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# Exploring the Potential of Using Industrialized Building System for Floating Urbanization by SWOT Analysis

Mohamad Ibrahim Mohamad, Mohammad Ali Nekooie, R. Taherkhani,
A.L. Saleh and Shaiful Amri Mansur
Faculty of Civil Engineering, Universiti Teknologi Malaysia, Skudai, Johor, 81310, Malaysia

**Abstract:** Population growth and following by that, increasing the demands, lead the industries such as construction, to the manufacturing production. Prefabricating technology or Industrialized Building System (IBS) is the most effective process among manufacturing processes. This manufacturing process also can be employed for floating urbanization as a new approach of flood adaptation method. There is a high potential for applying IBS technology in floating urbanization. Thus, this study identified a strategic plan to look at IBS as an answer to a housing shortage problem and flood protection. The SWOT analysis has been employed to identify and evaluate the internal and external environments influencing on the IBS implementation for floating urbanization in Malaysia. The strategic plan is demonstrated on educational sector, R and D and manufacturing sector.

**Key words:** Floating urbanization, industrialized building system, R and D centre, SWOT analysis

## INTRODUCTION

Population growth causes increasing the demands of productions in construction industries. The huge demand of construction associates with the challenges often occurring in the terms of productivity, efficiency, quality and delivery of work. Thus, the manufacturing systems are changed with rapid changes in technology (Liu and Tsai, 2007). Otherwise, the generating of the waste materials is increased due to this urban expansion (Begum *et al*., 2006). However, manufacturing industries try to manage an effective foundation for creating a value stream from resources to the customers (Shafia *et al*., 2009). Prefabricating technology or Industrialized Building System (IBS) is the main manufacturing processes with the highest effectiveness in construction industry (Taherkhani and Saleh, 2011). IBS has been undertaken to solve and improve the current construction method and scenario in Malaysia (Agus, 1997; Kamar *et al*., 2009; Mohamad *et al*., 2009). Malaysia attained high growth rate in economical success and it continues to take big strides in its industrialization nation by the year 2020 (Bani *et al*., 2011). The growth of the urbanization represents specific response to economic, demographic and environmental conditions. Dwelling and housing becomes the main reason of land use in this rapid urbanization and industrialization (Dhaimat and Shawabkeh, 2006). Thus, land use becomes an important factor for each policy even in flood management policies especially in Malaysia. On the other hands, flooding is one of the world wide major catastrophic issues especially in tropical regions. Malaysia in general, experiences a wet and humid tropical climate throughout the year that is characterized by high annual rainfall, humidity and temperature (Suhaila and Jemain, 2007). Rather than implementing normal protective actions such as barriers or ponds, floating urbanization is assumed as a navel story but new solution to protect urban and semi-urban area. Different studies alarmed about increasing the risk of flooding due to global warming in all over the world. They proposed floating house as a mitigation strategy for floods due to climate changes (Pasche *et al*., 2008; Holdsworth, 2007a, b, 2008; Ray, 2010). Climate change scenario imposes different impacts on surface water and it is the most important challenges in the recent decades (Yasin, 2009; Yazdani *et al*., 2011). Floating houses consist of different compartments in two main categories, Floating Platform and Mooring System. All parts have the potential of pre-fabrication manufacturing especially for pontoons (Pasche *et al*., 2008; Fit, 2006; Holdsworth, 2007a; Kuijper, 2006; Nieuwenhuizen, 2006). Regarding to high potential of application of IBS in floating urbanization, a strategic plan is needed to look at IBS as an answer to a housing shortage problem. This study is going to identify and evaluate the internal and external environments influencing on the IBS implementation for floating urbanization in Malaysia. The variables in this study are the strengths, the areas of improvement, the opportunities and the threats faced by

**Corresponding Author:** Mohammad Ali Nekooie, Faculty of Civil Engineering, Universiti Teknologi Malaysia, Skudai, Johor, 81310, Malaysia Tel: +6-0177351502

the IBS. After evaluating the above-mentioned internal and external factors, appropriate strategies for the status of IBS are introduced by SWOT matrix. The SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) is generally developed through a reading of few variables that are a priori selected based on the previous knowledge (Rostirolla and Rostirolla, 2011).This method has been proved as an effective tool and has constituted a suitable baseline to draw whole picture of a sector with high accuracy for making policies (Akca *et al*., 2006; Mahdavi *et al*., 2008).

The information are gathered during the evaluation process by applying semi-structured interview with 3 experts in Malaysian construction Industry. The results identify the strategic problems by using the SWOT analysis.

