

Assessment of Residents' Satisfaction on Building Maintenance in Public Low-Cost Housing

Sheelah Sivanathan, Nur hafizah Juhari, Nurhayati Khair, Puvaneswary Thanaraju, Amalina Azmi, Puteri Ameera Mentaza Khan

Abstract: *This study accessed the residents' satisfaction on the building maintenance in public low-cost housing in Penang, Malaysia. Through the study, it determined the level of satisfaction of the residents in the public low-cost building by identified several factors which included building services factors, physical and environment factors and building maintenance management factors. It was based on a questionnaire survey conducted in Rifle Range Flats and Kampung Melayu Flats. Data were collected from 100 respondents and analysed using habitability index. Findings from the study indicate that the residents are more dissatisfied with the building maintenance management followed by the building services and physical and environment in the public low-cost housing. From the habitability index analysis, it was found that all the independent variables are fall under negative region which is less than 60%. The lowest the Habitability Index (HI), the more the dissatisfaction of the residents on the maintenance in the public low-cost housing. The habitability index for building service, physical and environment and also building maintenance management are (HI=54.7), (HI=54.7) and (HI=44.8) respectively. The study suggests that residents' satisfaction can be enhanced through proper selection in the workforce on the maintenance works in public low-cost housing.*

Index Terms: *Keywords: Public low-cost Housing, Building Maintenance, Habitability Index.*

I. INTRODUCTION

As the globe population increased over the past two decades, the demand of the housing is increasing simultaneously. Recently, the low-cost housing had being a high demand especially in developed country likes Malaysia

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Sheelah Sivanathan, Department of Building and Property Management, Faculty of Accountancy and Management, Universiti Tunku Abdul Rahman, Malaysia, Sheelah@utar.edu.my

Nur hafizah Juhari, Department of Building and Property Management, Faculty of Accountancy and Management, Universiti Tunku Abdul Rahman, Malaysia.

Nurhayati Khair, Department of Building and Property Management, Faculty of Accountancy and Management, Universiti Tunku Abdul Rahman, Malaysia.

Puvaneswary Thanaraju, Department of Building and Property Management, Faculty of Accountancy and Management, Universiti Tunku Abdul Rahman, Malaysia.

Amalina Azmi, Department of Building and Property Management, Faculty of Accountancy and Management, Universiti Tunku Abdul Rahman, Malaysia.

Puteri Ameera Mentaza Khan, Department of Building and Property Management, Faculty of Accountancy and Management, Universiti Tunku Abdul Rahman, Malaysia.

and China. Low-cost housing is also known as affordability housing for which it appears due to the tremendous urban growth throughout the world in order to fulfils the needs of the human (Karim, 2013). Affordability housing could be defined as the housing which the individual could afford according to the household income, current national economic condition, demography and also the structure of financing cost (Barnley, 1994).

In order for a building to operate well and improve the quality of life of the residents, building maintenance plays as an important role to support the fundamental operation of the building and ensure the building can perform in optimum level (Zulkarnain, A Zawawi, Rahman, & Mustafa, 2011). Building maintenance is defined as a combination which actions are carried out in order to retain or restore the building in a preferable condition (Chanter & Swallow, 2008). According to the Abdul-Rahman, Wang, Wood & Khoo (2012), over the years, the deficient maintenance and reckless construction had been affected the public housing to be deteriorated very fast after post construction. The most prevailing defects which existed in the affordable housing that had been found includes leakage from piping system, failure of water supply system, cracks especially on the external walls of the building, moisture to concrete walls and also faulty door knobs (Abdul-Rahman et. al., 2012). Therefore, performing building maintenance in a building allows the residents can be in a better position to oversee the conditions of the building. Although it is important to perform building maintenance in a building, but there is a few barriers and factors that caused the building unable to perform a proper maintenance on it and affect the satisfaction of the residents on the maintenance in the building. According to Oliver (2014), satisfaction is about the consumer's fulfilment response while there's a pleasurable on related consumption fulfilment which includes level of under or over fulfilment on the judgement of certain products, services or features itself. While customer satisfaction had become the key operational goal in order to achieve and improve the performance of the organisation (Hill & Alexander, 2006).

