

Affordable Housing in Developing Countries

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Abstract

The construction of an affordable low-cost housing in developing countries can now be achieved using prefabrication process or prefab construction, considered as one of the latest technologies introduced in the last few decades, where the required structures for a prefab house are developed in a conservative environment reducing the quality issues and assembled on site. Hence, there is an annual shortfall of 600,000 houses in the developing country such as Pakistan (SMEDA, 2006) creating an opportunity for our housing construction industry to adopt the prefabricated construction process which includes innovation of new materials & advanced techniques in order to make up the backlog and meet the shortfall in the next 10-20 years. Consequently, this paper distinguishes the cost comparison analysis of prefab housing process with traditional and conventional built housing process along with the types of categories within which the customer may target and their corresponding benefits. The results indicate a significant difference in the cost comparison for the variant size houses ranging from 80 sq.yds to 250 sq.yds.

Keywords: Prefab Construction, low-cost housing, cost comparison analysis

1. Introduction

The entrepreneurial idea of affordable housing in developing countries has been explained by leibenstein (1968) as the income growth per capita which requires being more productive in comparison to the past experiences by utilizing new materials and commodities, new skills and techniques, collection of new knowledge and organizational forms to lower the overall project expenses. Basically, this conception presumes that the existing market players in the industry are still conceiving the old and existing technologies to provide competitive services or products. Thus, it grounded the opportunities for the new markets to emerge effectively having differentiated products or services with low-cost or cheaper rates provided by either existing or new firms. (Thompson and Rushing, 1999) as the economic development revolves around change and the adoption of new technologies. Thus, these new construction methods are the best agent for this change.

However, there is an annual shortfall of 600,000 houses in Pakistan (SMEDA, 2006). For this reason, our housing construction industry has to adopt the prefabricated construction materials & techniques in order to make up the backlog and meet the shortfall in the next 10-20 years.

2. Literature Review

The related literature is presented in subsequent sub-categories:

2.1 Prefabricated Houses

To understand the concept of Prefab house, we must first understand that the required structures/materials for a prefab houses are developed in a conservative environment reducing the quality issues and brought on site where they are simply assembled (if optional) and then each individual prefab structure is installed on “one at a time” basis.

2.2 Types Of Prefabricated Houses

There are various types of prefabricated houses that can provide a quality home differentiated by narrow gap with its pros and con (Kim, 2009).

2.2.1 Panelized homes

The panelized homes are developed by patching together flat and small parts or sections using a crane. These panels can either be open which only consist of basic framing or can be closed which includes insulation, electrical and plumbing in each panel (Kim, 2009). However, the local building codes are implemented in the development of these panelized homes which are also inspected by the local building inspectors (Kim, 2009).

2.2.2 Manufactured homes

In 1974, the federal government introduced the Housing and Urban Development (HUD) building codes along with the building process of manufactured homes also referred as “mobile homes” which helped improving the quality of the homes (Kim, 2009). However, its non-removable steel chassis bottom layer is the only major drawback of manufactured homes (Kim, 2009).

2.2.3 Modular homes

The modular homes are essentially used for creating multi-story homes over a permanent foundation, constructed in an industrial plant as very enormous modules and assembled on the construction site to build a home. These modules include all insulation, electrical and plumbing lines embedded in their smoothly varnished walls, which generally add up to 20-30% of increased in building materials for the home development (Kim, 2009).

2.3 Prefabricated Houses in Developed Countries

The use of prefab in developed countries has started long ago when first prefabricated home was built in the 1600's in England and was shipped to Massachusetts (Rhody, 2010). In USA "Trailer Coaches" were introduced in 1920 for the sole purpose of providing convenience to the traveler instead of tents to sleep in the camp areas. Similarly, in 1950's, mobile homes were initiated, a larger version of the house trailers which can be towed by a vehicle (Philipson, 2001).

The market establishment of the ‘trailer homes’ and ‘prefabricated homes’ has evolved the construction industry in the developed countries where the manufacturers are providing the residents an opportunity to

buy a home, increasing the production of modular homes being built up to 2% amounting \$7.4 billion in 2005 (Britto et al., 2008). In USA, approximately 6.2% out of \$12.5 trillion GDP is consumed on residential and commercial construction (Kim, 2009), where the worth of residential construction is approximately \$490 billion (Britto et al., 2008).

Similarly, the stick built homes being constructed are approximately 97% out of 1.2 million houses being developed annually (U.S Census, 2008), whereas, modular construction usually amounts up to nationally 3% of the single-family homes (U.S Census, 2008) and it rises up to 11% for the homes built in the rainy and snowy Northeast areas (U.S Census, 2008).

