e-ISSN: 2600-7568

Available online at
https://gadingssuitm.com/index.php/gadingss

GADING Journal for the Social Sciences 29(2) 2026, 106 – 118.

GADING Journal for the Social Sciences

Insights on Smart Home Adoption amongst Developers in Kuala Lumpur, Malaysia

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ARTICLE INFO

Article history:
Received 10 February 2026
Revised 16 July 2026
Accepted 22 July 2026
Online first
Published 29 July 2029

Keywords:
smart home
adoption
understanding
motivation

DOI:
https://doi.org/10.24191/gading.v29i2.819

ABSTRACT

Despite the growing global interest in smart home technology driven by convenience, security, energy efficiency and safety awareness, its adoption among Malaysian developers remains in its infancy stage. This is largely attributed to challenges such as high initial costs, technological complexity, and ambiguous regulatory frameworks. Nevertheless, smart homes technology offers numerous benefits for both the property owners and developers particularly in enhancing residential living environments and addressing environmental sustainability. To better understand developer perspectives, this study explores the insights, conceptual awareness, and core motivators influencing smart home adoption among developers in Kuala Lumpur. Utilising a quantitative approach an online survey was distributed to 252 developers in Kuala Lumpur, and the collected data were analysed using descriptive statistics. The findings indicated that the developers are familiar with the concept of smart home technology and demonstrated a good understanding of its application and benefits. Furthermore, the developers are motivated to adopt these technologies to enhance their projects' value proposition. Overall, this study concludes that developers possess a strong understanding of smart home technology and are willing to integrate it into future developments. This positive level of understanding and motivation indicates favourable prospect for the wider adoption of smart home technology in Malaysia's housing sector.

1. INTRODUCTION

Globally, the integration of smart home technology has emerged as a transformative force in redefining modern living standards. By incorporating advanced technologies such as fall detection and emergency response systems, smart homes support ageing in place while creating residential environments for future innovations that are adaptable to future technological innovations for long-term sustainability. These technologies extend beyond safety, offering convenience, energy efficiency, and improved security through interconnected networks of sensors, appliances, and services that can be remotely monitored and controlled. The adoption of smart home technology has attracted significant attention due to its potential to improve

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residential living spaces and address environmental challenges (Chan et al., 2009; Aldrich, 2003; Balta-Ozkan et al., 2013).

Smart home systems enhance daily life by enabling homeowners to control lighting, heating, and household appliances through smartphone applications or voice assistants, while automation provides a more personalised living experience (Chan et al., 2009). Integrated systems such as cameras, motion sensors, and smart locks offer real-time surveillance and remote access (Aldrich, 2003), contributing to increased safety. In addition, devices that monitor vital signs and activity levels further promote health and wellness, particularly among elderly and individuals with disabilities (Balta-Ozkan et al., 2013). These benefits underscore the role of smart homes in improving quality of life, reducing costs, and supporting environmental sustainability (Wilson et al., 2017; Karjalainen, 2009).

Despite these global developments, the adoption of smart home technology in Malaysia remains at an early stage. Although appliances such as smart lighting, thermostats, and security devices are available, their adoption has been constraint by contextual factors such as climate, perceived value, and market awareness (Chan et al., 2009). Furthermore, developers often prioritise technologies with clearer market appeal, leaving energy management devices underutilised.

This gap highlights the need for systematic investigation of property developers' awareness and willingness to adopt smart home technologies in Malaysia. Accordingly, the aim of this study is to provide a comprehensive insight of smart home technologies adoption by examining developers' level of understanding and the factors motivating its integration into their projects. Since the concept of smart homes is relatively new in Malaysia, the findings are expected to provide valuable insights into potential adoption in their projects and identify the aspects that significantly influence developers' willingness to incorporate this technology in residential development. Therefore, the objectives of this study are to study the property developer' understanding on smart home technology and to evaluate the property developers' motivation to adopt smart home technology.

2. LITERATURE REVIEW

The adoption of smart home technology has gained significant attention due to its potential to improve residential living spaces and address environmental challenges. Smart home technology enhances daily life by providing more convenience, security, energy efficiency, and health management.