The purpose of this study is to identify the factors that affect the satisfaction of the residents on the maintenance in the public low-cost housing in Penang. As Penang is an island that located at the north part of West Malaysia, there is limited

land on it and the price of the landed property is much expensive than other places. People that staying in Penang could not afford to buy a landed property, therefore, there was a lot of low-cost housing such as flat was introduced for the people that have interest in affording their own home. In order to examine level of the residents' satisfaction, we had chosen Penang as our scope to study as we found out that there are many maintenance problems such as building service factors, physical and environment factors and building maintenance management factors that had caused the dissatisfaction of the residents in the public low-cost housing. The area that we had chosen for this research is Ayer Itam, which the area is having more public low-cost housing being built at that particular area. The buildings that we had chosen are the Rifle Range Flat and the Kampung Baru Flat in that area.

II. LITERATURE REVIEW

This section reviews literature on level of satisfaction towards building maintenance and other selected construct relevant to this research. This section begins with a detail explanation of three major factors that affect the residents' satisfaction on building maintenance in public low-cost housing. Review of relevant literature pertaining to the selected construct (building service, physical environment and building maintenance management) are presented in the next section.

A. Building Services

Building services are the systems which installed in the buildings to make it functional, comfortable, safe, and efficient. Building services design must integrated into the overall building design from a very early stage, as it play a central role in contributing to the design of a building in terms of overall standards and strategies to be achieved. Among the various types of facilities which can be found in low cost building, lighting is a physical attribute that influences mental health, whereby the lack of lighting will result in mental disorders (Ibem and Amole, 2011). Therefore, it affects the satisfaction level of residents towards building maintenance performance. Lightings can be categorized according to natural lighting, artificial lighting (Djebuarni and Al-Abed, 2000) and quality of lighting (Kincaid, 1994). Proper orientation of the building is the major factor which affects the performance of daylight penetration (Syed Husin and Hanur Harith, 2012). However, during night time, the performance of artificial lighting and quality of lighting in common area such as staircase and corridor become essential for residents in low-cost housings. Clarke (2008) found that good lighting quality reduce crime in residential area. Pease (1999) also stated that good lighting performance in common area reduce crime as improved lighting deters potential offenders by increasing the risk that they will be seen or recognized when committing crimes.

Maintenance of plumbing and piping system is being concerned by residents in public low-cost housing. Hamzah (2012) state that pipes leaking are one of the most common defects occurs in low cost building. Hashim, Samikon, Nasir and Ismail (2012) observed that among the factors influenced performance in low cost public housing in Selangor area,

waterproofing claimed the highest frequency, followed by water leakage through joint, and water leakage at pipe fittings. Hashim et. al. (2015) also founds piping problem and burst pipes is the problem faced by the residents in low cost flats in Kuala Lumpur area. These problems are caused by several reasons. Zakaria and Saufi (2007) stated the current maintenance management practices in Malaysia are mostly not give priority for maintenance works and remedial works properly resulted in over budget expenses.

The next issue regarding facilities maintenance that affects the satisfaction level of residents in low cost building is lift maintenance. Some of the occupants are not comfortable staying on high levels due to the high risk of contingencies such as nonfunctioning lifts (Ismail, Jabar, Janipha and Razali, 2015). According to Karim (2011), the quality of low-cost housing runs a familiar tune or similar trend where numerous complaints of dissatisfaction with the badly maintained lifts. The condition of drainage system is one of the building services that affect the residents' satisfaction on building maintenance in public low-cost housing. Blocked drainage might cause some drainage become stagnant. This is unsanitary and poses a health hazard, being mosquito breeding grounds and pose risks to children who may play with the water (Isnin, Ramli, Hashim and Ali, 2012).

According to Chu (2004), a proper fire safety management system which included effective fire service system and good maintenance is needed especially on the residential buildings. In order to maintain a safety environment in the public low-cost housing, a good preventive maintenance system such as fault detection systems and inspection of the fire safety system should be carry out on schedule basis. Maintenance of fire protection system plays a vital role in all types of buildings. From the case studies of Kironji (2015) at Nairobi City, the findings had been found through the inspection and maintenance reports. Through the findings, poor housekeeping, inadequate reserve water and poor implementation of the maintenance program after inspection are some of the maintenance issues being found on the fire protection systems. (Kironji, 2015). According to Mathew, Andronaco & Adams (2014), all signage is place according to the hazards on every site. Correct safety signage should place at the proper place where the maintenance works being carried out on the site. In order to improve safety and minimize the incident in work zone, there are a lot of safety signage being used and placed but there are some signage is not effective enough (Yong, 2010). According to Husin, Nawawi, Ismail & Khalil, (2014), electrical being the second top poor attributes which is 39% that could contribute to Safety Performance Index of a low-cost building. Without a solid electrical maintenance plan, it can lead to catastrophe (Lamendola, 1999).

