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FACTORS TOWARDS THE VULNERABILITY IN LOW-COST HOUSING INFRASTRUCTURE SERVICES

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ABSTRACT

After the Twelve Malaysia Plan, many Projek Perumahan Rakyat (PPR) homes were erected under the government's responsibility to provide housing for every household. However, based on the Kuala Lumpur Structure Plan 2020, several difficulties linked to low-cost housing were identified, including insufficient space standards, inadequate community services, a lack of parking places, high maintenance expenses, and poor quality of construction and materials in low-cost housing complexes. The supply of housing and urban infrastructure is connected. Accommodation cannot be sustainably built without infrastructure; thus, it must be considered as a whole. A sound waste management system, security, power, and portable water supplies should all be available in a perfect urban community. *There are several challenges experienced in low-cost housing. Therefore, this research aims to identify the vulnerability in low-cost housing infrastructure services. Besides, it is to minimize the vulnerabilities in low-cost housing infrastructure services. Hence, the objectives of this research are to identify the factors that contribute to the problems in low-cost housing infrastructure services and to suggest strategies to minimize the vulnerabilities in low-cost housing infrastructure services. In order to achieve all of the objectives, a quantitative method is used. A 99 set of questionnaires were distributed to the PPR Seri Iskandar. The data were analyzed using SPSS and Likert Scale to obtain the mean and standard deviation. This study discovered that the community's careless attitude is the primary factor contributing to infrastructure issues. Consequently, the strategy that can be implemented to improve the problems is developing software and organizing campaigns.*

Keywords: *Low-cost housing; infrastructure services; vulnerability; Program Perumahan Rakyat (PPR); Malaysia*

INTRODUCTION

Ever since Malaysia achieved its independence, the government has been striving for the development of low-cost housing that every household can afford. During the Fourth Malaysia Plan (1981-1985), a concept of Low-Cost Housing was introduced and enforced by formal housing in Malaysia. According to the current Twelve Malaysia Plan Economic Plan Unit (EPU) (2021), more affordable homes will be built in essential areas. Five hundred thousand affordable dwellings will be created, with funding from many projects, including Rumah Mesra Rakyat, Residensi Wilayah, and Program Perumahan Rakyat. The government views public housing projects as a method for low-income people to own their homes and live in improved living circumstances by guaranteeing that minimum acceptable standards, services, infrastructures, and facilities are provided both within and outside the housing units. Housing and urban infrastructure are intimately connected. Housing cannot be sustainable without infrastructure; thus, it must be considered as a whole.

Despite the increase in demand for this housing, (Otegbulu and Adewunmi, 2009) stated that housing developments are planned and constructed without adequate infrastructure. According to (Johansson and Hassel, 2010) and (Huang et al., 2014), infrastructure service failures and disruptions may have direct and indirect effects on the population's health, safety, security, and economy. To contribute to sustainable housing development, one must first comprehend the environmental impact of improper infrastructure and its effects on users. Any bad conditions of infrastructure services will cause problems in some services, for instance, drainage, road, water supply and sewerage system. Echoing into this, this research is to identify the vulnerability in low-cost housing infrastructure services. In line with this aim, the objective of this research is to identify the factors that contributed to the problems in low-cost housing infrastructure services.

LITERATURE REVIEW

Definition of Infrastructure Services

There are various definitions made in terms of infrastructure services. The term "infrastructure" is defined by the American Heritage Dictionary (2000) as "the basic facilities, services, and installations required for the functioning of a community or society, such as transportation and communications systems, water and power lines, and public institutions such as schools, post offices, and prisons. In the realm of economics, (Tinbergen, 1962) makes the distinction between infrastructure (such as roads and education) and superstructure (which includes manufacturing, agricultural, and mining industries).

Whereas Hudson et al. (1997) contend that, a wide definition of infrastructure is required to address the issue of sustainable neighbourhood design. He describes infrastructure as interconnected buildings that deliver essential public services like transit, utilities like water and electricity, gas, and energy, telecommunications, waste management and sporting and recreational facilities. Nevertheless, these and similar definitions are somewhat broad and open to interpretation. Practically speaking, a lot depends on the context of usage to determine what infrastructure means. Infrastructure can generally be any foundation, system, or fundamental physical framework for societal growth.

Definition of Low-cost housing

Low-Cost housing is a concept that deals with effective budgeting and the use of techniques that help reduce construction costs using locally available materials and improved skills and technology without sacrificing the structure's strength, performance, and life. Based on Bajunid and Ghazali (2012), "Low-Cost Housing" considers that issue is to come up with new ways to cut the cost of building houses so that they are affordable to every household with different income rates. This can be supported by

Bakhtyar et al. (2013), which stated that although the federal government and the state government support the public housing plans in urban areas, many families still need to benefit from the programs.