**SWOT analysis:** As the first step in such planning, managers need to be deeply and thoroughly aware of the existing situation at their business. SWOT analysis is defined as a structured approach to evaluating the strategic position of a company, organization, product or system by identifying its strengths, weaknesses, opportunities and threats. (Kotler, 1994) The main message of the internal and external analysis of an organization (the SWOT Analysis) is the progress and the forward movement of the organization based on its strengths, the minimization of the weaknesses, the provision of the areas of improvement, the utilization of opportunities and the warding off of the threats (Piercy and Giles, 1989). SWOT analysis is one of the most famous tools for strategy formulation (Amin *et al*., 2011). It can be performed on a product, service, company, system or even on an individual. Proper application of SWOT analysis can draw an image of the most important factors that influence on the business successfulness and unsuccessfulness. This imaging can act as well as a plan toward business improvement. This method is essentially a brain storming season on the key variables due to the performance of the system (Akca, 2006).

**Industrialized building system (IBS):** Regarding to the low speed construction and higher cost, the conventional system is not able to meet the current demand of buildings (Agus, 1997). In order to overcome the present problems, the mass production of housing under high quality control is required. The concept of mass production of the high quality building is termed industrialized building systems (IBSs). IBS is a construction technique in which components are manufactured in a controlled environment (on or off site), transported, positioned and assembled into a structure with minimal additional site works (CIDB, 2011; Kamar *et al*., 2009). In terms of IBS, some researches emphasized on the concept of pre-fabrication, off-site production, manufacturing and mass production of building components, previously (Lessing *et al*., 2005; Rahman and Omar, 2006; Thanoon *et al*., 2003; Warszawski, 1999). Nevertheless, towards the last years, the efforts try to promote the usage of IBS as an alternative to conventional and labor intensive construction method. As confirmed by IBS Roadmap 2011-15 (CIDB, 2011) published by Construction Industry Developing Board (CIDB), a strategic plan is needed to cover IBS disadvantages and looks at IBS as an answer to a housing shortage problem. The objective of this research is to develop strategic plan in implementing IBS for floating urbanization and amphibious house.

## MATERIALS AND METHODS

**SWOT analysis:** SWOT model analyzes including the identification of factors which are internal to the business and also factors that affect the company from outside (Roumboutsos and Chiara, 2010). Strengths and weaknesses in the SWOT are internal factors. Opportunities and threats are external factors. Configuration of SWOT Matrix is including three steps. The first step is identification of the factors; second step is to match the key internal and external factors to establish four types of strategies and the final step is implementation and monitoring of the strategies. These steps are described briefly as below:

**Detect strategic issues (SWOT template):** This step consists of (1) identifying external and internal issues relevant to the firm's strategic position (2) analyzing and ranking the issues according to probability and impact (3) listing the strategic key factors that significantly impact competitive position in the SWOT template (Table 1).

**Determine the strategy (SWOT matrix):** It is important to match the key internal and external factors in the development of the SWOT matrix (Sherman *et al*., 2007). Identifying of the strategies base on internal capabilities and external environment to address key issues and placing the alternative strategies in one of the four quadrants in the SWOT matrix are the two achievements in this stage. The Strength-Weakness-Opportunity-Threat (SWOT) matrix (Table 2) as an important matching tool helps managers to develop four types

Table 1: SWOT template

| Strengths | Weaknesses |
|---|---|
| Opportunities | Threats |

Table 2: SWOT matrix

| SWOT Matrix | Strengths | Weaknesses |
|---|---|---|
| Opportunities | Maxi-Maxi SO strategy | Mini-Maxi WO strategy |
| Threats | Maxi-Mini ST strategy | Mini-Mini WT strategy |

of strategies (Proctor, 2000). Strategies that combine: Maxi-Maxi SO (Strengths/Opportunities), Maxi-Mini ST (Strengths/Threats), Mini-Maxi WO (Weakness/Opportunities) and Mini-Mini WT (Weaknesses/ Threats):

- Maxi-Maxi (S/O) combination illustrates the organization's strengths and opportunities. Therefore, an organization should strive to maximize internal strength to take advantage of external opportunities
- Maxi-Mini (S/T) combination illustrates the organization's strengths in consideration of threats. Therefore, an organization should make use of strength to avoid or reduce the impact of external threats
- Mini-Maxi (W/O) combination illustrates the organization's weaknesses in tandem with opportunities. Therefore an organization should aim to improve the internal weakness by taking advantage of external opportunities
- Mini-Mini (W/T) combination illustrates the organization's weaknesses by comparison with the current external threats. This strategy is a defensive tactic directing to reduce weaknesses and avoid environmental threats (Weihrich, 1982)

**Implement and monitor strategy:** At the final step an action plan develops to implement the strategies. This action plan is completed by responsibilities and budgets allocation and monitoring the process. At the end by review the process from beginning appropriate strategies will select.