B. Physical and Environment

The cleanliness is a big consideration for the users of a building. A poor cleanliness of living environment might help in the spread of diseases like dengue fever as the environment has been polluted. A management on the cleanliness in the residential building is very important to prevent all

these issues from happening as it can endanger the health and safety of the building users. Besides, the cleanliness of the environment can be link with the perception of security (Amblee, 2015). This explained that when the cleanliness of an environment is very bad, people will have the perception that the security level in particular area will be relatively low and this might help to increase the crime rate as everyone will avoid from reaching that place.

The common defects that involve on the ceiling includes the leaking and cracking. Ceiling might face cracking issues if there is inappropriate construction or poor maintenance. The joint cracks are commonly seen at the joint of different structural elements such as column or brick wall and beam (Suffian, 2013). The cracking of ceiling should be solved immediately before it become serious and endanger the safety of the users. Other issues that related with the ceiling will be the leaking or moisture problems. Most of the moisture problems are leaking and condensation, one of the leaking causes is the improper design (Othman, Jaafar, Harun & Ibrahim, 2014). The improper design of the ceiling might cause the rain water enter from outdoor and cause leaking in the ceiling. Condensation of ceiling happened because of the different temperature has created the water drop below the floor slab and above the ceiling, thus creates the watermarks on the ceiling (Othman et. al., 2014). Both of these issues caused the breakage of ceiling and endanger the safety of users.

The common maintenance of wall will be the cracking and leaking. Early-age cracking of base restrained concrete walls is a common problem (Zhou, Chen & Zhang, 2012). Common cracking problem on wall in Malaysia will be the joint cracks, can be commonly seen at the joint of different elements such as the brick wall, this type of crack can be repaired easily with straight forward methods such as applying repair mortar/putty onto the affected area (for cracks <3mm) together with suitable wire meshes provided the surface preparation is carried out in proper ways (Suffian, 2013). The roof is the upper part of a building or property, it is also the cover for the building itself. The common problems for the roof are the breaking or missing of tiles and also the leaking. The roof is normally guaranteed against "leaks" for a period of 10 or more years, providing reasonable roof maintenance is executed by the owner during the term of the warranty (Gracey, 1995). This shows that a proper management is needed to maximize the lifespan of the roof. The paint is considered as the finishes of the wall. It directly affects the appearance of the building as it can be clearly see from the outside. Practice showed that the projected service life paint coatings of building products and structures, is 5-6 years, not always confirmed (Loganina, 2014). The lifespan of paint can be affected by the maintenance applied on it too. The deterioration of building usually lead to a higher level of maintenance and repair with attendant cost of restoration to current acceptable standard (Folorunso & Ahmad, 2014). The floor finishes usually refer to the tiles, maintenance on the floor tiles commonly deal with the cracking issues. Surface cracks are commonly found on the floor screed and normally caused by the improper curing process (Suffian, 2013).

IEQ was known as indoor environment quality, it is a combination of filtration, ventilation, acoustic, daylighting (Burton, 2012) and also others factors that enhance the performance of indoor environment. Research has also stated that the indoor environmental quality, IEQ which include thermal, acoustic, visual and air quality has a direct effect to the comfort, health, and productivity of the occupants (De Giuli, Da Pos & De Carli, 2012). The performance of the IEQ is very important as it directly affect the users of the building. Besides of the common thermal comfort, acoustic comfort and also air quality, poor IEQ can lead to sick building syndrome (SBS).

C. Building Maintenance Management

Maintenance management in a building is an important factor that may affect the satisfaction of the building residents. Maintenance activities are being carried out continuously in the past year in order to ensure the building can function effectively all the time (Ibni Hashim & Mydin, 2012). The main purpose for the maintenance of the building is to retain the value of the investment and the condition of the building such as the function and appearance. Therefore building maintenance management are important for economically viable and operationally safety of the building (Olajide & Afolarin, 2012).

