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Satisfaction and Perception of Occupants Towards Highrise Government Apartments Built Using Industrialized Building System in Putrajaya, Malaysia

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ABSTRACT

Numerous advantages have been associated with the implementation of Industrialized Building System (IBS) in Malaysia like less construction time, saving in labour, better construction quality, increasing workers safety, optimized used of material, minimizing solid waste, and construction operation less affected by weather conditions. Despite these potentials, various studies showed that the system is still not a preferred alternative to the conventional construction method due to several reasons like negative perceptions towards the system and cold reception from the industry players, while several aspects regarding people's acceptability towards the system still remain uncertain. This study investigates the satisfaction and perception of occupants towards the multi-storey government quarters (highrise apartments) which have been built using IBS in Putrajaya, Malaysia. The main objective is to evaluate the level of occupants' satisfaction, acceptance and expectation towards the design & construction quality of the medium cost quarters apartment, particularly in terms of size and arrangement of spaces, indoor comfort, quality of building materials and the aesthetical aspect of the overall design. For this purpose, the structured 5-point Likert scale questionnaires have been distributed and answered by 150 occupants of the 3 apartment quarters built by three different main contractors using Precast concrete walls as main IBS component. Although generally the occupants are satisfied with the overall design of their apartments and most of the internal spaces and services provided, but they expected that the quarters should be provided with better spaces of veranda & clothes drying area and the quarters should be constructed with better workmanship.

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1. Introduction

Industrialized Building System (IBS), which is a construction system in which its components are manufactured in a controlled environment either on or off site before they are transported, positioned and assembled into a structure with minimal site work (CIDB, 2003; CIDB 2005; Hamid et al., 2008; Kamar et al., 2009) is not a new system in Malaysia. In fact, the system that has been first implemented since 50 years ago is now one of the most promoted systems by the government through its relevant agency, Construction Industry Development Board (CIDB) to be used in Malaysian construction sector. These encouragement and promotions have been highlighted in several Malaysia Budget announcements, policies and some formulated long-term and strategic IBS development plans like the Roadmap IBS 2003-2010 (CIDB, 2003). This is due to several advantages that have been associated with the IBS system like can shorten construction period, increase building quality, enhance occupational health & safety (Blismas et al., 2005; Luo et al., 2008), reduce construction waste (Jaillon et al., 2009, Baldwin et al., 2009), saving in labour, optimize use of materials and can reduce total construction cost (Pan et al., 2007; Hamid et al., 2008).

In spite of these advantages, the usage or implementation of the system in Malaysian construction industry nowadays is still not convincing and fails to achieve the expected momentum for such a beneficial and potential system. Several studies showed that there are some factors and barriers which resulted in the cold reception by the industry players like negative perceptions towards the system, high dependency on high-skill workers to assemble the structures and less flexibility, while several aspects regarding people's acceptability towards the IBS system still remain uncertain. This includes the acceptance and perception of Malaysian towards their residential buildings that have been built using such system.

2. IBS in Malaysian Housing Construction

In Malaysia, housing is one of the major sectors where the IBS is most implemented and constructed. In fact, the IBS was first introduced in this country by implementing it in the construction of housing projects i.e. Jalan Pekeliling Flats, Kuala Lumpur in 1964 and Rifles Range Road Flats, Penang in 1965. These two earliest projects were followed by several housing projects in various states that have implemented the system in 1970's and 80's, like 1000 units of 5-storey walk-up flats at Taman Tun Sardong, Penang in 1978 and more than 60000 units of PKNS housing projects that have been constructed during 1981 to 1993. Other examples of IBS implementation in Malaysian housing industry are shown in Table 1.