2.1 Defining Housing

The United Nations Human Settlements Programme (UN-Habitat, 2003) defines housing as the provision of living spaces for individuals and families, including the surrounding environment and the physical buildings that support human habitation. Housing is a component fundamental component of human settlements as it gives its occupants safety, security, and an overall sense of belonging. Single family homes, apartments, townhouses, condominiums, and mobile homes are just a few of the various types of housing, each of which can accommodate a distinct lifestyle and socio-economic background.

The fundamental aspect of housing is as a form of shelter which provides essential protection and comfort. Comfortable housing focuses on occupant well-being through thermal comfort, indoor air quality, noise control, and ergonomic design. In modern housing, proper insulation and efficient HVAC systems keep temperatures comfortable, while ventilation and low-VOC materials improve air quality. (Alavi and Ahangari, 2020).

Another conventional aspect for housing is to ensure safety. Safe housing incorporates structural integrity, fire safety, security systems and safe neighbourhood planning to minimize the risk of harm, accidents and hazards. High-quality construction materials ensure durability, while fire safety features and security systems prevent incidents and unauthorised access. Apart from detail specifications in housing community planning and crime prevention strategies encourage safe living conditions (Jaafar et al., 2017; Yusof et al., 2020).

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Beyond serving as a place residence, housing is recognized as an important investment asset. Investors in housing views residential properties as financial assets with the potential for long term growth and wealth accumulation. Real estate investment offer opportunities for capital appreciation, rental income, and portfolio diversification. Whilst location and economic conditions influence property value, buyers prefer eco-friendly and energy-efficient homes. Insurance and due diligence are two risk management strategies that can help maximise returns while minimising losses (Ahmad et al., 2018; Hashim et al., 2018).

2.2 Innovative Housing Concept

The United Nations Human Settlements Programme (UN-Habitat, 2003) defines housing as the provision of living spaces for individuals and families, including the surrounding environment and the physical elements. In the context of innovation, housing concepts extend beyond traditional construction to integrate sustainability, smart technologies, and community-oriented design.:

i. **Eco-Friendly Housing**: Focuses on sustainability and reducing environmental impact. This includes using renewable energy sources, sustainable building materials, and energy-efficient designs. Adoption of smart home elements very much complement the focus of this type of housing.

ii. **Affordable Housing**: Designed to provide cost-effective living solutions for low-income individuals and families. Incorporating smart home elements can generate long-term operational savings for occupants. These projects often incorporate sustainable features and community-oriented designs to enhance quality of life.

iii. **Co-Housing**: A community-focused concept where residents share common spaces and resources while maintaining private living areas. This promotes social interaction and a sense of community. Adoption of smart home elements is seen as a convenient feature in managing the household.

iv. **Modular Housing**: Involves constructing homes in sections (modules) in a factory setting, which are then transported and assembled on-site. This method can reduce construction time and costs.

v. **Micro-Housing**: Small, efficient living spaces designed to maximize functionality in a minimal footprint. This concept is popular in urban areas where space is limited.

These concepts reflect the evolving needs and priorities of modern society, emphasising sustainability, affordability, community, and efficient use of space.

2.3 Smart Homes

Smart home technology is a sophisticated and integrated system of internet-connected devices, sensors, and appliances in the home which enables comprehensive remote monitoring, management, and control of various household functions. This technology includes a variety of features aimed at improving the occupants' convenience, security, energy efficiency, and overall quality of life. Smart home systems use advanced information and communication technologies (ICT) to create an intelligent and flexible living space that can respond dynamically to its residents' needs and preferences. The smart home concept transforms conventional residential living with modern innovations that improve comfort, convenience, security, and energy efficiency (Al-Fuqaha et al. 2015). A smart home is basically made up of interconnected devices, sensors, and systems that communicate with one another and can be controlled remotely by the homeowner (Atzori et al. 2010). This interconnectedness enables the automation of various household tasks and allows residents to monitor and manage their homes from any location with internet access (Yang et al. 2018). Smart home technology allows homeowners to remotely monitor and control their homes using smartphone apps or web interfaces (Borgia, 2014).

This feature enables residents to change settings, view security camera feeds, and receive real-time alerts from anywhere with an internet connection, providing peace of mind and flexibility. Smart home devices aim to maximise energy efficiency and minimise waste (Díaz-Sarachaga et al., 2020). Energy-

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efficient appliances, smart lighting systems, and programmable thermostats enable homeowners to reduce their energy consumption and utility bills while maintaining comfort levels. Smart home security systems include advanced features including video surveillance, motion detection, and remote monitoring (Han et al., 2012). These systems improve home security by offering real-time alerts and allowing homeowners to monitor their property from anywhere, deterring potential intruders and providing peace of mind.

