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WELCOME SPEECH FROM THE CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

بسم الله الرحمن الرحيم السلام

عليكم ورحمة الله وبركاته

Greetings to all,

It is with great pleasure that I welcome you to the 17th RISM International Surveying Conference for Undergraduates (ISCU 2025), themed *"Embracing Construction Revolution 4.0: Transforming Malaysia's Built Environment."* On behalf of the Royal Institution of Surveyors Malaysia (RISM), I also wish to express our sincere appreciation to Universiti Teknologi MARA (UiTM), Perak Campus, for graciously hosting this significant event.

As we navigate the era of the Fourth Industrial Revolution (IR4.0)—or in our context, Construction Revolution 4.0 (CR4.0)—we are witnessing transformative advancements across the global construction sector. Technologies such as Building Information Modelling (BIM), the Internet of Things (IoT), artificial intelligence (AI), robotics, big data analytics, and cloud computing are redefining the way we build, manage, and interact with our built environment. For Malaysia, embracing CR4.0 is a strategic imperative to achieve our socio-economic and environmental goals.

This conference serves as a vital platform to unite surveying undergraduates from various disciplines, fostering critical dialogue on industry challenges, enhancing professional networking, and preparing a new generation of talent for the rapidly evolving construction landscape. It is also an opportunity for employers to engage with and inspire our future professionals.

I would like to extend my heartfelt thanks to all industry speakers, paper presenters, judges, and participants for their time, contributions, and support in making ISCU 2025 a success. I also commend the organising committee for curating a meaningful and dynamic conference experience.

May the knowledge gained, connections formed, and ideas exchanged during this event inspire all participants to lead and innovate in their future endeavours.

Wishing everyone a productive and memorable conference.

Prof. Ts Sr Dr. Adi Irfan Bin Che Ani'
Chairman, Universities' Partnering Committee
RISM Session 2024/2025
May 2025

WELCOME SPEECH FROM CO-CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

Bismillahirrahmanirrahim.

السلام عليكم ورحمة الله وبركاته and greetings to all.

It is my great pleasure to welcome everyone to the 17th International Surveyor Conference for Undergraduates (ISCU 2025), proudly hosted by Universiti Teknologi MARA (UiTM) Perak Branch in collaboration with the Royal Institution of Surveyors Malaysia (RISM). This event is a meaningful platform for students in the built environment to share ideas, showcase innovations, and build professional networks. We are honoured by your presence and enthusiastic participation, with 135 accepted papers and 78 poster presentations this year.

UiTM Perak, home to the College of Built Environment, has long been a hub for academic excellence in architecture, planning, and surveying. Our commitment remains strong in nurturing competent graduates who meet industry demands and contribute to nation-building.

While you're here, we invite you to experience the heritage and culture of Perak Tengah from the architectural richness of Rumah Kutai to the historical towns of Pasir Salak, Bota, and Kampung Gajah.

To all presenters and winners, congratulations on your achievements. Let your work today be a catalyst for future success and academic growth. We hope this conference will inspire you to explore new ideas, foster collaboration, and make lasting memories.

My deepest thanks to the Royal Institution of Surveyors Malaysia (RISM) and the organising committee for making this event a success.

We hope your experience here will be rewarding and unforgettable.

Thank you. Selamat datang dan selamat berjaya.

Associates Professor Dr. Nur Hisham Ibrahim, *PMP*
Co-Chairman, Universities' Partnering Committee
RISM Session 2024/2025
May 2025

WELCOME SPEECH FROM THE PROJECT DIRECTOR

RISM 17th International Surveying Conference for Undergraduates 2025

Alhamdulillah, all praise to Allah S.W.T. for His guidance and blessings in making the RISM 17th International Surveying Conference for Undergraduates (ISCU) 2025 a reality.

It is with great honour and gratitude that I welcome all participants, guests, academicians, and industry professionals to this prestigious event, proudly organized under the Royal Institution of Surveyors Malaysia (RISM). This 17th edition of ISCU stands as a proud testament to our collective dedication toward academic excellence, professional collaboration, and youth empowerment in the field of surveying.

I extend my heartfelt appreciation to RISM for its unwavering support, to the hardworking ISCU 2025 Organising Committee, and to all 16 partnering universities across Malaysia for their commitment and contributions. Your efforts have shaped this conference into a dynamic platform for knowledge exchange, innovation, and professional growth.

To the academicians and practitioners present, your insights are invaluable in bridging the gap between academic theory and real-world practice. To our undergraduate participants, your passion, curiosity, and commitment are the very foundation of our future. May this conference not only deepen your academic journey but also ignite a spirit of leadership, integrity, and sustainable thinking.