Drainage System

Failure of Drainage System

Inadequate drainage systems are one of the primary environmental problems. Most streets in urban and rural areas confront issues such as a lack of drainage or appropriately planned drainage to remove stormwater from the surface course of our roadways. Some towns have drainage issues not because they lack drains but because the present drainage system has collapsed, gotten obstructed, or needs repair and rehabilitation. Puddles on the surface area, poor surface flow, slope erosion, blocked ditches, pavement edge raveling, early cracking, pavement pumping, and surface settling are all signs of drainage difficulties that need to be addressed (Nyuyo, 1993). Diriba (2017) main failures caused by insufficient drainage include washouts, slides, slip-outs, road and pavement breakup, and flood damage.

Poor quality of drainage system

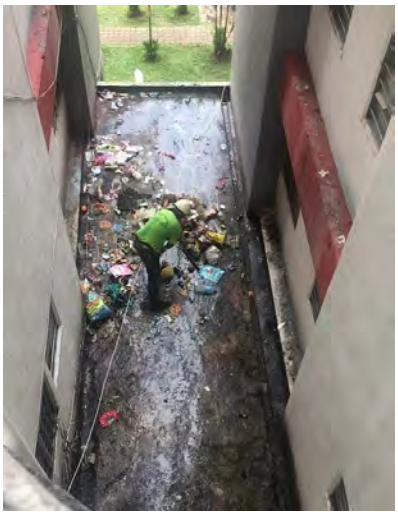

Figure 1: The cleaner is cleaning the rubbish thrown by residents in PPR Gombak (Source: Ng, 2020)

The poor quality of the drainage system will result in flooding. Flooding happens frequently in major Southeast Asian countries, including Malaysia. In Malaysia, as Ismail and Ghani (2017) mentioned, floods are often caused by high and continuous rainfall, unchecked growth, and unmonitored drainage systems. This statement is supported by Menon (2019) and Flash Flood Inundates PKNS Shops in Kampung Baru (2019). Because of its poor drainage system, Kampung Baru is vulnerable to rivers and flash floods. Besides, flash floods are also familiar in Malaysia, especially the metropolitan areas, due to fast urban development and climate change. It is also possible to threaten the life of residents.

Irresponsible attitude of the society

The irresponsible attitude of society also can contribute to the problems in low-cost housing infrastructure services. As mentioned by Azman (2018), the problem that often occurs for the plumbing system is the problem of leaking pipes in house units. As for the excreta drainage system, there is often a problem of clogged toilets due to irresponsible residents throwing things that cannot be dissolved into the toilet hole. Kuala Lumpur City Hall (DBKL) incurs a loss of almost RM40 million a year to cover the

maintenance costs of PPR apartments due to residents' refusal to pay their monthly rent in line with the introduction of a new act, the Strata Management Act 2013 (Act 757).

Road Condition

Failure of roadwork

Failures occur unpredictably and are impacted by various factors, including design, production (or construction), maintenance, and operation. Also, the human aspect is vital in this setting (AAAS, 1990). Water bleeding, cracks, depressions, edge subsidence, rutting, edge damage, local aggregate loss, potholes, and shovel are examples of road failures. Inadequate strength qualities of bituminous mixes, movement of heavy cars, poor drainage conditions, and natural disasters are all potential causes of road failures. According to Banda (2018), one of the road failures is the loss of physical infrastructure due to insufficient maintenance. The failure region is continuously expanding due to a lack of sufficient and timely maintenance.

Bad road conditions

The bad road conditions are due to the low quality of construction. Following the bad road conditions, it is linked with the poor drainage system. Since it influences the serviceability and lifespan of the road, drainage is crucial when designing roadways. When the road and drainage system is not adequately provided, the effectiveness of road infrastructure may be constrained. As Dagnachew (2011) supported, issues like floods and erosion can reduce the lifespan of road infrastructures and other urban services when they are chronic. Hence, this will bring difficulties towards residents and harm their safety.

Poor workmanship and quality

Poor workmanship and quality are also other factors that led to the problems with low-cost housing infrastructure services. The Kuala Lumpur Structure Plan 2020 has recognized the significant issues with affordable housing as being the poor quality of building materials and craftsmanship. Various construction defects may result from poor construction methods, workmanship inside and outside the house, inadequate building materials, inappropriate soil preparation and analysis, or inadequate drainage systems (Auchterlounie, 2009). Workmanship greatly impacts how well a structure is built, how much it costs, and how long it takes (Fromsa et al., 2020).

