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Sustainable Township and Sustainable Home: Public Perceptions

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Abstract – *Sustainable Townships and Homes (STSH) have become a trend in a number of countries throughout the world. However, being a developing country, Malaysia faces significant challenges in implementing the STSH idea. One of the challenges would be public support for sustainable development for new townships. Previous research has mostly focused on the framework for implementing STSH without taking into account public perceptions and expectations. Thus, this study determines public knowledge, awareness, as well as their perceptions and expectations of the STSH towards the environment and sustainability. A survey questionnaire was administered randomly to the public in Malaysia using convenience sampling. Feedback from 144 respondents indicates their good level of awareness of sustainable and smart living concepts. This awareness is reflected in their knowledge of the advantages of sustainable and smart living in terms of energy-saving, an improvement in the quality of the built environment in creating better places for people to live, and in terms of environmental protection. In general, they have an awareness of the use of energy-efficient and certified appliances, and these matters are echoed by their strong interest in living in STSH. The ranking based on the Relative Important Index (RII) revealed that the public's most preferred sustainable home features are solar systems, energy-saving appliances, water-saving devices, and rainwater harvesting systems. In addition, the public perceives and expects that a sustainable township should include efficient building arrangements, smart building layout, and the provision of green areas in a township with sustainable and smart home features. It is evident that this study suggests that the public is currently aware of sustainable development in Malaysia. Thus, this study provides a valuable reference for a future property development project to provide better service based on public satisfaction and feedback.*

Keywords: Sustainable township, sustainable homes, environmental

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1.0 INTRODUCTION

The rapid increase in the world population in contrast to the depleting resources indicates sustainability issues, especially for future generations. Hence, the development of sustainable townships and homes has become a necessity with the aim of making optimal and sustainable use of all resources while maintaining an appropriate balance between social, environmental, and economic costs (Johny et al., 2019).

Sustainable Township and Sustainable Homes (STSH) have become a trend in many countries around the world. Thus, building sustainable homes and creating sustainable settlements through township planning, compact city patterns, and urban consolidation have attracted considerable focus in recent years (Chavan & Sarnaik, 2013). Several studies stated that the STSH concept portrays positive impacts not only towards environmental sustainability but also promotes efficiency in township management and administration. However, Malaysia as a developing country faces huge challenges to implement the concept of STSH. One of the challenges would be the public and support towards sustainable development for new townships. Previous research mostly focused on the framework for SHTC implementation without considering public perceptions and expectations.

Nowadays, the increase in the rate of urbanization has resulted in many environmental problems. Patel and Gandhi (2019) studied how an integrated township is the only potential solution to overcome the challenges of urbanization. They suggested an integrated and sustainable township is a combination of residential, infrastructure, and basic amenities with employment opportunities provided in one place. Sustainable features for townships can be divided into three main areas in terms of the environment, energy, and construction materials used for housing. Some of the elements within the environment are green areas, building layout, and building arrangement. The sustainable township provides green areas for plantations to reduce heat in the environment, for human activities to improve health, and to reduce runoff to prevent flooding. In terms of building layout, the house design incorporates the use of glass and sufficient windows to promote clean and cool air in the house, which can reduce dependency on the air conditioner as well as promote sufficient lighting during the daytime to reduce the use of electricity, while the arrangements of a building should take consideration of wind and sunlight direction to allow cool air into the house and reduce the surface exposed to sunlight. Sustainable and long-lasting construction materials can be used for efficient insulation, which includes environmentally friendly products that can be recycled. Other examples are the selection of materials for recyclable roofs and walls, selection of paint technology, and color schemes which can reduce heat in the house. Although the importance of sustainable materials has been widely explored academically and accepted by the public, it does not always reflect in the residential house purchase decisions of typical buyers, including residential property investors (CIB, 2013).

There are many benefits and risks of having smart home technologies, such as energy savings, which are commonly related to the use of smart appliances such as smart meters and solar systems. Thus, smart homes are a priority area of strategic energy planning and national policy in the United Kingdom (Wilson et al., 2017). The solar system commonly consists of solar panels on the roof to reduce dependency on an energy company and to power several electrical appliances such as lighting, water heaters, and water pumps. Rainwater harvesting (RWH) is the most traditional and sustainable method, which can be easily used for potable and non-potable purposes both in residential and commercial buildings (Rahman et al., 2014).

The rainwater harvesting system accumulates and collects rain from the roof, lawn, or open areas around the house to reduce dependency on water supply companies. It is used as an alternative source of water for such activities as grass or plant watering, car washing, toilet flushing, and any activity which requires minimum human body contact. Another important appliance is the water-saving devices for water reduction in water distribution systems, such as dual toilet flush systems, showers, and pipes for a washing machine and automatic dishwasher. A recent study by Vijaykumar et al., (2020) proposed a sustainable township and home to have various amenities and facilities that use natural resources, such as rainwater harvesting that collects and stores rainwater, solar plates at the particular house and at the parking area of the township that produce electricity, a wastewater treatment plant that collects all the liquid waste and filters it to be used in gardening and stored in water bodies of the township, and converts solid waste into fertilizer. In addition, there is a restriction on the fuel consumption of vehicles in the township and the use of electronic vehicles in the township to maintain a healthy environment in the township.