Thus, the above facts are clearly identifying the changing trend of construction industry leaning towards prefab approach in developed countries. The same is happening in the developing countries also. Let's take a brief look over prefab trend in developing countries.

2.4 Prefabricated Houses in Developing Countries

The housing problem in the developing countries is the key factor for inspiring quality living, where a faster production system is required while maintaining home quality and economy for overcoming the annual shortages (Roy, 2001).

The main advantage applauded by prefabrication process in terms of architecture is increasing productivity and efficiency of workforce without compromising quality (Ryan et al., 2003). Even other developing countries such as Africa, India, China and several parts of South America, have realized the potential of affordable and quick houses that can be achieved using prefabrication process (Ryan et al., 2003).

In the country such as India, where there are numerous issues, yet they still tout prefabrication such as ZIP blocks and Funicular shell as the sustainable solution to constructing building (Ryan et al., 2003).

Nigeria located in Central Africa has faced the increment of population of more than 600% per annum and will increase more in the future, where only 25% and 41% of the high income and medium income population was able to afford new constructed homes leaving the rest of the low income population homeless or living in a trailer (Izeogu, 1993). Prefab with its low cost provides the opportunity for these low income people to have stable homes.

Many African countries such as Bissau, Mozambique and Cuba, a sandino system was started in 80's as an example of light prefab factory system (Stallen, 1994), also famous in Servivienda in Colombia, which also includes the transportable house and roof system which was first developed by Mexicans in the end of 60's (Stallen, 1994).

Similarly, the SP 80-T of prefabricated floor slabs is used extensively by both high-class private and low-class village builders in Cuba and China who prefer cheap technologies such as hollow core panels (Stallen, 1994).

That is why, National Housing and Habitat Policy has recommended reassessing the housing shortage in India that can be fulfilled using prefabrication system (NHHP, 2007).

2.5 Prefabricated Houses in Pakistan

The prefabricated house idea is in its infancy in Pakistan starts proving to be a better shelter solution for flood & earthquake affected people and for emergency purposes because of its fast track constructing

approach (Ahmed M., 2008). But it should also serve as a purpose of Low cost dwellings, educational buildings & industrial plants for various regions of Pakistan (Mian Z. et al, 2008).

Our project aims to build prefab houses not only just as an emergency solution but as a key solution to the shortage of 600,000 houses at an annual basis (Mian et al, 2008; SMEDA, 2006), whereas if we see the potential housing market of Sindh there is an annual demand of 500,000 housing units for next 10-20 years (SMEDA, 2006).

2.6 Advantages of Prefabricated Homes

The prefab adopted as the product to start low-cost venture due to the advantages researchers associate with it can be:

- Reduction in the overall project duration and scheduling due to fast tracking applied in the production activities (Lu, 2007).
- Reduction in the schedule disruptions on site due to weather conditions (Lu, 2007).
- Reduction in the environmental pollution such as noise caused on the site during construction process (Lu, 2007)
- Increased in the quality and technique applied on the building construction due to the required expertise (Philipson, 2001).
- Increased in the safety of the workforce.
- Increased in the productivity of the workforce.

3. Evaluation of Prefab Technology and its Market Business

SWOT (Strengths, Weakness, Opportunities and Threats) is a tool which evaluates a company's overall performance regarding its product/services provided to its customer. Strengths and Weakness include an organization's Internal capabilities and limitations that help them achieve their objectives, whereas Opportunities and threats are the company's external environmental factors and trends which may be favorable or unfavorable that may presents challenges to performance.

Thus, the SWOT analysis for the product of precast concrete which seems favorable for constructing affordable homes in developing countries can be better understood through table 1.

Table 1: SWOT Matrix of Prefab Concrete Homes for Affordable Homes

Strengths	Weakness
<ul style="list-style-type: none"> ▪ Speed, Quality, Economy ▪ Low Maintenance ▪ Seismic Resistant ▪ Universal Application 	<ul style="list-style-type: none"> ▪ Lack of awareness, acceptability & availability ▪ Resistance to Change ▪ Fear of Unknown ▪ Unfamiliarity of Architects and Engineers ▪ Lack of Exposure to the technology in Technical Institutes

Opportunities	Threats
<ul style="list-style-type: none"> ▪ Large market of affordable houses ▪ Population is increasing causing housing market expansion ▪ Unskilled labor ▪ Target middle class ▪ Large Size Projects ▪ Demand for Quality Construction ▪ Cost efficient technology 	<ul style="list-style-type: none"> ▪ Govt. Tax Policy, Lack of Govt. Support & Encouragement ▪ Bad Past Experience with Substandard Technology & execution ▪ Lack of Standardization ▪ Imaginary Problems ▪ Difficult to customize

Similarly, the SWOT analysis for business of the product of prefab concrete required for constructing affordable homes within the market of the developing countries can be clearly understood through table 2.

