



Study and Evaluation of Prefabricated Concrete Buildings Industry by SWOT Analysis: Sustainable Development Approach

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ABSTRACT: Considering the population growth and rapidly housing demands, it is inevitable to adopt industrial building systems for the purpose of raising the quality of industrialized building construction. Construction industrialization is an important factor in increasing production and striking the right balance between supply and demand in the market. There are multiple methods for industrialized building construction, the most common of which is the prefabrication concrete industry. An attempt has been made in this study to put forward the appropriate method for understanding the current status of this industry in developing countries and adapting it with economic, social and environmental criteria of sustainable development and to present suitable management methods for choosing and piloting the route toward sustainable development. The results suggested that when compared to the cast in place concrete, prefabricated concrete is of higher quality according to the sustainable development criteria. The results indicated that the order of desirability of prefabricated concrete in terms of different aspects of sustainable development is as follows: environmentally, socially and economically. According to the sustainable development criteria, prefabricated concrete could provide more opportunities to communication development. Moreover, there are more opportunities than threats in the industry of prefabricated construction. In this article, appropriate strategies were formulated by means of SWOT analysis for the purpose of developing and improving and expanding the prefabricated concrete industry.

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1- Introduction

There are several solutions for industrialized building systems among which the most commonly used method is prefabricated industry, especially precast concrete. In this industry, the stages of concreting and processing of all or a number of components of the structure such as foundation, pillar, bar, and slab will be done in factory and prefabricated components will be assembled after being transported to the site; and the structure would be ready [1]. Jaillon and Poon (2009) demonstrated that reduction in construction waste and environmental protection are some of the major advantages of using of prefabricated parts [2]. Chen et al. (2010) emphasized that prefabricating can bring some considerable advantages such as reducing construction waste, overall cost and construction time, improving quality and enhancing safety in site [3]. Once more, Jaillon and Poon (2014) studied the most important advantages of prefabricating as follows: reducing construction waste, improving quality, reducing raw materials consumption and improving environmental factors in site. On the other hand, these researchers studied the most important disadvantages of using of prefabricated parts as follows: more need for storage space, limit in dimensions of site with respect to the proper place for storage of parts, high costs of initial investment, lack of flexibility, and resistance against changes [4].

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“Sustainable development” is one of the concepts which were being focused by many of decision-makers over the recent years. Construction is an industry that draws many attentions in improvement of social, economic, and environmental factors [5]. Oritz et al. (2009) focused on study of building’s life cycle based on social, economic, and environmental factors of sustainable development. Using of survey of life cycle, optimization of these dimensions would be possible, from extraction of raw materials to disposal of waste building materials [6]. Vallance and Dixon (2011) presented a triple plan on sustainability in construction industry including sustainability in development, connection and maintenance [7]. Growth and development of the industry of installation of concrete prefabricated building requires optimized management and taking steps in line with sustainable development. Growth of this industry is not possible without a specific strategy, design and plan; and the first step would be learning a detailed knowledge about it [4]. In this paper, we tried to introduce an appropriate model and solution for recognizing the reality of this industry in developing countries and to match it with standards relate to social, economic and environmental aspects of sustainable development. The information we gathered for the purpose of this paper has been analyzed by SWOT method. This paper has been done based on prefabricated building projects formed of structural and separator components in residential buildings up to 5 levels.

Experts of the industry of construction in Iran, Syria, Egypt, Qatar and Saudi Arabia form the statistical population of this paper, and sampling was done by using criterion-based method.

2- Methodology

The methodology of this research is comprising of the following stages:

1. Library studies in order to recognize advantages and disadvantages of the industry of installation of prefabricated concrete buildings.
2. Literature review for identification and determination of key criteria of sustainable development in relation with construction industry.
3. Field studies (questionnaire) for recognizing strengths and weaknesses of the industry of installation of concrete prefabricated buildings with regards to key criteria of sustainable development.
4. Field studies (questionnaire) for determining importance of each criterion of sustainable development from the points of view of experts in the construction industry.
5. Calculation of importance of the criteria and determination of their priorities. And then, with respect to the importance-desirability index of precast concrete, opportunities and threats of advantages and disadvantages of the industry of installation of prefabricated concrete structures in comparison with cast in place concrete structures by using of SWOT method as a risk identification approach.
6. Investigation of the industry of installation of precast concrete buildings by using of SWOT method as the status analysis approach.
7. Studying and preparing guidelines for using of opportunities and dealing with threats in order to promote position of the industry of installation of precast concrete buildings with respect to sustainable development

3- Discussion and Results

The key criteria of economic, social and environmental aspects of sustainable development in relation with the construction industry are depicted in Tables 1, 2, and 3 respectively.