Another important aspect of a sustainable home is the applications of appliances to remotely monitor and control electrical/internet/water appliances using smartphones or computers to improve safety and security in the township and home. In addition, sustainable townships and sustainable housing features can also provide beneficial information such as real-time energy/internet/water consumption and also their usage history periodically (hourly, daily, weekly, and monthly) for comparison, planning, and budgeting of energy/internet/water consumption.

Due to rapid urbanization, there is a need for an account of the reasons for the need to have sustainable townships and homes to provide an environmentally friendly and sustainable concept to give the best option for healthy living conditions as well as a healthy environment. This paper focuses on seeking public awareness, knowledge, perceptions, and expectations of sustainable townships and homes and their preferences for the features provided in the townships and homes.

1.1 Objectives of Research

The objectives of this research are:

i. To determine public awareness, current knowledge, perceptions, and expectations, with regards to Sustainable Township and Sustainable Home features; and

ii. To determine the most preferred features of sustainable townships and homes based on public ranking.

1.2 Scope of Research

This study focuses on public perceptions of their awareness, knowledge, expectations, and preferences toward sustainable townships and sustainable homes in modern urbanization in Malaysia. Convenience sampling was used to get public feedback both in East and West Malaysia.

1.3 Significance of Research

This research is significant for the designers, developers, and contractors based on the feedback of the customers on the sustainable features in terms of their value, functionality, practicability, and effectiveness of the township development. The findings based on the public ranking of sustainable features based on public preferences will provide a valuable reference for future property development projects and indicate public or user satisfaction.

1.4 Research Framework

Based on the review of literature, the variables in the research framework are developed to determine the public perceptions (knowledge, awareness, expectations, and preferences) on the sustainable township and sustainable home as shown in Figure 1.

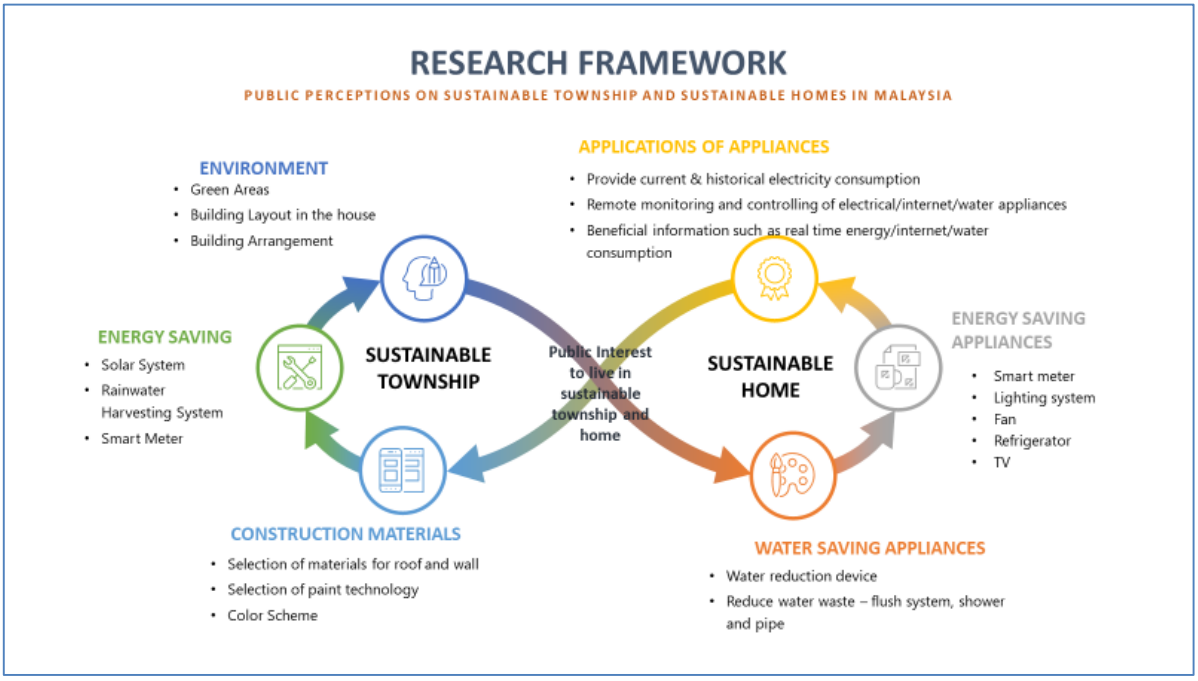

Figure 1: Research framework

Therefore, this study aims to study the public perceptions of the sustainable township and home features. The implication of this study is to assist the developers to understand the public preferences in their future property development projects.

2.0 METHODOLOGY

2.1 Research Approach

This research focuses on public perceptions of sustainable townships and home features by adopting a quantitative approach. A survey questionnaire was conducted throughout both West and East Malaysia. In order to generalize from a random sample and avoid sampling errors or biases, a random sample needs to be of adequate size. Determining an adequate sample size and the population is important in order to ensure the reliability and validity of the data collected. The systematic process is shown in Figure 2.