Let this gathering serve as more than an academic milestone. May it foster lifelong networks, inspire transformative ideas, and chart new directions in our shared professional journey.

Wishing everyone a rewarding and inspiring conference experience.

Sr Dr. Nurul Fadzila Zahari
Project Director
RISM 17th ISCU 2025

CHALLENGES IN GREEN RETROFIT METHODS FOR SUSTAINABLE BUILDING TRANSFORMATION

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ABSTRACT

Green retrofit (GR) is recognised as a pivotal strategy for reducing carbon emissions and enhancing energy efficiency. GR intended to transform or improve the function from the old or existing building into a green building aims to achieve building sustainability and carbon free. Many appropriate methods of green retrofit can be applied to existing buildings from the elements of design or technology such as energy-efficient equipment, insulation and etc. However, there are a few issues related to the utilisation of the GR method, such as the inattentiveness of construction participants in approaching various methods of GR, constraints that limit the implementation of a GR, and a lack of strategies for implementing GR. Therefore, this research aims to determine the challenges of the green retrofit implementation in transforming existing buildings into green buildings. The quantitative approach was adopted using questionnaire surveys to 218 construction professionals in Perak, Malaysia, involving architects, engineers, quantity surveyors, and contractors registered with CIDB (G6-G7). Random sampling method was used where only 103 feedback were returned. The data collected was then analysed using SPSS version 30 quantitative software. The findings reveal that most of the respondents agreed on the challenges to implement GR methods in building sustainable transformation. There are several challenges agreed by the respondents, such as insufficient funds, high capital, lack of incentives to apply retrofit, the behaviour of people around, and lack of awareness of the method used and sustainability concept, which hinder the widespread adoption of GR practices. Findings generated have proven that the research objective for this research have been met. The outcome contributes to the growing body of knowledge on sustainable construction practices and offers strategic recommendations for advancing GR in Malaysia.

Keywords: Challenges, Existing Building, Green Retrofit Method, Sustainability, Transformation

I. INTRODUCTION

According to the Cambridge Dictionary (2024), sustainability means causing or making in a way that causes little or no damage to the environment and, therefore, can continue for a long time, which applies to building for the construction industry. It is controlled in terms of carbon production and energy consumption, which creates a thermal situation that can be seen in China (Li, Zhang, Zhang, & Wu, 2021). The sustainable concept focuses on the construction sector, where it will not pollute the environment and maintain the environment and the building itself. As reported by Chin, Terh, and Zheng Yik Koo (2023), currently, the sustainable concept in Malaysia is still in progress. Yang, Sun, Dai, and Zhu (2023)also mention the production of carbon dioxide (CO2) can affect the environment and climate, like how China's construction industry has become one of the major producers of CO2. They produced 40% of CO2 from the construction, which is not sustainable. That is how green retrofitting can target energy saving and achieve the sustainable development goals created by the United Nations (UN) (Liu, Ma, & Wang, 2022).

Moreover, the transformation or improvement of function from the old or existing building into a green building can increase the success of sustainable and carbon-free. In some cases, the total function of the old building changed, like the Nifayyi Warung Theater located in Ipoh, Perak, which went from an abandoned theatre into a restaurant that tackles the issue of the unused buildings that produce carbon into the environment. The green elements adapted to this new function of the building are ventilation, natural lighting, and energy-efficient electric equipment. The change of building used increases the function of the building and sustains the building, which is related to the sustainable concept mentioned before (Chin Yee Ha et al., 2023). Other than that, the improvement

in the structure of the building, such as the superstructure, improves the material and technology and turned it into a green roof that operates more efficiently and brings new improvement to the existing structure (Miletić, Zeković, Ignjatović, & Ignjatović, 2023). The other building that is going through a transformation is the Kuala Lumpur Performing Arts Centre, which used to be a private theatre but has now changed into an art centre. Another example is a retrofit lighting system at Melaka Hospital in 2018 which saw a transformation of the old lighting system into LED lighting. It shows all these projects overcome the current issues of carbon produced by the existing buildings that have been given attention globally to achieve zero carbon in construction.