However, studies showed that along its development, there are several weaknesses or unsuitability of the system with the local climate and Malaysian lifestyles that have limited its

Table 1: Chronology of IBS implementation in Malaysian housing projects

Year	Project	Location	Technology	Description
1964	Jalan Pekeliling Flats	Kuala Lumpur	Danish System of large pre-fabricated panels	7 blocks of 17-storey flats
1965	Rifle Range Road Flats	Penang	French Estoit System of large panel system	6 blocks of 17-storey flats & 3 blocks of 18 storeys flats
1978	Taman Tun Sardon	Penang	British Research Establishment Design (BRECAST System)	1000 units 5-storey walk-up flat
1981 -1993	Low cost houses & high cost bungalows for Selangor's new townships by Perbandanan Kemajuan Negeri Selangor (PKNS)	Selangor	Germany based Praton Haus Int. (pre-cast concrete technology)	52000 housing units
			Taisei Marubumi (large panel casted using tilt-up system)	1237 housing units & 11 shoplots at PJS
			Hazama System	3222 flat units & 1112 housing units at Bandar Baru Bangi
			Swedish Ingeback System (large panels in vertical battery mould & tilt-up table mould)	3694 flat units

full acceptance from the industry players and end users. In its first implementation, the study showed that the technology used for the Jalan Pekeliling Flats construction at that time which is a dry joint system is not very suitable with the tropical climate. While the design without wet toilet in the Taman Tun Sardong Flat which was based on the European apartment design was said to be unfit with the lifestyle of the Malay occupants who need relatively wetter bathroom types than the European. Although the dry joint technology then has been replaced with the wet joint technology in more recent IBS buildings, but the perception of end users towards the design and the material used for the IBS building is still unconvincing, when it's still regarded as unaesthetically pleasure, low quality finish and less flexible as compared to conventional construction technique (Nawi et al., 2007). Therefore, the main intention of this study is to investigate the satisfaction and perception of people towards their IBS houses, with the main focus of the study is the occupants of the multi-storey government quarters (highrise apartments) which have been built using IBS in Putrajaya, Malaysia.

3. Methodology

This study has implemented the survey research method, particularly the systematic random sampling due to its easier conduct compared to simple random sampling. The target respondents are the occupants of the government apartment i.e. household head or his wife. Considering the time and financial constraints, the structured 5-point Likert scale questionnaires have been

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distributed and answered by 150 occupants of the three government apartment quarters built by three different main contractors in Putrajaya, Malaysia. To be specific, the name of the apartment and the numbers of questionnaires distributed are Parcel 15-12B (50 questionnaires), Parcel 17RK2 (50 questionnaires) and Parcel 18R12 (50 questionnaires). The collected data which is based on 5-point Likert Scale has been analyzed by using an Average Index, which the range calculation to classify the satisfaction or agreement level is based on the mean scale formula as follow:

$$\text{Mean Scale Range} = (5 - 1) / 5 = 0.8 \quad (1).$$

Based on 0.8 mean interval obtained from the above formula, the classification of the levels of satisfaction or agreement are then determined as in Table 2.

Table 2: Classification of the level of satisfaction or agreement based on Average Index value

Likert Scale Range	Level
- 1.8	Very Satisfied / Strongly Agree
1.81 – 2.6	Satisfied / Agree
2.61 – 3.4	Moderate / Undecided
3.41 – 4.2	Dissatisfied / Disagree
4.21 – 5.0	Very Dissatisfied / Strongly Disagree

4. Results & Discussion

As above-mentioned, the study on the satisfaction and perception of occupants towards their quarters has been done in 3 selected apartments in Putrajaya which involved 50 respondents from each apartment. Out of 150 respondents, 115 or 76.7% of them are household head while the rest are the spouse of the household head. The outcomes of the research are discussed based on these aspects:

4.1 Outdoor Facade & Overall Apartment Design

Regarding the design and aesthetical aspects of the apartment building, especially its form and outdoor façade, it is found that most of the respondents are very satisfied with it when the value of Average Index recorded were 1.04 for Parcel 15-12B, 1.34 for Parcel 17RK2 and 1.30 for Parcel 18R12 Apartments. These values clearly show that the occupants have considered their government quarters as shown in Figure 1 as pleasant looking buildings with good aesthetical value although they were built using IBS system.

Figure 1: Parcel 15–12B Apartment, Precinct 15.