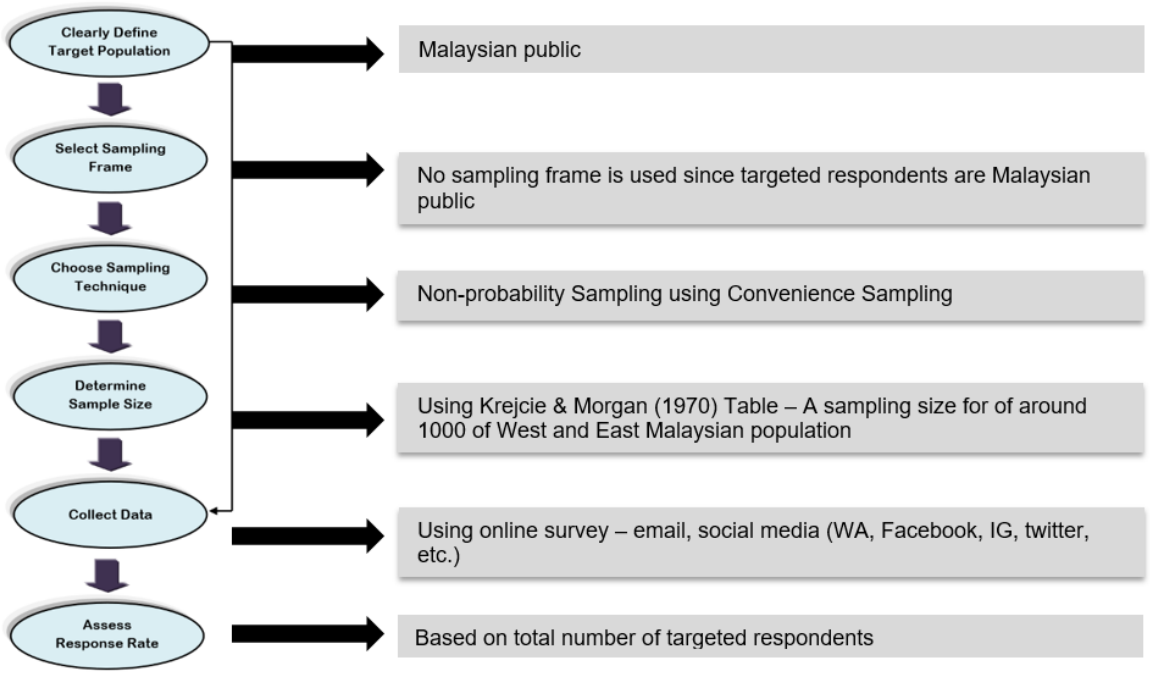

Figure 2: Systematic process in determining adequate sample size and population

2.2 Target Respondents and Sampling Design

The target respondents are based on a non-probability sampling where convenience sampling was adopted (Figure 3).

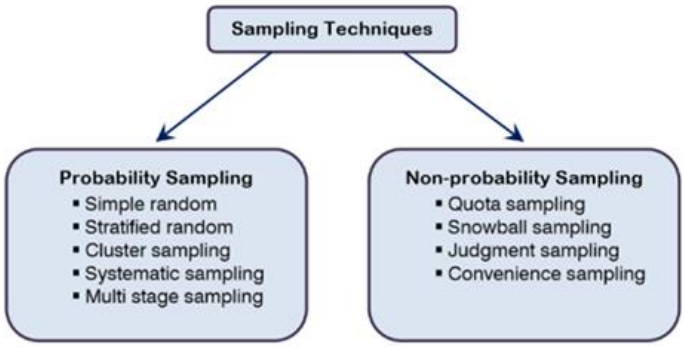

Figure 3: Sampling techniques

Practically, researchers neither have the time nor the resources to analyze the entire Malaysian population. Thus, there is a need to apply a sampling technique to reduce the number of cases. Based on Krejcie and Morgan (1978), a sampling size for East Malaysia is 384 and for West Malaysia is 384, totaling 764.

2.3 Design of Instrument

The questionnaires, which formed the basis of this study, are based on the framework for the research area used to answer the research questions regarding STSH features towards green environment and sustainability. Questionnaires can be classified as both quantitative and qualitative methods depending on the nature of the questions. The questionnaires were refined and reviewed by designing the initial instrument through piloting and enhancing the instrument by carrying out the final check. There are two types of questionnaires in this study, namely open-ended and close-ended. Close-ended questions are used, where respondents are restricted to choosing among any of the given multiple-choice answers. One of the main advantages of including closed-format questions in the questionnaire design is the case of performing preliminary analysis, and these questions are ideal for calculating statistical data and percentages, as the answer set is known. Specifically, answers obtained through closed-ended questions with multiple choice answer options are analyzed using quantitative methods and involve pie charts, bar charts, and percentages. The design of questionnaires used in this study is described in further detail in the following sub-sections.

2.3.1 Section A (Background of Respondents)

This section requires the respondents to fill in various information related to terms of gender, age, education, monthly household income, and monthly household bill variables. The purpose of this section is needed to identify the type of respondent to ensure that it fits the criteria for this study.

2.3.2 Section B (Respondent's Awareness and Knowledge on Sustainable Township and Sustainable Home Features)

This section focuses on the respondents' awareness and knowledge of sustainable townships and sustainable home features related to this study. This section consists of eight close-ended dichotomous questions designed in which respondents were asked to choose either 'yes' or 'no'. There are two statements to determine the public knowledge of energy saving achieved through sustainable and smart living and the advantages of using sustainable and smart appliances. The other six statements are related to public awareness of sustainable and smart living, usage of energy-efficient appliances, usage of sustainable environmental materials, features of sustainable and smart appliances such as solar systems, rainwater harvesting systems, smart meters, and finally, their interest in living in sustainable townships and homes.

