



## Major Aspects of Sustainability in Building Industrialization

### KEYWORDS

Building industrialization, Sustainability, Sustainable construction, Industrialization challenges.

### Ujjawal V Sidhpura

Senior Student, Department of Civil Engineering, Faculty of Technology and Engineering, The M.S. University of Baroda, Vadodara, Gujarat, India

### Bharat Kuvadiya

Senior Student, Department of Civil Engineering, Faculty of Technology and Engineering, The M.S. University of Baroda, Vadodara, Gujarat, India

### Shyam D Kotecha

Senior Student, Department of Civil Engineering, Faculty of Technology and Engineering, The M.S. University of Baroda, Vadodara, Gujarat, India

### Prince M Patel

Senior Student, Department of Civil Engineering, Faculty of Technology and Engineering, The M.S. University of Baroda, Vadodara, Gujarat, India

**ABSTRACT** In recent years, Building construction challenge is the reduction of social, economical and environmental impacts along with economical nature and increasing life quality, as here sustainable construction is important. Pre-fabrication and industrialization are referred as a solution of sustainable construction due to some of its main characteristics consisting of many sustainability aspects. Due to this fact, the application of these building systems in most cases, makes achieving to sustainable building more easy. Sustainability aspects in industrialized systems are categorized in four groups of environmental, social, economical and technical issues and in each group some of general characteristics of industrialization in these methods are studied. Today, industrialized construction systems by relying on quality increase idea and blending with the environment and more flexibility, good design and planning and optimization, can fulfill the goals of sustainable construction.

### I. INTRODUCTION

Building construction has important role in sustainable development, it is not only due to participation in national economy, but it is due to the fact that constructed environment has great influence on life quality, comfort, security, health etc. construction, maintenance and updating the constructed environment have potential influence on environment and the building consume most of unrecovered resources and create great amount of waste and the performance of buildings creates half of the total carbon dioxide pollutants. Industrialized systems in building in the current era are more used with the aim of increasing quality beside economically. Of potential characteristics of industrial methods due to using high technology and planning is the possibility to fulfill sustainability goals. These methods can fulfill most of sustainability goals namely environmental sustainability.

### II. THEORETICAL BACKGROUND

#### • Material and Methods

The current building construction challenge is creating economical buildings that increasing life quality while reducing social, economical and environmental effects. Achieving sustainability in architecture and construction is the goal emphasized more these days. There are many theoretical basics but some of them are not practical. Among practical solutions to provide good housing is industrialization that is sometimes. Building industrialization due to some of characteristics has many sustainability aspects and due to this fact, the application of these constructional systems most of the time facilitate achieving sustainable construction. Thus, the idea of architecture application based on industrial idea thought is as a good solution in linking theoretical basics and constructional realities of sustainable architecture namely in housing.

#### • Industrialization

Industrialization is social and economical change process as a society is changed from pre-industrialization condition to industrialization case. This fact is mostly a part of extensive

process of modernization via development of new methods of production and technology and it means factory production based on concentration and regular activities and atomization of operation by emphasis on mass production. Industrialization based on high capacity is for reducing costs and quality improvement and accessibility to complex product for a wide range of people. But industrialization in building is not executed as a whole in building. If a car is built with the same method as a building is built, rarely people could afford to buy. In a complete definition, industrialization is general organizing based on quantity presenting a personalized and complete product. In building industrialization, it is possible that the final product is not a standard building, because the demands of user and site are different in each case. Final product is preferably a constructional system. A construction system is similar set of coordinate components or some tools producing buildings with different shapes, sizes and performances. In each case construction method is not invented again, but there are a set of drawing activities like the traditional approach the every building is behaved differently. Also, any process should fulfill two demands of production simplicity and proposal of intelligent labor distribution between the factory and the site.

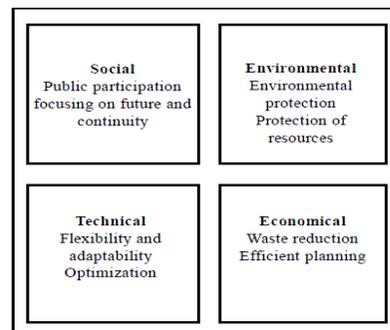


Fig. 1: The main issues in sustainability

**Sustainability**

International Council of Building (CIB) in 1994 defined the purpose of sustainable architecture creating and innovate an artificial healthy environment based on ecologic design and resources efficiency. A sustainable building is a building with the lowest inadaptability with artificial and natural environment and it is including the building itself, surrounding environment, regional and global environment.