2.3.1 Smart Homes Technology Elements

Smart home technology has evolved significantly since its emergence in the late 20th century, with early systems introducing features like programmable thermostats and remote-controlled lighting. The rise of internet and wireless communication technologies in the late 20th and early 21st centuries led to a new era of connectivity, have evolved into seamless communication.

Table 1. Smart Home Elements

Elements	Specifications	Reference
Smart Thermostat	• Energy-efficient heating and cooling management • Improve air conditioning efficiency using learning algorithms and remote control capabilities	Mohamed et al., 2020
Smart lighting system	• Provide adaptable settings, remote control and integration with other smart devices • Addressing the growing demand for energy-efficient and environmentally friendly lighting solution • Features such as dimming, scheduling and colour adjustment improve ambiance while saving energy	Nik et al.,2019
Smart security cameras	• Essential for improving home security in Malaysia • Equipped with motion detection, night vision and cloud storage • These cameras enable remote monitoring and surveillance, providing peace of mind and deterring potential intruders	Ong et al.,2018
Smart sensors	• Pivotal for enhancing convenience, safety and energy efficiency • Primarily serve in environmental monitoring, measuring factors like temperature, humifdity and air quality to maintain optimal indoor conditions • Contribute to security by detecting motion and triggering alerts or security systems in case of potential intrusions	Liew et al,. 2021 Ong et al.,2018
Smart door locks	• Equipped with advanced security features like tamper alarms and auto-locking mechanism • They ensure secure entry management and prevent unauthorised access • Encryption and authentication protocols enhance overall security by securing communication between the lock and users' smartphones	Suhaimi et al.,2019

2.3.2 Evolution of Smart Homes Technology

Smart home technology has evolved significantly since its emergence in the late 20th century, with early systems introducing features such as programmable thermostats and remote-controlled lighting. The rise of internet and wireless communication technologies in the late 20th and early 21st centuries led to a new era of connectivity, allowing for seamless communication between smart devices in the home. Home networking gained popularity in the 1990s, leading to the development of advanced home automation systems that integrated with personal computers. AI and machine learning technologies have been implemented in smart home ecosystems, enhancing automation routines and personalizing user experiences. The integration of Wi-Fi, Bluetooth, and Zigbee protocols has further expanded the capabilities of smart home systems.

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Housing is a fundamental form of shelter which provides essential protection and comfort. Comfortable housing focuses on occupant well-being through thermal comfort, indoor air quality, noise control, and ergonomic design. In modern housing, proper insulation and efficient HVAC systems keep temperatures comfortable in buildings that facilitate human occupancy. It is an essential part of human settlements as it gives its occupants safety, security, and an overall sense of belonging. Single family homes, apartments, townhouses, condominiums, and mobile homes are just a few of the various types of housing that may be found, each of which can accommodate a distinct lifestyle and socioeconomic background.

2.3.3 Benefits of Smart Homes Technology

Smart home technology provides numerous benefits that have a significant impact on daily life, including increased convenience, increased security, improved energy efficiency, and streamlined health management. One of its primary benefits is the convenience and automation it provides, allowing homeowners to seamlessly control various aspects of their homes, such as lighting, heating, and appliances, via unified interfaces such as smartphone apps or voice assistants (Chan et al. 2009).

Smart technology integration improves comfort and living environments through analysing user preferences and creating personalised environments adapted to individual needs, including aspects such as preferred lighting, temperature, and ambiance (Chan et al., 2009). Integration with personal assistants such as Amazon Alexa and Google Assistant streamlines daily activities and improves access to information, increasing convenience and efficiency in tasks.

Furthermore, the integration of smart infrastructure positions homes to better absorb future innovations, effectively future-proofing investments and increasing their long-term viability. In essence, smart home technology provides comprehensive benefits such as improved quality of life, cost savings, and environmental sustainability, making it an appealing and valuable addition to modern living space.