2.3.3 Section C (Respondent's Perception and Expectations on Sustainable Township and Sustainable Home Features)

This section is also designed as a closed-ended question with a Likert scale from 1 to 5. In this section, the respondents must choose the level of interest to measure their perceptions and expectations to live in a sustainable township and sustainable home features. The scale for each statement is as follows: 1 = Very not interested, 2 = Not interested, 3 = Moderately interested, 4 = Interested, 5 = Very interested. There are twelve statements related to sustainable and smart application of appliances, energy-saving appliances, remote monitoring and controlling of appliances through the sustainable and smart applications, sustainable township and sustainable housing features, solar system, rainwater harvesting, green areas in township, building layout in the house design, building arrangements take consideration of wind and

sunlight directions, efficient insulation that provides good and environmental material in the construction stage, water-saving devices and finally, their interest to live in a sustainable township with sustainable home features.

2.4 Data Analysis

There are several methods of data analysis that are commonly used for analyzing quantitative data based on questionnaires survey. Two methods of data analysis were used in this study: (1) descriptive analysis using percentage frequency; and (2) Relative Important Index (RII).

3.0 RESULTS AND DISCUSSION

3.1 Response Rate

Even though the public survey is popular and commonly used in market research, obtaining good responses has always been a great challenge to researchers. The response rate in the Malaysian scenario range between 10% to 30%. The targeted respondents using Krejcie & Morgan (1978) is around 764, thus the response rate in this study for both West and East Malaysia is about 19%.

3.2 Pilot Study

A pilot study was carried out on 30 respondents to test the reliability of the instrument. The Cronbach's alpha value from the reliability test is 0.881. This means there is very good internal consistency reliability of the scale in the sample. Moreover, a value greater than 0.8 is preferable, according to Pallant (2011).

3.3 Respondent's Profile

Table 1 shows the respondent's profile in terms of gender, age, education, monthly household income, and monthly household bill variables. The results indicate that 55.6% of respondents were male. More than half of them are aged between 22 and 44 years old. Around 44% have a tertiary level of education. Almost 70% of the respondents earn a monthly income of RM5000 or below. Fifty percent (50%) of the respondents pay for an average monthly electricity, internet, waste, and water bill of between RM401 and RM500.

3.4 Public Current Knowledge and Awareness on Sustainable Township and Sustainable Home

The purpose of this section is to determine public awareness and current knowledge and awareness on Sustainable Township and Sustainable Home (STSH) features based on eight questions.

3.4.1 Awareness on Sustainable Township and Smart Living

Around 86% of the public indicate their awareness of sustainable townships and smart living. A sustainable township takes into consideration the location, the way in which the townships are planned, the amenities provided, the quality of life, and the neighborhood (Chavan & Sarnaik, 2013).

Table 1: Respondent's profile

Profile	Frequency (n)	Percentage (%)
Gender		
Female	64	44.4%
Male	80	55.6%
Total	***144***	***100%***
Age		
Less than 25 years old	34	23.6%
25-44 years old	79	54.9%
44-65 years old	31	21.5%
Total	***144***	***100%***
Highest education qualification		
Secondary school	38	26.4%
Vocational/technical	34	23.6%
Tertiary	63	43.8%
other	9	6.2%
Total	***144***	***100%***
Monthly household income		
RM 5000 and below	98	68.1%
RM5001-RM7000	6	4.1%
RM7001-RM10000	19	13.2%
RM10001-RM12000	12	8.3%
RM12001-RM15000	5	3.5%
RM15001-RM20000	1	0.7%
RM20000 and above	3	2.1 %
Total	***144***	***100%***
Average monthly electricity, internet, waste, and water bill, etc.		
RM100(below)	2	1.4%
RM101-RM200	20	13.9%
RM201-RM300	13	9.0%
RM401-RM500	73	50.7%
RM501-RM600	26	18.0%
RM600 and above	10	7.0 %
Total	***144***	***100%***

3.4.2 Knowledge on Energy Saving Achievement Through Sustainable and Smart Living Practices

Figure 4 shows that the majority of the respondents (97.2%) know that energy saving can be achieved through sustainable and smart living practices. A previous survey on smart home applications indicated that the majority of the respondents were found to be interested in versatile smart home applications and willing to live in a smart house (Zhai et al., 2014). Energy savings can be achieved in the building sector by improving the building's dynamic energy performance in terms of sustainable construction management in urban-based built environments (Hong et al., 2015).