The factor such as the skill and the knowledge of the labour in maintaining the public low-cost housing may affect the satisfaction of the residents in the building. Skill is the critical asset for individuals, business and societies (Geisier & Wickramasinghe, 2015). Knowledge and skills are the "public good" par excellence and the key to overall productivity growth (Piketty, 2014). It is important to have skill and knowledge by the labours in order to perform their jobs well and make sure that the building is well maintained. Workforce management is important in the organisational performance as it involve utilising people with the works to ensure the achieved of the organisational goal and good performance of the workers (Nienaber & Sewdass, 2016). Workforce management is to have the right people at the right place in order to complete the jobs. Workforce management helps to allocate the workers to their attribute to the work based on the workers that has the significant skills and knowledge (Mei, Zeng, Feng, & Tu, 2016). Inadequate workforce management in a building maintenance may affect the satisfaction of the residents in the low-cost building.

The process of response toward failure and downtime involved the time required for detection, repair or replacement, the unavailability of the response towards the problems faced by the occupants may affect the satisfaction of the residents in the building (Au-Yong, Ali, & Ahmad, 2014). Documentation of the maintenance data and information is important to clarify the accuracy of the data and information about the maintenance records, conditions and lifetime of the facilities (Au-Yong et. al., 2014). Producing detailed and accurate report information of the defects so that the defects of a component or system failure that might happen again can be solved in an easier manner (Henshaw, 2014). Accuracy of



maintenance data and information helps in minimize the maintenance work and reduce the impacts to the facilities performance, quality and safety in the building (Qingfeng, Wenbin, Xin, Jianfeng, & Qingbin, 2011).

The frequency of monitoring and inspection of the building is also one of the factors that may affect the satisfaction of the residents. The failure or downtime of the facilities in the building can be reduced when there is a regularly inspection and monitoring work had been done. According to Soliman et al. (2016), monitoring and inspection help to maintain the reliability of the building at the acceptable level and make sure that the required maintenance work had been done.

III. RESEARCH METHODOLOGY

This section describes the research methodology used in this research. The objective of this research is to identify the critical factors of building maintenance that will affect resident's satisfaction level in public low-cost housing. This research will be delivering the quantitative research as research design in order to fulfil the objective of this research. Firstly, the possible determinants of independent variables, which are the factors that affect the satisfaction of the residents on the maintenance were determined and describe from the literature review. Next, quantitative study is applied to obtain the opinion from the residents of public low-cost housing regarding their satisfaction level on building maintenance.

In this study, questionnaires are used as an instrument to collect data from targeted respondents. The sampling location of this research that being selected is located at Ayer Itam, Penang Island which the area is having more public low-cost housing as observed. Ayer Itam is a suburban area that being developed since 19th century. Numerous of neighborhoods are located in Ayer Itam as Ayer Itam is located at the central of Penang Island. The public low-cost housing in Ayer Itam had been chosen in this research are Rifle Range Flats located at Rifle Range road and Kampung Melayu Flats. A total of 100 questionnaires were distributed to targeted respondents at Rifle Range Flats and Kampung Melayu Flats. Data were collected from 100 respondents and analysed using the habitability index.

IV. RESULT AND DISCUSSION

Residents' level of satisfaction on maintenance factors in public low-cost housing consists a total of 18 variables. Habitability index is being applied in order to facilitate the interpretation of the contribution on the public low-cost housing in Penang and other maintenance variables to the level of satisfaction or dissatisfaction which from the view of point by the respondents. Based on the table I, II and III, the result of the habitability index on the three factors which included building service, physical and environment and also building maintenance management factors that affected the satisfaction level of residences on maintenance are nearly similar and it is more towards the negative index (-) which is having the habitability index at less than 60. Building Service and physical and environment factors are having the same result which it falls at (HI=54.7) whereas the lowest HI result in this research is building maintenance management which it

(HI=44.8). The lowest the Habitability Index (HI), the more the dissatisfaction of the residents on the maintenance in the public low-cost housing.

However, there are some differences on the HI result in each of the variables from three of the factors. Firstly, the highest HI on the maintenance of building service factor is performance of electrical system with (HI=70.8) and it falls under the highly positive region at (++). Next it follow by few of the variables which include performance of fire protection system, performance of lighting in common area, availability of safety signage during maintenance work, performance of plumbing and piping system, condition of drainage system and performance of CCTV with (HI=63.2), (HI=59.2), (HI=58.8), (HI=58.0), (HI=52.4) and (HI=43.2) respectively. The lowest HI in this component is the performance of lift which is at only (HI=31.4). This shows that there is much number of respondents are not satisfied with the performance of lift in the public low-cost housing.