3. METHODOLOGY

This research adopts a quantitative approach as this method is suitable for gathering numerical data that can be statistically analysed to reveal insights into current practices, challenges, and future trends. A structured questionnaire was prepared to collect quantifiable information in order to reveal patterns and relationships of the subject. The quantitative design allows for objective measurement of variables as well as the use of statistical techniques to generate conclusions.

3.1 Sampling

The study included approximately 684 property developers in Kuala Lumpur where random sampling technique was applied. The target sample size was obtained using the Taro Yamane formula, which calculates an appropriate sample size with a 95% confidence level and a 5% margin of error.

$$n \frac{N}{1 + N(e^2)}$$

n = Total Respondent
N = 684 (Population Size)
e = 0.05 (Margin Error)

$$n \frac{684}{1 + 684(e^2)}$$

$$\frac{684}{2.71} = 252$$

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Thus, a target sample size of 252 developers was calculated. However, after accounting for logistical constraints and time constraints, the study determined an initial target of 252 developers for practical reasons.

3.2 Data Collection Procedure

The survey was distributed online via email to ensure that property developers had easy access. Follow-up reminders were purposefully distributed to increase response rates and encourage participation. The TEDUH and REHDA Malaysia databases were used to ensure that the sample was representative, as they provide information on Malaysian developers and housing projects.

3.2.1 Survey Dissemination

A set of questionnaires was designed to capture insights into the smart home technology adoption. It was distributed via email to 252 identified developers. The email contained a detailed introduction, the purpose of the study, and a link to the online survey. Consent letter was also attached to get the respondents agreement to participate in this study where responses were treated as confidential and solely for the purpose of academic study.

3.2.2 Follow-up Procedures

Follow-up calls were conducted to enhance the response rate. These calls served to remind participants about the survey and resolve participant queries. Ultimately, 78 developers responded, showing a response rate of 30.95%. This could be contributed to time and logistical restrictions Although this response rate falls short of the ideal aim, it gives useful information about smart home technology adoption patterns, challenges and perceptions among developers. While higher response rates are generally preferred, a response rate of approximately 30% is often considered acceptable for online or email-based surveys, as it can still provide valid and reliable results if the sample is representative and efforts were made to minimize non-response bias (Baruch & Holtom, 2008).

3.3 Analysis

Data processing was executed via descriptive analysis using SPSS software to evaluate the motivation to adopt smart home technology and to identify the smart home elements preferred to be adopted by the developers. The questionnaire consists of 2 sections (Section A: General Information; Section B: Smart Home Technology Adoption) and was designed as multiple-choice questions. The reliability analysis showed the motivation construct yielded Cronbach's Alpha of 0.78 which indicate an acceptable level of reliability.

4. RESULTS AND DISCUSSION

This section presents the results of a survey on the adoption of smart home technology among property developers in Kuala Lumpur. The analysis is organised around key issues such as company profile, awareness, understanding and motivation of property developer's willingness to adopt the smart home technology, and future adoption trends.

4.1 Company Background

Medium-sized companies (SMEs) dominated the sample, accounting for 55.1% and 41.0% of respondents, respectively. Large companies represented only 3.8% of the responses (Table 2).

Table 2. Company's Profile

Company Size	Frequency	Percentage (%)
Small	43	55.1
Medium	32	41.0
Large	3	3.8

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4.2 Understanding of Smart Home Technology

4.2.1 Future Expectation

The survey indicated that 92.3% of respondents are familiar with smart home technology, while 7.7% responded as not familiar with the concept. This figure demonstrates a strong level of awareness among developers, implying that smart home technology is well recognised in the industry. The significant percentage of respondents who are familiar with this technology shows that the concept is not only prevalent, but will also be considered in future projects for development.

Table 3. Expectations on Smart Home Technology Adoption

Expectations	YES (%)	NO (%)	Currently planning to (%)
Has your company ever incorporated smart home technology into any of your development projects?	48.7	26.9	24.4
Do you think government incentives or regulations would encourage more developers to adopt smart home technologies?	32.1	29.5	38.5
Do you believe smart home technology will become standard in residential developments in the next five years?	74.4	10.3	15.4

Referring to Table 3, the survey indicated that almost half (48.7%) have already incorporated smart home technology while 24.4% plan to incorporate them in future. Generally, they agreed that incentives or regulations by government would encourage more developer to adopt smart home technologies. However, a substantial number of respondents remained unsure. A majority of respondents anticipated that smart home technology will be a standard regulation in residential development. These indicated a positive acceptance by the developers in adopting smart home technologies in future projects.