Table 2: SWOT Matrix of Business for Affordable Homes

Strengths	Weakness
<ul style="list-style-type: none"> ▪ Excellent Customer Service ▪ Excellent Sales Service ▪ Calculated risk (Affordable loss) ▪ Less Investment required ▪ Time and cost efficient ▪ Quality Product 	<ul style="list-style-type: none"> ▪ Initially Low Profit Margin ▪ Less Customization in Product ▪ Nonexistent Market
Opportunities	Threats
<ul style="list-style-type: none"> ▪ Market demand of 600,000 houses annually ▪ No Market Competitors ▪ Standardized Housing Schemes ▪ Product innovation and improvement ▪ Changing trend of people towards prefab ▪ Flood and earthquake affected areas ▪ First mover advantage ▪ High profit margin in Mass production 	<ul style="list-style-type: none"> ▪ Wrong customer perception ▪ High risk associated with product ▪ Market entry barriers ▪ Non-supportive attitude of contractors ▪ Non-adopting attitude various industry stakeholder ▪ Economic slowdown ▪ Lack of knowledge about product

3.1 Cost Comparison with Traditionally Built Homes

We have taken 3 different sizes of house in Pakistan i.e. 80 sq.yds, 120 sq.yds and 250 sq.yds, where cost evaluated through traditional built-homes was compared with prefab homes as shown in table 3.

Table 3: Summary of Cost Comparison b/w Traditional Cost and Prefab Cost

House Size	Traditional Cost	Prefab Cost	% Comparison
80 sq.yds House	Rs. 12,24,000	Rs. 8,40,840	31 % Less
120 sq.yds House	Rs. 18,36,000	Rs. 12,61,260	31 % Less
250 sq.yds House	Rs. 38,25,000	Rs. 27,19,500	29 % Less

Note

- *This variable cost only include the civil works such as structural cost and finishing cost which includes plastering and paint, windows, doors, ventilators and floor finishes as according to the package.*
- *This is an approximate comparison ranging from 29% to 31% which is an effort to depict a maximum realistic cost comparison and it can vary with the level of customization customer want in our standardized homes and little bit due to external factors.*
- *This is the cost which is utilized in complete manufacturing, transportation, site clearance and preparation, assembling and final finishes of homes.*
- *The cost does not include the internal profit/mark-up and solely representing the manufacturer's manufacturing and finishing cost plus transportation cost.*

3.2 Target Segments

Similarly, the targeted segments are focused as per customers corresponding needs for prefab concrete homes which have been categorized along with its benefits and features in table 4.

Table 4: Customer Needs and its Corresponding Benefits as per the Targeted Segment for Prefab Homes

Target Segment (Annual Income)	Customer Needs	Corresponding Features/Benefits
Aspirers (Rs 90,000 – Rs 200,000)	<ul style="list-style-type: none"> ▪ Limited Budget/Low Cost housing ▪ Quality Product ▪ Less Spacing capable of accommodating more people 	<ul style="list-style-type: none"> ▪ Standardized low cost houses ▪ Less customization & features ▪ Space saving furniture on reasonable price ▪ Quality product
Seeker (Rs 200,000 – Rs 500,000)	<ul style="list-style-type: none"> ▪ Medium-Low cost housing ▪ Quality Product ▪ Medium level of aesthetics & beauty ▪ Less construction time 	<ul style="list-style-type: none"> ▪ Standardized housing system ▪ Medium customization features ▪ Quality Product ▪ More finishing & aesthetics
Strivers (Rs 500,000 – Rs 1,000,000)	<ul style="list-style-type: none"> ▪ Quality Product ▪ Aesthetics & Beauty ▪ Fast construction of home ▪ More conscious of uniqueness & individuality of product 	<ul style="list-style-type: none"> ▪ Quality & Fine product ▪ More customization features ▪ More value added features

4. Conclusion

We can conclude that the marketing industry of prefab housing has been emphasizing entirely on the quality and cost issues in comparison to traditional built-homes proving the fact from table 3 that the overall project cost on any size of house built by prefab method is cheaper than other traditional methods. However, the prefab also improves the product's quality and overall project duration with low maintenance and few market competitors in the construction industry and an opportunity of 600,000 houses annually will mostly likely aid in the economic development of Pakistan in the near future.

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