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## Evaluating Offsite Technologies for Affordable Housing

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### Abstract

Availability of an attribute-based evaluation and selection system for offsite technologies is crucial for the adoption of these technologies in mass housing projects. Due to this gap, adoption of offsite technologies remains low in the Indian construction industry in spite of a huge requirement of 18.78 million housing units to be built by 2022. The traditional 'sticks and bricks' approach is not likely to fulfil this demand. Adoption of offsite technologies has to be looked into as an option to deliver the extensive requirement in the area of affordable housing. Rejection of technology by evaluating the first cost alone is not the desired strategy to evaluate these offsite technologies. To evaluate and adopt these offsite technologies in affordable housing segment, a holistic selection framework encompassing a set of attributes is needed. This paper identifies a holistic selection framework with a set of offsite specific attributes alongside a set of standard attributes that are mandatory and desired for the adoption of offsite technologies in the affordable housing. Simple scoring of attributes is utilized in devising the framework. This framework is tested and validated on a case study where offsite technologies are used.

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### 1. Introduction

Looking at the shortage of the housing in India, the Government has outlined a vision of 'Housing for All' (HFA), 2022 which has now been formalized as the 'Pradhan Mantri Awas Yojana'. This scheme is launched with an aim to provide housing for all the citizens under economically weaker section (EWS) and low-income group (LIG) categories. In this scheme, construction of 18.78 million houses across the country within next seven years [1] is planned.

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Offsite technology adoption in the housing sector would achieve this grand vision of India. Offsite technologies that are superior to the traditional approach have to be mainstreamed in the industry to construct such large volume of housing stock. Offsite can be a game changer for the housing industry in India. In the case of traditional approach of project execution, numerous sub-contractors have to be engaged and are to be managed to deliver the common deadline. There are many unforeseen factors such as weather, government approvals, labour shortage, etc. that can affect the delivery of the project in the traditional system. In a factory built approach, we have all the work trades right from carpenters to plumbers working simultaneously in a controlled environment eliminating the risks associated with wastage, etc. This study will provide an awareness of different parameters and a holistic framework for evaluating offsite technologies in construction, and increasing knowledge related to the offsite construction. It is very important to document and evaluate these offsite technologies, to be implemented in other regions as well, thereby ensuring that the mission set HFA by 2022 is accomplished.

## 2. Literature Review

Offsite Construction (OSC) helps us transfer the construction activities into a controlled environment enabling us to organize the workforce in a process similar to manufacturing, enabling us to achieve a higher standard of quality, increased productivity, and waste reduction thereby increasing the overall efficiency of the process. The process also helps implement lean, six sigma, etc. in the design and construction processes. Various reports and research as shown in Table 1 claim that offsite construction can result in 90% reduction in site wastage when compared to conventional construction practice. Offsite is being widely used for the construction of temporary structures such as site offices, and permanent structures such as hotels, hostels, office buildings and residential houses. The materials used in the manufacturing of different offsite components or panels can be handled with better efficiency by practicing proper supply chain management resulting in better control over the design and production process. The wastages will also decline significantly by practicing integrated design, procurement and management.

### 2.1. Benefits of Offsite Construction

Offsite reduces the time spent on site drastically since most of the activities are performed inside closed environment within a factory. Most of the activities that are done on a production line can be completed in a fixed time frame [2]. Other benefits include:

- ✓ The components or panels produced in the controlled condition of the factory can be scrutinized for stringent quality check measures, proper supervision of materials and workmanship, improved quality and a better product. [3]
- ✓ Construction process can be outsourced to external facilities reducing the requirement of labour, which is the major problem in most of the housing projects
- ✓ Better testing facilities can be made e.g. prototype testing, which will improve the design efficiency and other design parameters.

### 2.2. Barriers to Offsite

In spite of numerous benefits over traditional construction, offsite faces many implementation barriers [4], [5]. Some barriers include:

- ✓ Resistance to Change: In these technologies, the traditional culture which we follow needs to be changed, also the skill requirements need to be redefined, and also the team needs to have an improved understanding of project management, scheduling and planning. In addition to this, there are constraints in terms of process, product, quality, technology and market [6]
- ✓ Capital Investment: There is a requirement of huge capital to set up manufacturing units for offsite. The project needs to be in the economies of scale in order to invest such capital.
- ✓ Guidance and Information: There is more guidance required in this case. The flow of information between different teams of design, production and assembly are unlike conventional construction. More Integrated approach and knowledge are required in this case.

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