Figure 2: Parcel 17RK2 Apartment, Precinct 17.

Figure 3: Parcel 18R12 Apartment, Precinct 18.

4.2 Spatial Elements & Lifestyle

The study on spatial element aspect and its suitability with the needs and lifestyle of the occupants have involved 3 major aspects namely as the design, size and arrangement of the spaces. The results show that majority of the occupants are very satisfied with the design of their internal spaces, except occupants of Parcel 15-12B Apartment who are very dissatisfied with the design of the veranda and their kitchen. The good level of satisfaction also goes to the aspect of space size, when most of the occupants are very satisfied with the size provided for all the

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spaces, except for the size of veranda and clothes drying area which the values of Average Index are shown in Table 3.

Table 3: Occupants satisfaction on spatial elements of their apartment buildings based on 5-point Likert Scale

Space	Average Index								
	Design			Position & Arrangement			Size		
	A	B	C	A	B	C	A	B	C
Living Room	1.04	1.34	1.30	1.02	1.30	1.24	1.06	1.28	1.06
Dining Room	1.04	1.34	1.30	1.02	1.30	1.24	1.06	1.28	1.06
Family Room	1.04	1.34	1.30	1.02	1.30	1.24	1.06	1.32	1.06
Master Bedroom	1.04	1.12	1.02	4.80	1.26	1.22	1.06	1.18	1.04
Bedroom 2	1.04	1.28	1.02	4.80	1.26	1.16	1.06	1.18	1.16
Bedroom 3	1.04	1.20	1.02	4.80	1.06	1.10	1.06	1.18	1.16
Kitchen	3.00	1.06	1.24	1.02	1.24	1.20	2.62	1.20	1.04
Bathroom & Toilets	1.04	1.26	1.26	1.02	1.16	1.18	1.06	1.18	1.06
Veranda	4.98	1.22	1.18	5.00	1.14	1.08	5.00	1.16	1.06
Corridor/Pathway	1.04	2.02	1.20	1.02	1.16	1.04	1.06	1.08	1.02
Clothes Drying Area				1.02	3.00	1.04	4.60	4.48	4.32

*A= Parcel 15–12B Apartment; B= Parcel 17RK2 Apartment; C= Parcel 17RK2 Apartment

In terms of position and the arrangement of the spaces, it is found that there are some spaces which are not suit with the real needs of the occupants. For instance, majority of the occupants in Parcel 17RK2 Apartment are very dissatisfied with the location of the clothes drying area while most of the occupants in Parcel 15–12B Apartment are very dissatisfied with the location of their 3 bedrooms which they considered to be mistakenly located and not appropriately orientated. However, for other spaces, most of the respondents are very satisfied with the positioning of the spaces in all the 3 apartments.

4.3 Thermal, Visual & Sound Comfort

Although the study has not involved numerical or physical experimental methods, but the evaluation of occupants comfort in regard with their indoor environmental conditions are also involved in this study. This is done by distributing questionnaires that ask occupants' personal opinion on the aspects of lighting, ventilation, visual and sound comfort in their quarters.

Table 4: Occupants satisfaction on indoor environmental comfort based on 5-point Likert Scale

Space	Average Index								
	Lighting			Ventilation			Heat & Internal Temperature		
	A	B	C	A	B	C	A	B	C
Kitchen	1.02	1.18	1.16	1.02	1.18	1.16	1.10	1.12	1.16
Bathroom & Toilets	1.06	1.18	1.16	1.06	1.18	1.16	1.10	1.10	1.16
Drying Area	4.21	4.50	4.82	4.00	4.50	4.82			
Corridor/Pathway	1.06	4.82	1.18						

*A= Parcel 15–12B Apartment; B= Parcel 17RK2 Apartment; C= Parcel 17RK2 Apartment