Next, the highest HI on the component of physical and environment factor is performance of indoor environment quality (IEQ) with (HI=71.8) at the highly positive region. Other than IEQ, the condition of roof tiles falls under moderate high region with (H=68.8). While other variables are fall under negative (-) region which include condition of painting, condition of floor finishes, condition of the ceiling and the cleanliness of the common area with (HI=57.6), (HI=56.2), (HI=52.4) and (HI=39.2) respectively. The condition of walls resulted the lowest HI in this component with (HI=37.2).

The building maintenance management factor is resulted as the lowest average HI as the respondents are most likely not satisfied with the maintenance management in the public low-cost housing. In this component, the highest HI among three variables in this factor is skill and knowledge of the workers on the building with (HI=59.6) and it follow by the measured on the response towards failure and downtime at (HI=55.0). Lastly, the measured on frequency of monitoring is resulted at the lowest with (HI=44.8).

As summarised, the highest HI among these 18 variables is the performance of Indoor Environment Quality which is under physical and environment factor at (HI=71.8). This is most likely shows that the residences staying in the high rise public low-cost housing are strongly satisfied with the Indoor Environment Quality. In adverse, performance of lift under the building service factor resulted the lowest HI at (HI=31.4) as most the respondents are strongly dissatisfied with its performance.

Table I. Analysis and Results of Habitability Indices (HI) for Building Service Factors

Construct/ Items	Percentages					Regions
	1	2	3	4	5	
Physical and Environment Factors						54.7 (-)

1. Cleanliness of the common area (staircase , corridor)	36	39	18	7	0	39.2 (-)
2. Condition of the ceiling (leaking , cracks)	14	36	26	22	2	52.4 (-)
3. Condition of walls (cracks , graffiti)	50	27	12	9	2	37.2 (-)
4. Condition of roofs tiles	5	12	32	36	15	68.8 (+)
5. Condition of painting (wear and tear , aesthetic)	14	22	34	22	8	57.6 (-)
6. Condition of floor finishes (cracks)	12	31	25	28	4	56.2 (-)
7. Performance of Indoor Environment Quality (humidity, ventilation, lighting)	3	12	27	39	19	71.8 (++)

Table II. Analysis and Results of Habitability Indices (HI) for Physical and Environment Factors

Construct/Items	Percentages					Regions
	1	2	3	4	5	
Building Service Factors						54.7 (-)
1. Performance of lighting in common area	11	25	26	31	7	59.6 (-)
2. Performance of plumbing and piping system (water leakage)	8	32	27	28	5	58.0 (-)
3. Performance of lift (frequency of failure, downtime)	57	33	6	4	0	31.4 (-)
4. Condition of drainage system (sanitary, odour)	23	23	25	27	2	52.4 (-)
5. Performance of fire protection system	7	14	44	26	9	63.2 (+)
6. Signage (availability of safety sign during maintenance works)	19	18	22	32	9	58.8 (-)
7. Performance of electrical system	1	19	21	43	16	70.8 (++)
8. Performance of Closed Circuit Television (CCTV)	31	35	23	9	2	43.2 (-)

Table III. Analysis and Results of Habitability Indices (HI) for Building Maintenance and Management Factors

Construct/Items	Percentages					Regions
	1	2	3	4	5	

Building Maintenance Management Factors 53.1 (-)

1. Response towards failure and downtime (water leakage , lights of corridor down)	17	21	36	22	4	55.0 (-)
2. Skill and knowledge of the workers of the building (repairing , handling cases such as robbery)	14	20	33	20	13	59.6 (-)
3. Frequency of monitoring and inspection (duration of checking the facilities)	29	36	20	12	3	44.8 (-)

V. CONCLUSION

The habitability index is being used as an analysis to identify the residents' level of satisfaction and it resulted that most of the respondents are below satisfaction level. Based on the result, the average habitability index which generated on 3 of the main independent variables are all falls under negative region (-) that below with the value below 60. The habitability index for building service, physical and environment and also building maintenance management are (HI=54.7), (HI=54.7) and (HI=44.8) respectively. As the poor maintenance in public low-cost housing has bring a lot of negative impacts such as physical, social, environment and economic impact, thus researchers discussed on the factors of maintenance in order to identify the residents' satisfaction level. The management body should come out with more effective solution for these in order to improve the level of satisfaction of residents towards the building maintenance.

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