as well as cost required to project for completion.

V. REFERENCES

1. Abhishek K.Taware1' Prefabrication, Sustainable Technique in Building Construction' Volume 1, Issue 2, February 2017

2. Aki Aapaoja "the Challenges Of Standardization Of Products And Processes In Construction" Proceedings IGLC-22, June 2014

3. EvanjalineLibie "Impact Of Prefabrication On Profitability Over Traditional Construction" ISSN: 2455-5797 Vol. (2), No. (3): June 2016

4. Elzbieta Radziszewska -Zielina, Monika Glen. "Studies of the Prefabricated Housing Construction Market in Poland" Journal Of Civil Engineering Vol. 9, Issue 2, 2014

5. Gerhard Girmscheid, "Industrialization in Building Construction – Production Technology or Management Concept" Vol. 8, Issue 1, 2012

6. H. W. Lee "Macroeconomic Labor Productivity and Its Impact on Firm's Profitability" Journal of the Operational Research Society August 2013

7. Hamza Khan "Study on the Trends & Usage of Prefabrication and Modularization: Increasing Productivity in the Construction Industry" ISSN 2278-3652 Volume 8, Number 2 (2017)

8. Hong Xue "Factors Affecting the Capital Cost of Prefabrication—A Case Study of China" Published: 24 August 2017

9. M. Muhammed Ansar T.Subramani1, "Impact Of Prefabricated Technology & Equipment On The Profitability Using Primavera" ISSN 2278-6856Volume 6, Issue 3, May -June 2017

10. Mohamed Nor Azhari Azman "The Perspective View Of Malaysian Industrialized Building System (Ibs) Under Ibs Precast Manufacturing" The 4Th International Engineering Conference 2012

11. N.Dinesh kumar "Comparative Study on Prefabrication Construction with Cast In-Situ Construction of Residential Buildings" ISSN 2348 – 7968 ,29 September 2016

12. Ong Ying Rui1 "The Productivity Rate of Prefabricated Pre-Finished Volumetric Construction (PPVC)" Construction management Vol 2, November 2016

13. Omid Reza Baghchesaraei "Behavior of Prefabricated Structures in Developed and Developing Countries" ISSN 1229 – 1234 Vol. 85, 2016

14. T. Subramani "Impact Of Prefabricated Technology And Equipment On The Profitability Using Primavera" Volume 6, Issue 3, May- June 2017

15. Tony Cunningham "Factors Affecting The Cost of Building Work – An Overview" School of Surveying and Construction Management 2013-10-09

16. Tianying Li "Strategies for Implementation of Integrated Prefabrication Technology in Small Scale Isolated Buildings" UIA 2017

© 2022, IERJ All Rights Reserved

17. Vaishali Turai "A Study of Cost Comparison of Precast Concrete Vs Cast-In-Place Concrete" Volume -2, Issue -2, June -2016

18. Yuan, HP "Investigating waste reduction potential in the upstream processes of offshore prefabrication construction" September 2014