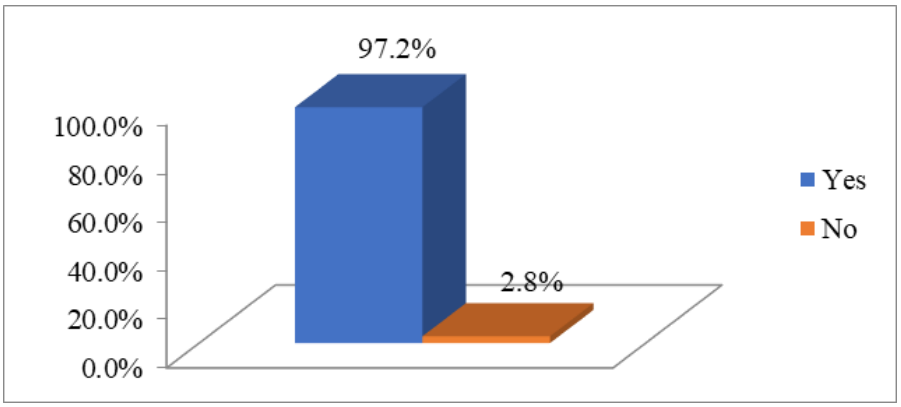

Figure 4: Knowledge on energy savings

3.4.3 Awareness on Usage of Energy Efficient Appliances

Figure 5 indicates that the majority of the respondents are aware that the use of energy-efficient appliances will use less energy and can save their electricity usage. It was shown that in the past public awareness of energy efficiency has been limited in the past, however, this study suggests that the public is placing value on more sustainable and energy-efficient house designs that should follow proper guidelines (CIB, 2013).

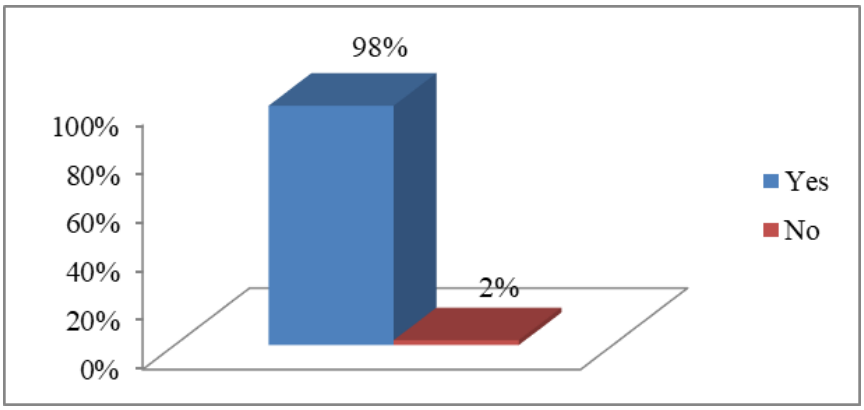

Figure 5: Awareness on the usage of energy-efficient appliances

3.4.4 Awareness on Usage of Sustainable Environmental Materials

Figure 6 shows that 85% of respondents are aware that the use of sustainable environmental materials in sustainable townships and sustainable homes.

Globally, buildings consume 30% – 40% of primary energy and account for 25% – 33% of CO2 emissions. Building energy consumption emanates from a variety of sources, some of which are related to the building envelope or fabric, some to the equipment in the building, and some to both. Opportunities for reducing energy use in buildings through the application of innovative materials are therefore numerous (Judkoff, 2011).

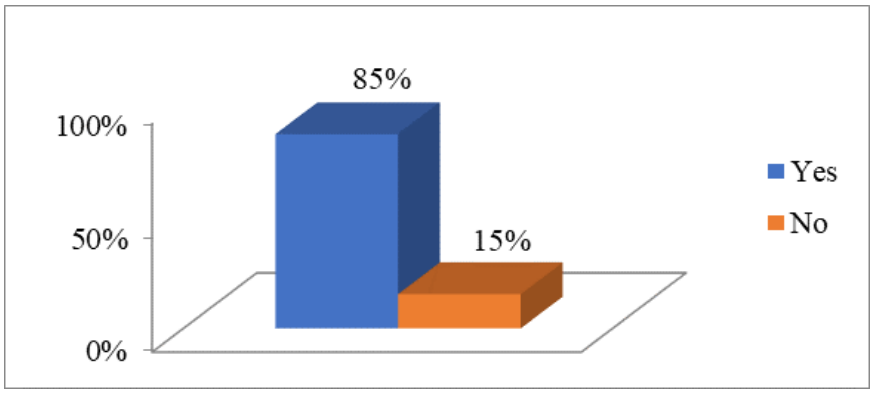

Figure 6: Awareness on sustainable environmental materials

3.4.5 Awareness on Usage of Appliances with Sustainable and Smart Features

Figure 7 shows that around 90% of respondents are aware of the sustainable and smart features of appliances such as recyclable roof systems, rainwater harvesting, and other certified energy-efficient appliances in housing development.

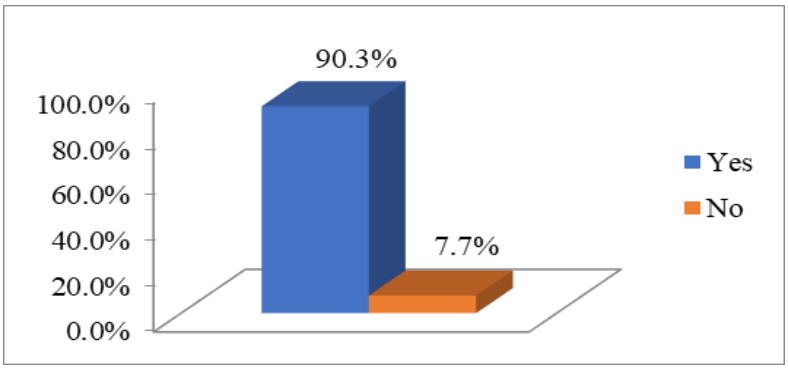

Figure 7: Awareness on the usage of appliances with sustainable and smart features

3.4.6 Awareness on Sustainable and Smart Feature of Certified Energy Appliances

About 93.1% of respondents are aware of the sustainable and smart features of certified energy appliances in modern housing development such as smart meters (Figure 8).