Water Supply System

The failure of water supply system

The failure of the water supply system. Water supply is another significant indicator of house quality. Most low-cost housing is supplied with water sources; however, according to Hamzah (2012)'s research on defects in Affordable Housing Projects in Klang Valley, Malaysia, the most common defects occurring in affordable housing are leaking pipes, failure of water supply systems, cracking in external walls, dampness to concrete walls, and faulty doorknobs. Residents have experienced several inconveniences due to this defect because many essential household tasks are impossible without a water supply. According to Khatri and Vairavamoorthy (2007), inadequate financial resources and poor management are typically blamed for poorly maintained water supply systems.

Lack of capacity and skills at municipalities

In an article stated by Program Perumahan Rakyat (PPR) Gua Musang residents," in a week there is only two days of water, so we have to plan as well as possible the use of water supply for the five days after that," (Lah, 2022). This issue is created by a combination of circumstances, including the availability of operators and the municipal authorities in charge of Operation & Maintenance (O&M)

(Mothetha et al., 2013). It can be concluded that the water supply problem is due to a need for more communication among the officials. In other circumstances, operators are not accessible when the infrastructure fails. Thus, it takes longer to repair and make it function on time.

Sewage System

The deficient standard of sewerage services

Lastly, there is the need for a higher standard of sewerage services. Even though in Malaysia sewerage services are already developed and managed by government organizations, there are still some issues regarding wastewater services in low-income housing; as stated by (Alam et al., 2020), low-income communities are facing infrastructural limitations like the absence of water supply, drainpipe blockage, leakage, narrow connecting drainpipes, and poor quality or no sewerage. The statement was supported by (Scott et al., 2013); low-income households typically need to invest in sanitation due to their unstable housing situations. In low-income metropolitan areas with inadequate infrastructure, significant population expansion combined with low socioeconomic status typically leaves shared sanitation facilities as the only feasible alternative (Tidwell et al., 2019).

Poor operation and maintenance

Figure 2 : Failure at almost all of the sewer system at PPR Taman Mesra, Sandakan
Source: (Sidom, 2019)

The poor operation and maintenance of infrastructure was another aspect that led to the issues with low-cost housing infrastructure services. In previous studies, Mohammed and Hassanain (2010) discovered that several low-cost housing units had issues because of inadequate inspection and maintenance, material limits, design restrictions, and a lack of building skills. Infrastructure and assets must be maintained in order for them to remain continually in a functional state. Maintenance is the process of renewing the environment of an infrastructure or preserving its value so that it may continue to be used for the intended purpose. The complete failure of infrastructure facilities and the high expense of providing infrastructure is brought on by ineffective maintenance strategies.

Table 3: Summary of Factors That Contributed to The Problems in Low-Cost Housing Infrastructure Services.

Factors		Authors: *Latif, H. M., Mohamed, N., Schachler, M. H., & Jalaludin, A. (2022)*	*Diriba, R. (2017)*	*Zumrawi, M. M. (2016)*	*Ismail, M. S. N., & Ghani, A. N. A. (2017).*	*Govender, T., Barnes, J. M., & Pieper, C. H. (2011)*	*Banda, T. (2018)*	*Otegbulu, A., & Adewunmi, Y. (2009).*
Drainage system	Failure of drainage system	X	X	X			X	X
	Poor quality of drainage system	X	X	X	X	X	X	X
	Irresponsible attitude of the society			X				
Road condition	Failure of roadwork		X	X			X	X
	Bad road conditions		X				X	X
	Poor workmanship and quality	X	X		X		X	
Water supply system	The failure of water supply					X		X
	Lack of capacity and skills at municipalities	X					X	
Sewerage system	The deficient standard of sewerage services				X	X		X
	Poor operation and maintenance	X		X	X	X	X	X

RESEARCH METHODOLOGY

PPR Seri Iskandar was chosen to investigate the vulnerability of the infrastructure services of a recently completed residential, since the residential was recently built in Seri Iskandar in 2018. To make sure the problem is well described, some study into the subject may be done to find the problem statement. Afterwards, the scope of the research and aims are described. To produce an effective dissertation outcome, the target and objectives are required. Usually, the aims of the research provide the foundation for questionnaire design. In order to achieve those objectives, it is also purposefully created to guarantee that the data is correct.