**III. Sustainability Aspects in Industrialization (Related Tables)**

Perception and interpretation of sustainable development in the building have been changed in recent years. At first the important point was emphasis on resources limitation namely energy and the method of its impact reduction on natural environment. In the past decade, the emphasis was on technical issues of building and construction such as materials, building parts and components, construction techniques and energy. Today, most of non-technical issues were taken into consideration and economical issues and social development were raised as sustainable development indices. Thus, using some solutions such as selection of good construction materials and applying new building engineering methods (Industrial production and pre-construction methods) environmental goals and sustainable development in the industry of building are pursued. Optimized use of construction materials, making the consumption of raw material minimum and recovering them, building industrialized production and maintaining building with the minimum cost are the factors to achieve sustainable development in building industry.

**TABLE 1**  
Four principles of sustainability

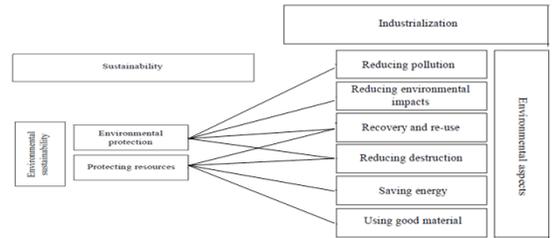
Sustainability principles	Explanation
Equity	Regarding Equity law in local and global aspects in productions.
Futurity	Being assured of fair among generations that keep the minimum environmental asset for future generations.
Environment	Integrity of ecosystem should be kept and its value should be recognized and be respected not only to disturb.
Public participation	The importance of public participation in decisions related to them and sustainable development process.

**TABLE 2**  
Aspects of Industrialization with Sustainability Potentials

Sustainability Potentials	Aspects Of Industrialization
Controlled environmental	Industrial systems provide controlled production environment with availability to the corners and hard sections that are unavailable in common construction methods.
Conditions in production	Industrialization is considered with the minimum waste amount by material recovery capability.
Waste reduction	One module or product to another product.
Construction materials	The used materials have high potential in creating buildings with more saving in consuming energy.

**Major Aspects in Industrialization**

I. Environmental Aspects in Industrialization	II. Social Aspects in Industrialization
III. Economical Aspects in Industrialization	IV. Technical and Execution Aspects in Industrialization



**Industrialization Challenges in Relation to Sustainability**

Nevertheless, the existence of most of sustainability aspects in constructional industrial methods, some of these methods face with some problems in this regard. Long periods of recovering materials from building wastes, environment pollution in materials recovery process, high material costs, construction machineries, the effect of continuous changes (performance, technological, economical, cultural and ecological) on buildings in their life service, variant and increasing need to buildings and unsuitable extension and flexibility and few existing buildings reducing the expected life of buildings considerable and create main structural changes in short-term.

**IV: CONCLUSION**

According to the analyze study, industrial methods have a lot of characteristics and functionality in sustainability. Industrialization is a force along with sustainability. The idea of using industrial idea in architecture is a solution in achieving sustainable architecture. Today, industrial architecture by relying on idea of increasing the quality and conforming with the environment and more flexibility and by good planning and optimization can be in the range of sustainable architecture definitions. Sustainable aspects in industrialization are presented in Table 3.

**TABLE 3**  
Sustainability aspect in building industrialization

Sustainability aspect in building industrialization	
Environmental aspects	Reducing pollution & reducing environmental effects, Destruction and reduction, Saving in energy consumption
Social aspects	Controlled conditions in the production & Organizing human resources, individualization of product and mass customization
Economical aspects	Reducing maintenance costs & reducing waste (material, energy, time), Long-term economical saving
Technical aspects	Adaptability and continuity & Increasing product quality, Optimized design

**REFERENCE**

[1]. JOURNAL PAPER: Tam, V. et al (2006). International Journal of Construction Management, Vol. 6, No 1, 15-25. Title: "INDUSTRIALISED, FLEXIBLE AND DEMOUNTABLE BUILDING SYSTEMS: QUALITY, ECONOMY AND SUSTAINABILITY". Author: Roger Bruno Richard, School of Architecture, University of Montreal, Montreal (Quebec) Canada | [2]. JORNAL (online): WIT Transaction on Ecology and the Environment (ISSN: 1743-3541), Vol.167 (2011). Title: "Sustainable Construction and Green Building: The case of Malaysia", Author: K.A.Kamar and Z.A.Hamid | [3]. BOOK: Constructing Green: The Social Structures of Sustainability, Edited by: Rebecca Henn L. and Andrew Hoffman J., Foreword by: Nicole Woolsey Biggart | [4]. BOOK: Sustainable Construction: Green Building Design and Delivery, Author: Charles J. Kibert | [5]. EXTRA SOURCE: Ding, G. K. C. (2008). Sustainable Construction, the Role of Environmental Assessment Tools. Journal of Environmental Management, 86, pp 451-464