4.2.2 Smart Home Elements

In this sub-section, the survey intended to provide insights on smart home technologies that developers identify as crucial for building a "smart" living or working environment. This could include automation systems, smart energy solutions, integrated security systems, and others.

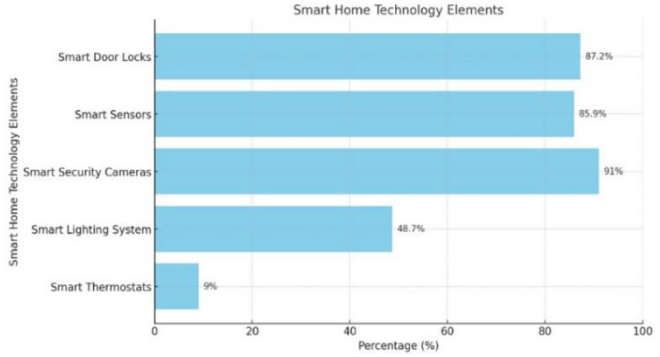

Fig 1. Smart Home Technology Elements

Figure 1 indicates how respondents identified various key elements as smart home technology elements. Smart door locks are the most often known element, identified by 98.7% respondents. This is followed by smart security systems, identified by 92.3%, and smart sensors, chosen by 85.9%. Smart lighting systems were mentioned by 50%, but smart thermostats were the least popular, with just 7.7% choosing them. These findings indicate that security-focused technologies, such as smart door locks and security systems, are seen as the most significant elements of smart homes, owing to their direct impact on safety and convenience.

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This corresponds with the evolution of housing in the era of smart home technology which reflects a move towards more intelligent, connected, and sustainable living environments that focus on occupant comfort, security, and well-being (Zanella et al., 2014).

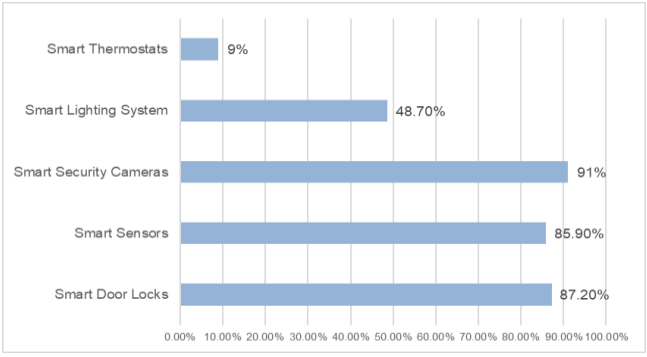

Fig 2. *Smart Home Elements to be Implemented in Future*

Figure 2 shows that smart security cameras, identified by 91%, and smart door locks, chosen by 87.2%, are the most probable smart home technology to be implemented in future projects. Smart sensors were similarly popular, with 85.9% probable implementation. Smart lighting solutions were picked by 48.7%, with smart thermostats chosen by only 9%. These findings indicate a strong preference for security-focused solutions, which is comparable with the priority given in safety aspects. This is as indicated in previous study where smart home security system is seen as providing advanced features such as real-time monitoring and alerts, which improve home security and residents' peace of mind (Chen et al., 2021). Meanwhile, poor interest in smart thermostats could be attributed to regional climate conditions or a lack of perceived value in the local context. In tropical regions like Malaysia, where temperatures remain relatively stable throughout the year, the demand for advanced heating and cooling management systems is limited. Studies have shown that thermostat adoption is strongly influenced by seasonal variation and energy price sensitivity, with higher uptake in temperate climates where households experience significant fluctuations in heating and cooling needs (Karjalainen, 2009; Wilson et al., 2017).

4.1 Motivation to Adopt Smart Home Technology

This section focusses on why property developers choose to adopt smart home technologies. Consumer demand for smarter homes, the potential for higher property value, the desire to remain competitive in the market, and long-term sustainability goals may all motivate developers.