Based on the results, it is found that most of the occupants are very satisfied with the aspects of visual and sound comfort for every space of their quarters. However, there are many respondents in Parcel 15–12B and Parcel 18R12 apartments who expressed dissatisfaction over the heat and indoor temperature levels in their 3 bedrooms which they thought are resulted from the inappropriate orientation and positioning of the bedrooms. On the other hand, most of the occupants in all the 3 apartments are very dissatisfied with the aspect of lighting and ventilation in their clothes drying area which is resulted from the inappropriate position and opening size provided for such room, which the values are shown in Table 4 and the photos of the area are shown in Figure 4.

a b

Figure 4: (a) Clothes Drying Area of the Parcel 18R12 Apartment (b) Clothes Drying Activity at the Verandah of the Parcel 18R12 Apartment

4.4 Structure, Materials & Services Quality

The aspect of structure, material and services quality is one of the most major aspects that have been associated with the weaknesses of the IBS systems implementation in Malaysia. In this study, some issues related with the quality of structure and materials used for the building like major building defects e.g. water penetration, cracking of walls, peeling paint etc. have been asked to 150 respondents in all the 3 studied apartments.

Results show that many occupants suffered some major problems like leakage or water penetration through ceiling and wall in their quarters which is built using the IBS system, especially in Parcel 17RK2 apartment. On the other hand, most of the occupants in Parcel 15-12B Apartment expressed their strongly agreement about the existence of peeling paint and tiles in their quarters, which are mainly due to poor workmanship and low quality of materials.

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However, almost all respondents reported that their IBS apartments are free from other types of building defects like cracked wall, uneven floor, wrong installation of building elements & components etc., as shown by the values in Table 5.

Table 5: Occupants agreement on building defects in their apartments based on 5-point Likert Scale

Building Defect	Average Index Level of Agreement		
	Parcel 15-12B	Parcel 17RK2	Parcel 18R12
Leakage/Water Penetration through Walls	4.60	1.86	4.94
Uneven floors	5.00	4.92	4.88
Poor Installation of Door & Windows	4.84	4.92	4.88
Leakage/Water Penetration through Ceiling	4.44	2.56	4.94
Cracking of Wall	4.94	4.82	4.90
Poor Installation of Tiles	1.80	4.92	4.90
Peeling Paint	1.80	4.94	4.88

Regarding the materials used for the elements and components of the building, generally most of the respondents expressed their satisfaction over the materials, except of some occupants in Parcel 15-12B apartment who expressed dissatisfaction over the quality of floors, tiles and paint of their quarters.

In terms of services aspect, most of the respondents also expressed their agreement about the high quality level of services provided, except occupants of Parcel 18R12 apartment who are very dissatisfied with their kitchen sink installation and the sewerage piping system, where the values of Average Index of agreement recorded on the quality of such services are 4.42 and 4.74, respectively. Apart from these problems, the Average Index of agreement level recorded for other spaces which mostly are under 1.8 clearly show that all the 3 apartments generally have provided satisfied and expected quality of services to their occupants although they were built using the IBS system.

5. Conclusion

The study to investigate the level of occupants' satisfaction and expectation towards the design and construction quality of their apartments which are built using IBS system has been done by distributing 150 questionnaires to respondents in the 3 medium cost government apartment quarters in Putrajaya, Malaysia. The results show that majority of the occupants are very satisfied with the aesthetical aspects of the outdoor façade and interior design of the apartment, as well as the size, position and arrangement of the spaces in general. However, many occupants expressed dissatisfaction over the thermal discomfort in certain spaces of their

quarters, especially in all three bedrooms provided in Parcel 15-12B Apartment which are resulted from unsuitable position and arrangement of the bedrooms. Some of the respondents are also very dissatisfied with the quality of structural construction and building materials used for the quarters since some major defects are found after the occupancy. The examples are the wall & roof leakage and peeled paint in Parcel 17RK2 Apartment and improper installation of the kitchen sink and sewerage piping system in Parcel 18R12 apartment. Although generally the occupants are satisfied with the overall design of their apartments and most of the internal spaces and services provided, but they expected that the quarters should be provided with better spaces of veranda, clothes drying area and circulation space, and the quarters should be constructed with better workmanship.

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