**Interview:** In this study the information are gathered during the evaluation process by applying semi-structured interview with 3 experts in Malaysian construction Industry. The results identify the strategic issues by using the SWOT Analysis. The determination of the SWOT matrix addresses the key issues and places the alternative strategies.

## RESULTS AND DISCUSSION

The application of IBS was applied on amphibious house as a new strategy regarding to floating urbanization. Floating platform is the main part providing buoyancy for the house whilst huge concrete pontoons are installed underneath of the concrete slab. Precast concrete could be applied straight on this part of the amphibious house. Lateral system, underneath columns and retaining walls could be built by IBS application. Fig. 1 illustrates the sketch of this system especially for concrete pontoons.

The interviewees compared the conventional and *in situ* concrete with this type of precast one. Their visions concerned about practicality, speed, economy and sustainability of the project. Based on the results extracted from interviews the strengths of applying IBS technology for floating houses are defined. The strength of the precast application in amphibious house contains different categories. Labours and workshop area, economy and marketing, environmental and safety and quality are different categories regarding to the strength. Application of IBS in amphibious house helps to reduce foreign labour, reduce of using temporary formwork and props, clean and neat construction site which are under Labours and workshop area category. Reducing the wasting material components easy installation, applying local materials could be mentioned under environmental category. Application of IBS improves construction quality and increases the safety of the manufacturing site. Economy and cost is one of the major criteria which help to conduct a successful business plan for each project. Land value is very important issue for developing countries with accelerated demography. On the other side, climate change and raising the level of the sea make the issue of the land value more critical. On the other hand, the manufacturing cost becomes less by using precast concrete for this especial issue according to the expert's idea. Moreover, IBS speeds up the construction project which helps for faster marketing. Table 3 illustrates the strengths of applying IBS for amphibious house.

By majority, all of the interviewees mentioned about the incentive from the government for applying IBS in South-East Asia as an opportunity for this project. Training and development for workers, consultation by the IBS experts, the execution of IBS Road Map 2003-2010 by CIDB are the other opportunity regarding to applying IBS for floating urbanization. Since, floating urbanization is completely popular in Netherlands and other European countries, importing of IBS components would helps international collaboration and push the local manufacturers for joining to the worldwide market. Application of IBS components can increase the construction value.

The weakness points regarding to internal environment are evaluated as transportation requirement, suitable site condition for the transportation of the IBS components. Since, this project should be applied for low-cost houses, site conditions play very important role

Table 3: Summery of SWOT factors

| Strengths | Weaknesses |
|---|---|
| Reduce foreign labour | Transportation requirement |
| Speeding up construction project | Suitable site condition for the transportation of the IBS components |
| Reduce of using temporary formwork and props | Lake of skill operator |
| Clean and neat construction site | Lack of maintenance of components after installation |
| Reduce the wasting material components easy installation | Lack of awareness about floating urbanization |
| Applying local materials | Lack of advertisement |
| Improve construction quality | |
| Increase safety of the manufacturing site | |
| Increasing land value | |
| Reduce the manufacturing cost | |
| **Opportunities** | **Threats** |
| Training and development for workers | Increase of fuel prices |
| Consultation by the IBS experts | Location of manufacturers that is far away from the construction site |
| The execution of IBS Road Map 2003-2010 by CIDB | Expensive IBS components |
| Incentive from the government | Lack of varieties of products manufactured by the local producers |
| Import of IBS components | The competition by competitor to produce better quality at a cheaper price |
| Application of IBS components can increase the construction value | IBS components size that are not economical |
| | New regulation |
| | Negative perception for floating urbanization from social view |