As shown in Figure 3, the most commonly identified benefit of smart home technology in housing development is an enhanced security, which was cited by 79.5% of respondents. This is closely followed by higher home value (76.9%) and better energy efficiency (73.1%). Greater convenience for residents was mentioned by 51.3%, while better marketability to buyers was chosen by 28.2%. These findings indicate that developers perceive smart home technology primarily as functional mechanism for increasing security and property value, with secondary benefits such as energy efficiency and convenience. This correspond with the earlier findings on the elements of smart homes identified by developers and the elements they most likely will adopt in future. However, increased marketability was less emphasized pointed out, imply that, while an acknowledged benefit, it may not be considered as an immediate priority for developers as compared to it being a functional and with financial benefits.

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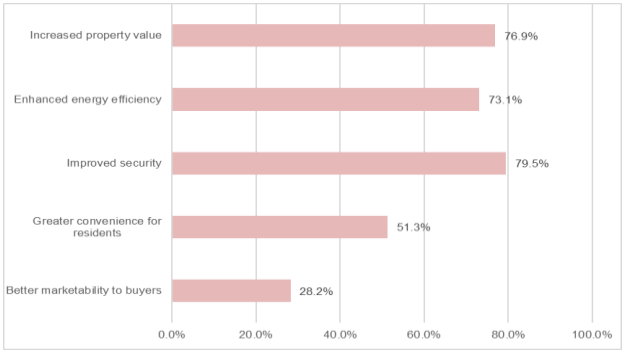

Fig 3. *Benefits in Adoption of Smart Home Technologies*

As shown in Figure 4, the majority of respondents (64.1%) believed security measures such as cameras and smart locks provide the highest value to a residential asset. In comparison, 35.9% said energy efficiency systems, such as smart thermostats, were the most valuable feature. These findings indicate that developers place a greater emphasis on security-related smart home technologies, most likely because they appeal directly to homeowners seeking protection and peace of mind. While energy efficiency solutions are recognised for their worth, they appear to be viewed as a secondary priority when compared to security improvements.

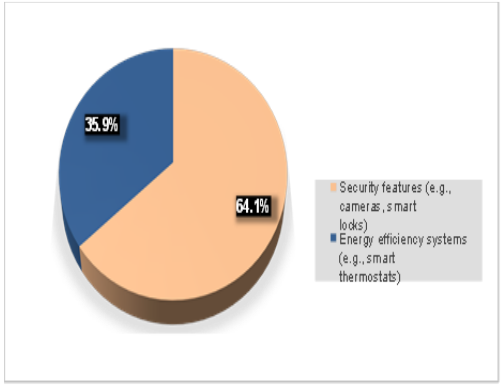

Fig 4. *Value Added Elements*

Figure 5 depicts the motivations to implement technology for smart homes. The most frequently stated motivation was an increased property value, (87.2%). This is closely followed by accommodating to consumer demand (80.8%). Therefore, developers believed that smart homes technology adoption will appeal to the consumer as smart home elements could enhance safety and energy efficiency of the houses. Improving energy efficiency was also cited as an important factor by 44.9% of respondents, while 21.8% were motivated as it will keep them competitive in the market. These findings show that property developers prioritise the financial and consumer-centric benefits of smart home technology, which is consistent with previous research showing that such technologies considerably boost market value and appeal (Chen et al., 2021). Furthermore, the emphasis on energy efficiency represents an increasing trend in real estate towards sustainability, which is being driven by environmental rules and public awareness (Smith, 2020).

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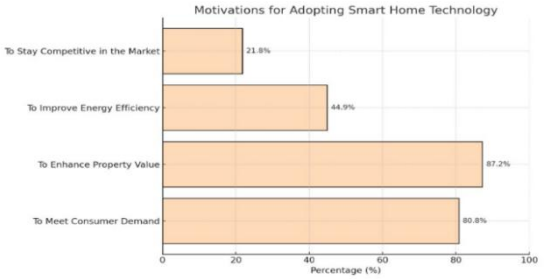

Fig. 5. *Motivation to Adopt Smart Home Technologies*

5. CONCLUSION

The willingness to adopt smart home technology is driven by developers' recognition of the advantages these innovations yield, including enhanced property value, operational efficiency, and alignment with market demands. Familiarity with the concept often forms the foundation for openness to adoption, with most developers indicating a high level of awareness regarding smart home technologies and their potential applications. However, familiarity alone does not translate to adoption; it must be complemented by a clear understanding of motivations and sufficient knowledge to navigate the complexities of integration. Market-driven needs, such as customer demand and competitive differentiation, encourage adoption, alongside operational benefits such as energy efficiency and cost savings. These factors do not only highlight the strategic importance of smart home technology in modern real estate developments, but also the need for developers to align their products with changing consumer preferences.