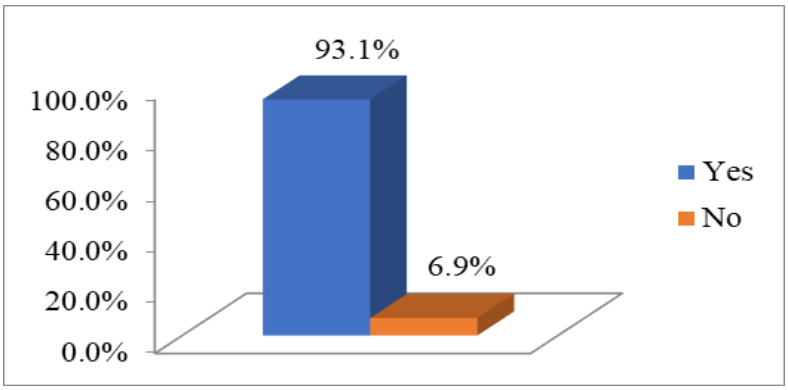

Figure 8: Awareness on sustainable and smart features of certified energy appliances

3.4.7 Awareness on Sustainable and Smart Feature of Certified Energy Efficient for Solar System

About 97.2% of respondents are aware of the sustainable and smart features of certified energy-efficient appliances such as solar systems in a modern housing development (Figure 9).

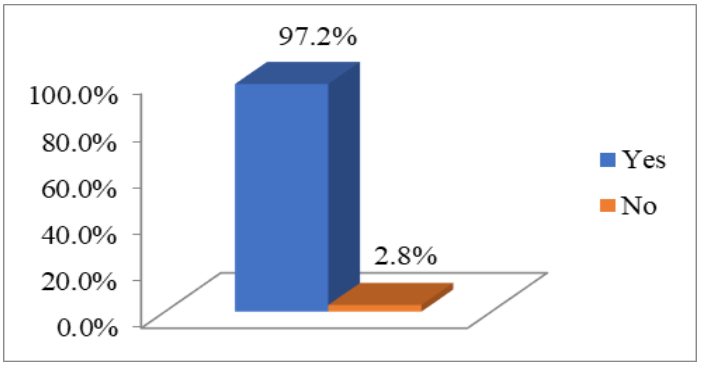

Figure 9: Awareness on sustainable and smart features (Certified Energy Efficient Solar System)

3.4.8 Knowledge on the Advantages of Using the Sustainable and Smart Living Appliances

Around 92.3% of respondents have knowledge of the advantages of using sustainable and smart living appliances, which are to improve the quality of the built environment, to create better places for people to live, and, at the same time, improve and protect the environment (Figure 10).

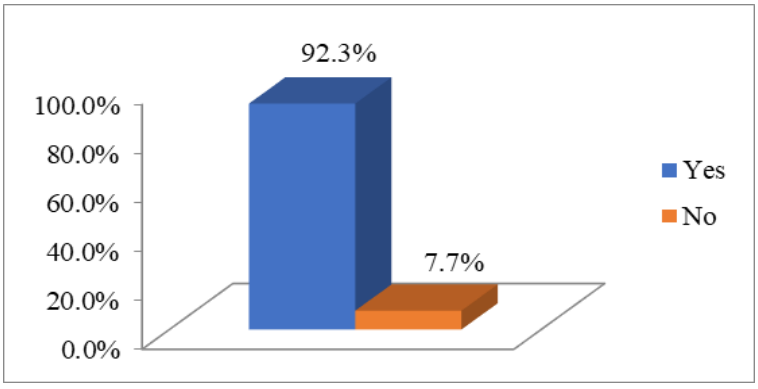

Figure 10: Knowledge on the advantages of using the sustainable and smart living appliances

3.4.9 Respondent's Interest to Live in Sustainable Township and Sustainable Home

Almost 95% of respondents are interested in living in sustainable townships and sustainable homes (Figure 11). However, it was shown that the residential property sector will pay more for an environmentally sustainable township and home compared to a similar-located residential property that has not been constructed with the same level of environmental sustainability (CIB, 2013).

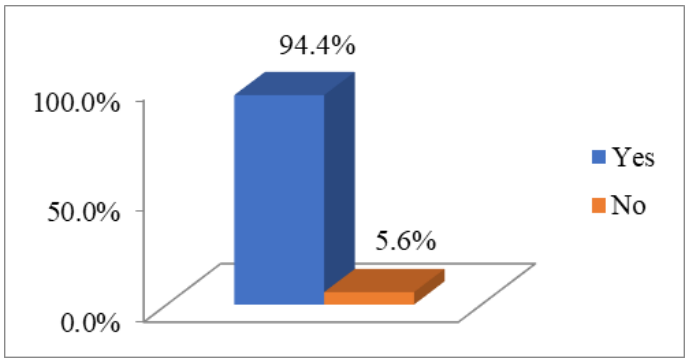

Figure 11: Respondent's interest to live in sustainable township & sustainable home

3.4.10 Summary of Findings on Public Current Knowledge and Awareness on Sustainable Township and Sustainable Home

Based on the above questions imposed on the public, the majority of them are aware of the sustainable and smart living concept. This awareness is reflected in their knowledge of the advantages of sustainable and smart living in terms of energy-saving, an improvement in the quality of the built environment in creating better places for people to live, and in terms of environmental protection.