The questionnaire will be developed based on the literature study outcomes. the questionnaire survey's reliability, median and standard deviation was tested using the Statistic Package for Social Science

(SPSS), Version 29. Cronbach's alpha was used to test the questionnaire's reliability since it is appropriate for this questionnaire survey with Likert Scale items. The pie chart, bar chart, and table are used as visual displays to make the data more comprehensible, and the data is then examined. Lastly, the results of the data analysis will be summarized, and recommendations for further study will be made. Cronbach's alpha is calculated as the formula follows:

$$\alpha = \frac{N}{N-1}\left(1 - \frac{\sum_{i=1}^{N} \sigma_{Y_i}^2}{\sigma_X^2}\right)$$

Figure 3 ; Cronbach's alpha formula

Based on the alpha value that is obtained based on the formula above, as shown in the figure, it was tabled and classified into six groups, as shown in the table below:

Table 4: Cronbach's alpha value

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

ANALYSIS OF FINDINGS

Reliability Test of Questionnaire Survey

Table 5 : Reliability test result based on Cronbach's alpha.

Description of section	No of items	Cronbach's alpha (a)
Factors that contributed to the problems in low-cost housing infrastructure services	10	0.779

According to Sekaran & Bougie (2010), a test that has an alpha index of more than 0.70 is considered to have a high-reliability standard.

Discussion of Results

Table 6 : Summary of analysis on the residents' agreement level on the issues on infrastructure services

Factors that contribute to issues	Mean	Standard Deviation	Rank
Irresponsible attitude of the society toward the drainage system	3.92	0.860	1
Poor operations and maintenance of the sewerage system	3.85	0.777	2
Poor quality of drainage system	3.85	0.894	3
The deficient standard of sewerage services	3.81	0.715	4
Poor workmanship and quality of the road	3.81	0.742	5
Failure of drainage system	3.77	0.831	6
Lack of capacity and skills at municipalities in handling the water supply system	3.75	0.711	7
Bad road conditions	3.67	0.785	8
Failure of roadwork	3.48	0.874	9
The failure of water supply system	3.37	0.864	10

Table 5.1 shows that the mean value ranges from the highest mean score (3.92) to the least score (3.37). The standard deviation (sd) demonstrates that the ratings are consistent across all respondents, indicating the validity and dependability of the data. The result shows that the top three (3) factors that contribute to the problems in low-cost housing infrastructure services are the irresponsible attitude of the society in handling the drainage system (mean = 3.92, sd = 0.860), followed by poor operations and maintenance of the sewerage system (mean = 3.85, sd = 0.777) and poor quality of drainage system (mean = 3.85, sd = 0.894).

As you can see, the results differ from the observation state in the literature review. As Irresponsible attitude of society ranked first. The issue of the irresponsible attitude of society is the central issue that contributes to the problems that occur. It can assume that this is mainly due to the mindset and behavior of the residents themselves, who are often seen as neglecting their shared responsibility and commitment to taking care of their housing areas. This factor matches a statement made by (Besar et al., 2018) that all damage is caused by negligence and human-induced factors because they are lazy to throw trash through the elevator and throw it in the garbage dump on the ground floor. It is supported by Dr Lim Shiang Cheng, RTI Malaysia's Better Health Programme lead, who mentioned that many low-cost flats are neglected and filthy due to occupants' attitudes or structural issues, and it is beyond their control. (The Star, 2022).

CONCLUSION

It can be concluded that most respondents stated that they are satisfied with the infrastructure services provided in their area. However, the residents still believe that the factors towards the vulnerability in low-cost housing infrastructure services are the irresponsible attitude of society in handling the drainage system as the most agreed factor. Followed by the Poor operations and maintenance of the sewerage system, Poor quality of the drainage system. Based on the conclusion reached, the serviceability of the infrastructure could be strengthened in constructing a similar building that serves the same objective for future planning. As a result, the proposal aims to offer suggestions for future research because several issues still need to be addressed in this study. Here are a few recommendations for further study in this particular area, as recorded underneath:

I. It is recommended to extend the location of the low-cost residential building. This is because there is a lot of low-cost housing in Perak, and there is the highest probability that some of it still needs to be studied regarding the infrastructure problem.

II. Extend performing the survey using observation and qualitative approach. Thus, it can increase the accuracy of this research by conducting interviews to enhance the result.

III. Interview a contractor or subcontractor with experience in infrastructure projects to ask for their opinion on the factors that might contribute to the problem in infrastructure. For example, the default in designing or drawing does not follow the specification.

IV. Adding another type of infrastructure to be analyzed such as electrical.

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