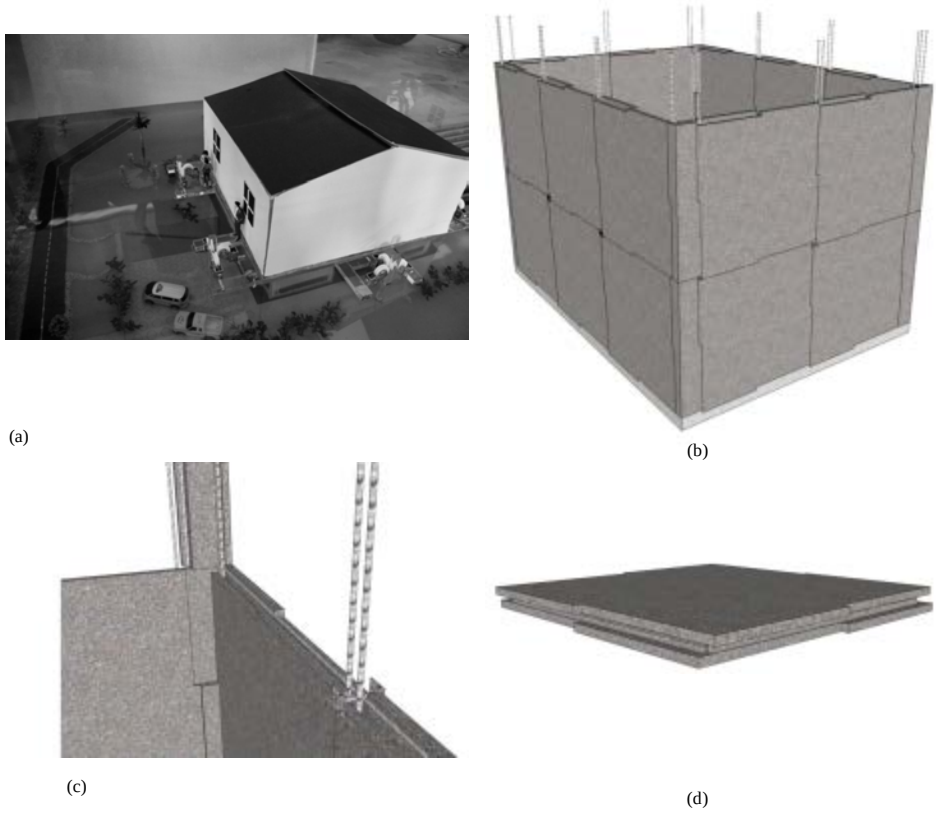


Fig. 1: Illustration of floating house model, (a) Amphibious House during flood, (b) Concrete pontoon, (c) Innovative IBS connection, (d) Precast concrete compartment

during construction. However, using of conventional method can be faced with the same critical issues. Designing of amphibious house in floodplain area is completely new for developing countries. Thus, lake of skill operator, lack of maintenance of components after installation, lack of awareness about floating urbanization are the other weaknesses which should be fulfilled to avoid any failure in the marketing of this project. Furthermore, new solutions need time to be accepted by the dwellers. Thus, lack of advertisement affects the success project as an important weakness. The Threats which influence the strategy of developing floating

Table 4: Strategic plan for applying IBS system

| S/O | W/O |
|---|---|
| Training and persuasion more local labours in the construction industry<br>Improve the R&D centres regarding to IBS towards simple applications and collaborate with the foreign market to achieve new technologies<br>Solving the housing shortage problem in flood plain area by government | Motivating manufacturers for better quality IBS components with high durability<br>Persuasion of workforce to intend in training courses by governmental and funding<br>Increasing the level of awareness by promoting exhibitions and support showrooms, supported by governmental sector |
| **S/T** | **W/T** |
| Collaboration with the new technologies<br>Balancing the price between land value and IBS compartments' price to reduce the rice of manufacturing and design<br>Localization of manufacturing to improve social perceptions and reduce transportation price<br>Improving franchise in construction and developing the new approach towards branding<br>Improving marketability and tabulating and standardizing the procedure of manufacturing in floating urbanization sector | Improve the transportation capability to avoid manufacturing and construction failure<br>Collaborating with foreign market to improve technological aspect<br>Increase the social trust to floating urbanization |

urbanization consist of different factors. Transportation problems such as the increasing of fuel prices and distance problems regarding to the location of manufacturers are considered as a threat for IBS implementation. Likewise, expensive IBS components especially for new products, lack of varieties of the products manufactured by the local producers and the competition by competitor to produce better quality at a cheaper price are the other threats based on price and cost. Moreover, manufacturers mostly ignore to produce IBS components without economical size. On the other hand, regarding to the political issues, new regulations make lots of milestones in previous or current projects. For instance, new regulation about earthquake exposed construction project to the major design changes. Finally, the negative perception for floating urbanization and amphibious house from social view make a critical social treat for this innovative project in South-East Asia.

The Strength-Weakness-Opportunity-Threat (SWOT) Matrix is an important matching tool that can help an organization to develop four types of strategies. It is important to match the internal and external key factors in the development of the SWOT Matrix. Table 4 defines all of the Maxi-Maxi, Maxi-Mini, Mini-Maxi and Mini-Mini strategies to improve the capability, applicability, sociability and constructability of floating urbanization amphibious house.

## CONCLUSIONS

The results of SWOT Analysis explore the high potential of applying IBS technology in Floating urbanization to reduce flood vulnerability and solving the house shortage problems for Malaysia. However, there are initial requirements in educational sector, R and D and local manufacturing as a strategy to implement floating urbanization and amphibious house by applying IBS technology in Malaysia. Social perception plays very important role which indrawn different strategies to its area. However, research centres and R and D centres play critical role to improve the implementation of amphibious house in floodplain area.

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