In addition, the majority of the respondents have awareness of the usage of energy-efficient and certified appliances with sustainable and smart features, such as solar systems, rainwater harvesting systems, and the usage of sustainable environmental materials. Thus, their awareness and knowledge of the matters asked in the survey are echoed by their current interest in living in sustainable townships and sustainable homes.

The following section further discussed public perceptions and expectations based on the ranking of the given twelve statements related to sustainable townships and sustainable home features.

3.5 Public Perception and Expectation on Sustainable Township and Sustainable Home Features

For each statement, the respondent is required to choose the scale from 1 (not interested) to 5 (very interested). Based on the feedbacks, the Relative Important Index (RII) was calculated for each statement and ranked accordingly (RII ranges between 0 (Not Interested) to 1 (Very interested).

3.5.1 Ranking of Respondents' Perceptions and Expectations on Sustainable Township and Sustainable Home Features

Table 2 shows the ranking of the statement on public perceptions and expectations of sustainable townships and sustainable home features related to the application of appliances, energy-saving appliances, monitoring and controlling of appliances remotely, information management, smart appliances such as solar systems, rainwater harvesting systems, a green area within the township, building layout and arrangement, efficient insulation, water-saving devices, and finally, their interest in living in a sustainable township with sustainable home features.

Table 2: Ranking of respondents' perceptions and expectations on sustainable township and sustainable home features

No.	Statement on public level of perceptions and expectations on STSH features	RII	Ranking
1	Sustainable and smart application of appliances that can provide current and historical electricity consumption for my electricity usage planning and budgeting anytime.	0.7811	12
2	Energy-saving appliances based on approved electrical devices by the Malaysian government which used less energy for example smart meter, lighting system, fan, refrigerator and TV.	0.8591	3
3	Remote monitoring and controlling of electrical/internet/water appliances through sustainable and smart applications on my smartphones or computers anywhere, anytime. These features will improve the safety and security of my home and township.	0.7893	10
4	Sustainable township and sustainable housing features that provide beneficial information such as real-time energy/internet/water consumption and also their usage history on a periodic basis (hourly, daily, weekly and monthly) for the purpose of comparison, planning and budgeting of energy/internet/water consumption.	0.8027	9
5	Solar system helps to reduce dependable energy from power company and able to power several electrical appliances such as lighting, water heater and water pump.	0.8609	2
6	Rainwater harvesting that can help to rescue dependable water from water supplies company. This system is able to accumulate and collect rain through roof or lawn or open area around house and provide alternative source of water such as grass or plant watering, car wash, toilet flush and any activity which less human body contact.	0.8446	5
7	Green areas in township that provide areas for plantation which reduce heat to environment, area for human activities to improve health and freedom and at the same time reduce runoff which can reduce flood.	0.8084	8
8	Smart building layout in the house design to incorporate the use of glass and window which promotes clean and cool air in the house which can help dependable in air conditioner. This layout will also promote sufficient lighting during daytime to reduce the used of light.	0.8350	7
9	Building arrangements take consideration of wind and sunlight direction which promotes cool air getting into house and reduce surface exposure to sunlight.	0.8378	6
10	Efficient insulation that provides good and environmental material in construction stage. Usage of this insulation will promote environmentally friendly product, can be recycled product and last long material. For example, of selection of material for roof and wall, selection of paint technology and color scheme which can reduce heat in the house.	0.7879	11
11	Water-saving device to provide approved water reduction device in water system and to promote reduction in water waste such as dual toilet flush system, shower and pipe.	0.8581	4
12	Interest to live in sustainable township with sustainable housing features.	0.9532	1

Generally, the statements that are ranked 1 to 10 shows the RII between 0.8 to 1, indicates that the public is "interested" towards "very interested" in relation to the statement. Only two statements with RII between 0.7 and 0.8 show that the public is "moderately interested" towards "interested".

In terms of the public preferences of a sustainable home, features are the solar system, energy-saving appliances (RII = 0.8591), water-saving device (RII = 0.8581), and rainwater harvesting system (RII = 0.8446), while the expectations of sustainable township features are building arrangements (RII = 0.8378), smart building layout (RII = 0.8350), provision of green areas in a township (RII = 0.8084), sustainable township and sustainable housing features (RII = 0.8027), remote monitoring and controlling of appliances (RII = 0.7893), efficient insulation (RII = 0.7879) and lastly the Sustainable and smart application of appliances (RII = 0.7811). The following discussion is divided into two (2) parts; (i) respondents' most preferred sustainable home features and (ii) the respondents' expectations on the sustainable township.

3.5.2 Discussion

This section discusses the respondents' most preferred sustainable home features, which are solar system, energy-saving appliances, water-saving devices, and rainwater harvesting systems, while the respondents' expectations for sustainable townships are building arrangements, smart building layout, provision of green areas in townships, sustainable townships, and sustainable home features. The RWH system offers a sufficient amount of water and energy savings through lower consumption. In addition, the cost of installation and maintenance expenses, the system is effective and economical (Rahman et al., 2014).