Considering the results, the most important advantages of the industry of installation of precast concrete buildings regarding the criteria of sustainable development are as follows:

Reducing the project duration (using of industrializing advantages, decreased executional errors) due to speed of construction.

- Increasing the possibility of execution of several projects simultaneously based on initial investment.
- Improvement and promotion of final product.
- The possibility for working in different weather conditions, elimination of seasonal limits and having work continuity.
- Increasing level of safety, sanity and health of workers due to more desirable site management.
- Increasing the rate of employment and creating jobs continuously which may lead to a decrease in social damages.
- Reducing consumption of natural resources, raw

Table 1. Key criteria of economic aspect of sustainability

Eco1	Increasing the possibility of execution of several projects simultaneously based on initial investment
Eco2	Less need for initial investment for project execution
Eco3	The possibility to execute greater projects and to construct more in a specific period of time
Eco4	Reducing construction costs of the project
Eco5	Increasing lifetime and strength of the structure
Eco6	Possibility of reusing prefabricated components of the building
Eco7	Continuous sustainable job creation
Eco8	Less need for several specialties and human force in the site
Eco9	Decreasing dangers and possibility of damage of parts and materials during transportation and storage
Eco10	Less need for storage space in construction site
Eco11	Reducing project duration (using of industrializing advantages, decreased executional errors)
Eco12	Flexibility in construction related to changes
Eco13	Improvement of project management
Eco14	Decreasing reworks
Eco15	Improvement and promotion of final product
Eco16	Reducing impact of environmental and climatic factors during construction

Table 2. Key criteria of social aspect of sustainability

Soc1	Increasing rate of employment and continuous job creation
Soc2	Increasing satisfaction, comfort and welfare of residents
Soc3	Promotion of levels of skills of construction team
Soc4	Increasing satisfaction and confidence of quality and durability of the final product
Soc5	Decreasing noise, dust, and other pollutions in construction site
Soc6	Ability of working in different climatic conditions and elimination of seasonal limits
Soc7	Enhancing competitiveness in labor market
Soc8	Improving levels of health, safety and hygiene of workers (improved safety against possible accidents)
Soc9	Improving levels of general health, safety and hygiene

Table 3. Key criteria of environmental aspect of sustainability

Env1	Decreasing consumption of natural resources and raw materials
Env2	Decreasing noise, dust, and other pollutions
Env3	Reducing rate of energy consumption during construction period
Env4	Reducing water consumption during construction
Env5	Reducing waste materials leading to contamination of soil and water
Env6	Decreasing losses and material waste, and utilizing national resources more efficient
Env7	Less spread of waste in the site

materials and construction materials.

- Decrease of losses in materials and waste of raw materials and better use of national resources.
 - Reducing rate of spread of waste in site and having more adaptability with the environment.
- Moreover, the main disadvantages in the industry of installation of precast concrete buildings with respect to criteria of sustainable development are as follows:
- Increasing dangers and the possibility of break or damage in prefabricated parts while being transported or being stored as well as other problems of transportation.
 - Lack of flexibility of construction to changes.
 - More need for initial investment for project execution.

Also, considering the guidelines provided for promotion of position of the industry of installation of precast concrete buildings, some of the effective solutions can be listed as follows:

- Allocating suitable budget to applied research centers for feasibility study of localization and fabrication of parts and components required in installation of precast concrete structures over the country
- Empowerment and providing a suitable ground for competition of private sector as the main driving force of growth and development
- Trying for providing a suitable ground to increase activity of foreign contractors and to attract investment and foreign financial/executive power
- Prioritizing payment of housing loans considering using of prefabricating methods
- Using of different media for public information and advertisement
- Making the suitable ground and to bind consultants to provide and to compare prefabricated structure options in feasibility studies
- Codification of encouraging regulations by government, banks and municipalities for using of prefabrication methods
- Maintaining and developing the name and brand for all of products and introducing and promoting the position of this industry according to international standards with an increase in production, quality and influence in markets

4- Conclusions

Taking into consideration the influence of the construction in global society and economy as well as human environment, this industry is considered as one of the most important industries in the area of sustainable development. Thus, considering the concept and aspects of sustainable development, activities conducted, how leading the market toward sustainable development this research conducted in construction industry.

With the aim of identification and determination of opportunities and threats of the industry of installation of precast concrete buildings, this paper provided a framework for surveying sustainability of precast concrete structures in terms of economy, society and environment; and attempted to recognize advantages and disadvantages of this industry. The results of this study shown the desirability of precast concrete from the point of view of sustainable development regarding environmental, social and economic aspects. With respect to criteria of sustainable development and in comparison with cast in place concrete, precast concrete is capable of making more opportunities for development over the country.

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