Developers who consider these technologies as ways to improve their projects' value proposition are more inclined to incorporate them into their projects. Knowledge affects developers' willingness to adopt smart home technology. Those that possess a thorough understanding of the functionality, installation, and maintenance of smart systems are more confident in their capacity to deploy these technologies efficiently. On the other hand, information gaps, particularly in technical issues and economic consequences, can hinder adoption. Bridging these gaps through training programs, industry alliances, and information-sharing initiatives is critical to creating a more technologically prepared development sector which includes initiatives from the government to encourage adoption of smart homes elements through tax relieve, faster approval process and CPD training for developers.

Ultimately, this study concludes that while developers are willing to integrate smart technology, they prioritise features that provide a clear return on investment and are reasonably simple to execute. In summary, developers are generally prepared to adopt smart home technologies that correspond with their business objectives of increasing property value and attracting buyers. However, their readiness is significantly related to cost considerations, ease of execution, and the prospect of long-term advantages. This study is significant as it can inform policy, guide industry practices, and accelerate integration into Malaysia's residential sector. Smart home adoption could eventually create a more sustainable living environment and enhance the well-being of the neighbourhood.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES

This manuscript was developed with the assistance of Microsoft Copilot for the purpose of general writing before it was further proofread and to find information. The tool/service supported the author(s) in structuring sentences, finding information and refining the sentences, and the authors assume full responsibility for the final version submitted for publication.

FUNDING / ACKNOWLEDGEMENT

This research received no external funding. The researchers would like to acknowledge the Universiti Tun Hussein Onn Malaysia for their support and aid in the support of the study.

CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

AUTHORS' CONTRIBUTIONS

Haidaliza Masram conceptualised the central research idea, wrote and revised the article. Nurul Al-Fatihah Kiu Mohamad carried out the research and co-wrote the article. Azlina Md Yassin, Haryati Shafii and Siti Hajar Misnan contributed to the theoretical framework and gives suggestions on the submission.

REFERENCES

Alavi, H. S., & Ahangari, S. (2020). Impact of home energy management systems on energy efficiency in smart homes. *Energy and Buildings*, 224,110271 Retrievedfrom http://dx.doi.org/10.1016/j.apenergy.2021.117310

Aldrich, F. K. (2003). Smart homes: Past, present and future. In R. Harper (Ed.), *Inside the Smart Home* (pp. 17–39). Springer.

Al-Fuqaha, A., Guizani, M., Mohammadi, M., Aledhari, M., & Ayyash, M. (2015). Internet of things: A survey on enabling technologies, protocols, and applications. *IEEE Communications Surveys & Tutorials*, 17(4), 2347-2376.

Atzori, L., Iera, A., & Morabito, G. (2010). The Internet of Things: A survey. *Computer networks*, 54(15), 2787-2805. https://doi.org/10.1016/j.comnet.2010.05.010 (doi.org in Bing)

Balta-Ozkan, N., Davidson, R., Bicket, M., & Whitmarsh, L. (2013). Social barriers to the adoption of smart homes. *Energy Policy*, 63, 363–374. https://doi.org/10.1016/j.enpol.2013.08.043

Baruch, Y., & Holtom, B. C. (2008). Survey response rate levels and trends in organizational research. *Human Relations, 61*(8), 1139–1160. https://doi.org/10.1177/0018726708094863

Borgia, E. (2014). *The Internet of Things vision: Key features, applications and open issues*. Computer Communications, *54*, 1–31. https://doi.org/10.1016/j.comcom.2014.09.008 (doi.org in Bing)

Chan, M., Campo, E., Estève, D., & Fourniols, J. Y. (2009). Smart homes—Current features and future perspectives. *Maturitas, 64*(2), 90–97. https://doi.org/10.1016/j.maturitas.2009.07.014 (doi.org in Bing)

Chen, W., Shang, Y., Cheng, J., & Wang, G. (2021). *A smart home system based on incomplete data. Journal of Ambient Intelligence and Humanized Computing, 12*(3), 3125–3137. https://doi.org/10.1007/s12652-020-02519-2 (doi.org in Bing)