The finding shows that the public prefers to have a solar energy system in their home. They are aware that solar energy is one of the widely used renewable energy sources that can be harnessed either by directly deriving energy from sunlight or indirectly. According to a study by Jamar et al. (2016), solar collectors, storage tanks, and heat transfer fluids are the three core components in solar water heater applications.

The finding in this study indicates that the public preferred water-saving devices in their sustainable homes. Thus, it is expected an approved water reduction device in the water system will be provided, which will promote a reduction in water waste, such as a dual toilet flush system, shower, and pipes for the washing machine and dishwasher. In addition, large amounts of heat are wasted during the showering process. A study by by Guo et al. (2012) that focused on a wastewater heat recovery system indicated that more than 50% of the shower waste-water heat can be recycled by the high-performance heat recovery device

Energy-saving appliances were one the most preferred sustainable home feature in this study is related to the environment as proven in a study by Trotta (2018) that shows environmental variables are good predictors of both energy-saving behaviors and investment in energy-efficient appliances. It was shown that by evaluating and understanding the household and dwelling characteristics that affect energy-saving behaviors and energy efficiency investments, it is possible to obtain a clearer idea of where and how energy and emissions savings can be made and propose effective and targeted policies that promote energy-responsible lifestyles.

The next preferred sustainable home feature is the rainwater harvesting system. In Malaysia, the use of a rainwater harvesting system is considered as part of the solution proposed by the government to avoid a water crisis. Che-Ani et al. (2009) first reviewed the scenario of water shortages in Malaysia even though Malaysia has an ample supply of water due to heavy rains. However, there was increasing water consumption by industry, agricultural, and household users that resulted in a limited water supply. Thus, at the user's home level, it was found that rainwater harvesting has become the most suitable solution as suggested by the government, with many benefits not just for the users, but also for the government and the environment.

The least preferred (RII < 0.8) sustainable home features which indicate that the public is moderately interested towards interested to have remote monitoring and controlling of appliances, efficient insulation, and sustainable and smart application of appliances. The previous study indicates some concerns about individual privacy in Europe and Asia due to a smart home records the habits, movement, and information of the inhabitants (Zhai et al., 2014).

Efficient insulation provides good and environmental materials during the construction stage, thus promoting environmentally friendly products. Namini et al. (2013) identified efficient sound insulation as one of the most important indoor quality parameters under building quality management. These products can be recycled and, thus, can be considered as long-lasting materials. Examples are the selection of materials for recyclable roofs and walls, selection of paint technology, and color schemes which can reduce heat in the house.

The public expectations of sustainable townships are the building arrangements, smart building layout, provision of green areas in the township, sustainable townships, and sustainable home features. The finding indicates that public expectations of the design of building arrangements that take into consideration the wind and sunlight direction to promote cool air getting into the house and reduce surface exposure to sunlight. Based on the analysis of the energy consumption corresponding to the different orientations, it emerged that a well-orientated building can save a considerable amount of energy throughout its life cycle (Abanda & Byers, 2016). In addition, it is expected that a smart building layout in the house will incorporate the use of glass and enough windows to promote clean and cool air in the house, which will help rely on the air conditioner. This layout will also promote enough lighting during the daytime to reduce the use of light. The finding also shows that the public expects those green areas in the township to be provided for plantations to reduce heat in the environment, and areas for human activities to improve health and freedom, and at the same time, reduce runoff, which can reduce flooding.

4.0 CONCLUSION

This paper has given an account of the reasons for the need to have sustainable townships and homes due to rapid urbanization. Thus, the present study was designed to determine the public perceptions in Malaysia of their awareness, knowledge, perceptions, and expectations of sustainable townships and sustainable homes. This study has shown that the public is aware of the sustainable and smart living concept. This awareness is reflected in their knowledge of the advantages of sustainable and smart living in terms of energy-saving, an improvement in the quality of the built environment in creating better places for people to live, and in terms of environmental protection. These findings suggest that, in general, they have awareness of the

usage of energy-efficient and certified appliances with sustainable and smart features, such as solar systems, rainwater harvesting systems, and the usage of sustainable environmental materials. It was also shown that their awareness and knowledge of these matters are echoed by their current interest in living in sustainable townships and sustainable homes. The second major finding based on ranking using the Relative Important Index (RII) revealed that the public's most preferred sustainable home features are solar systems, energy-saving appliances, water-saving devices, and rainwater harvesting systems. In addition, the public perceives and expects that a sustainable township should include efficient building arrangements, smart building layout, and the provision of green areas in a township with sustainable and sustainable home features. The evidence from this study suggests that the public is currently aware of sustainable development in Malaysia. Thus, this study provides a valuable reference for a future property development project to provide better service based on customer satisfaction and feedback. A limitation of this study is that the numbers of respondents representing the Malaysian public were relatively small. The study also used convenience sampling where the selection might be prone to biases, thus the sample may not reflect or be representative of the overall Malaysian public. Future research may focus on specific developers using a readily available sampling frame to provide more meaningful and substantial references for new sustainable townships and sustainable homes.

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