Diaz-Sarachaga, J. M., Jato-Espino, D., & Castro-Fresno, D. (2020). Smart energy and environment system for sustainable development of smart cities and homes. *Journal of Cleaner Production, 276*, 124289. https://doi.org/10.1016/j.jclepro.2020.124289 (doi.org in Bing)

Han, Y., Chen, H., Lei, L., & Chen, W. (2020). Smart Home Automation System Design Based on Internet of Things. *2020 IEEE 4th Information Technology, Networking, Electronic and Automation Control Conference* (ITNEC). https://doi.org/10.1109/ITNEC48600.2020.9172496

Jaafar, M., Ramayah, T., Abdul-Aziz, A. R., & Saad, B. (2017). Technology readiness and UTAUT model in utilising housing technology among Malaysian construction companies. *International Journal of Technology*, 8(5), 855-865. https://doi.org/10.14716/ijtech.v8i5.834 (doi.org in Bing)

Karjalainen, S. (2009). Thermal comfort and use of thermostats in Finnish homes and offices. *Building and Environment*, 44(6), 1237–1245. https://doi.org/10.1016/j.buildenv.2008.09.002 (doi.org in Bing)

Liew, A. W., Ismail, S., & Johar, M. G. M. (2021). Smart sensors for home automation in Malaysia: Current status and future prospects. *Journal of Sensors*, 2021, 1-9. https://doi.org/10.1155/2021/1234567 (doi.org in Bing)

Marikyan, D., Papagiannidis, S., & Alamanos, E. (2019). A systematic review of the smart home literature: A user perspective. *Technological Forecasting and Social Change*, 138, 139-154. https://doi.org/10.1016/j.techfore.2018.08.015 (doi.org in Bing)

Mohamed, A., El-Mekawy, M., Elmogy, A., & Habib, H. (2020). Factors affecting the adoption of smart home technologies: An empirical study in the Egyptian context. *Smart Cities*, 3(1), 77-94. https://doi.org/10.3390/smartcities3010006 (doi.org in Bing)

Mohamed, N., & Rahman, R. (2020). Technological innovations in smart housing: Challenges and opportunities. *Journal of Property Management*, 35(4), 202-219. https://doi.org/10.1108/JPM-01-2020-0001 (doi.org in Bing)

Nik, Z. S., Ahmad, M. N., & Rahim, M. (2019). Exploring the adoption of smart lighting systems in Malaysian homes. *Journal of Light & Visual Environment*, 43(1), 11-18. https://doi.org/10.2150/jlve.43.11?utm_source=copilot.com

Ong, W. L., Rahman, A., & Tan, L. K. (2018). Smart security systems for Malaysian homes: An overview. *IOP Conference Series: Materials Science and Engineering*, 319(1), 012043. https://doi.org/10.1088/1757-899X/319/1/012043 (doi.org in Bing)

Suhaimi, S., Yusof, S., & Ahmad, S. (2019). Smart door locks: Enhancing home security in urban Malaysia. *Journal of Advanced Research in Dynamical and Control Systems*, 11(5), 208-215. □

Wilson, C., Hargreaves, T., & Hauxwell-Baldwin, R. (2017). Benefits and risks of smart home technologies. *Energy Policy*, 103, 72–83. https://doi.org/10.1016/j.enpol.2016.12.047 (doi.org in Bing)

Yang, H., Lee, W., & Lee, H. (2018). IoT smart home adoption: The importance of proper user perception and design. *IEEE Consumer Electronics Magazine*, 7(2), 12-20. https://doi.org/10.1109/MCE.2017.2774739 (doi.org in Bing)

Yusof, N., Abidin, N. Z., Zainal, R., & Ismail, Z. (2020). Adoption of smart home technologies in Malaysia: Drivers and barriers. *Sustainable Cities and Society, 62*, 102394. https://doi.org/10.1016/j.scs.2020.102394 (doi.org in Bing)

Zanella, A., Bui, N., Castellani, A., Vangelista, L., & Zorzi, M. (2014). Internet of Things for smart cities. *IEEE Internet of Things Journal*, 1(1), 22–32. https://doi.org/10.1109/JIOT.2014.2306328 (doi.org in Bing)

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