The term retrofits itself are very unfamiliar to Malaysians, and that includes the construction industry's practitioners. Various research has been done regarding the challenges in green retrofit implementation that happen around the world, and the data findings are almost similar to the challenges of green retrofit implementation. The main challenges will be in terms of lack of awareness (e.g. weak in government role), finance or funds (e.g. high capital, lack of incentives from the government, expensive cost of items), skilled consultants or experts (e.g. low knowledge, low education level) which mainly will have a higher percentage of feedback from the research that has been conducted (Alabid, Bennadji, & Seddiki, 2022; Alam, Zou, Stewart, Bertone, Sahin, Buntine, & Marshall, 2019; Amoah and Smith, 2022; Jagarajan, Abdullah Mohd Asmoni, Mohammed, Jaafar, Lee Yim Mei, & Baba, 2017; G. Liu et al., 2020). These challenges make contractors, clients, or anyone in the construction industry reluctant to use green retrofit. The difficulty of practising new methods to increase the quality of construction makes it hard to grow, which happens to be green retrofit. Thus, this research aims to determine the challenges of green retrofit implementation in transforming existing buildings into green buildings.

II. LITERATURE REVIEW

Table 1 presents the challenges faced in implementing green retrofits and transforming existing buildings into green buildings with support from various authors. From the table, the frequent variables debated among the previous authors are lack of awareness of the method use and sustainability and lack of skilled experts to execute the green retrofit projects. However, risky investment for clients is among the variables that have been less discussed among previous researchers.

Table 1 Challenges of The GR Implementation in Transforming Existing Buildings into Green Buildings.

No	Variables	Authors	Frequency
1	Insufficient of funding	Morshed (2019), Huo (2023), Periyannan (2023), Dowson (2012), Monteiro (2017), Bergman (2020), Alabid (2022)	7
2	Lack of education	Monteiro (2017), Yaduvanshi (2023), Liu (2020)	3
3	Lack of awareness on the method use and sustainable	Alam (2019), Amoah (2023), Huo (2023), Caputo (2015), Alabid (2022), Fasna (2019), An (2023), Liu (2020)	8
4	Behaviour of the people's around	Huo (2023), Monteiro (2017), Yaduvanshi (2023), Liu (2020)	4
5	Lack of incentives to apply retrofit	Amoah (2022), Periyannan (2023), Bergman (2020), Fasna (2023), An (2023)	5
6	Risky investment for client	Welch (2023), Bergman (2020)	2
7	Lack of government support	Alam (2019), Huo (2023), Bergman (2020), An (2023), Liu (2020)	5
8	Lack of knowledge	Welch (2023), Amoah (2022), Periyannan (2023), Monteiro (2017), Yaduvanshi (2023), Fasna (2019)	6
9	Lack of skilled expert	Alam (2019), Amoah (2022), Caputo (2015), Dowson (2012), Bergman (2020), Alabid (2022), Yaduvanshi (2023), Fasna (2019)	8
10	High capital	Welch (2023), Amoah (2022), Periyannan (2023), Bergman (2020), Alabid (2022)	5
11	Lack of regulation and policies	Welch (2023), Periyannan (2023), Bergman (2020), Alabid (2022)	4

A. Insufficient Funding

Insufficient funds is one of the issues that keep on being the most talked about topic whenever there is new action being applied or new technologies being produced. According to Alam et al. (2019), a lack of funds indicates the inability of the owner to initiate the programs. Moreover, it also indicates how the other parties involved, which are like the government, should help the owner or any developer that wants to try green retrofit to practice in the construction industry. Undoubtedly, a fund is something that needs to be required, once the fund is required, the green retrofit methods can proceed. In this modern world, the presence of funds is very critical and necessary for the improvement of technology in the construction industry. Lack of funds is an issue that needs to be seen as seriously as possible. This is supported by Huo et al. (2023), which shows the situation in China, where the people demand the government to give funds to them to practice green retrofit methods.

B. Lack of Education

Monteiro et al. (2017) mention that a lack of education or inflammation can create a chain effect on all the parties involved in the construction industry as they do not have enough knowledge regarding the methods that are trying to be applied, which is the green retrofits method. The kind of information they require, like examples, the frameworks, the materials, the process, available technology, the maintenance of structure, and so on. Without education about this greener trophy method, people will not know whether this method is good for us, whether it will benefit us, or whether it is going to cause a loss of money to the people. Yaduvanshi and Park (2023) and Liu et al. (2020) state that training and educating people about green retrofit methods, including those in the construction industry, will enhance knowledge, improve education levels, and shift mindsets. This, in turn, helps achieve the main goal of green retrofitting: improving environmental quality and increasing building efficiency.

C. Lack of Awareness of The Method Use and Sustainable Concept

Energy efficiency is a critical issue, yet there is a concerning lack of awareness about green retrofitting methods and sustainable practices (Caputo & Pasetti, 2015; Huo et al., 2023; Amoah et al., 2022). Although green retrofits and energy efficiency are closely linked, public engagement and understanding remain low, posing a major barrier to implementation. Alabid et al. (2022) and Huo et al. (2023) highlight that insufficient awareness among builders and the public prevents effective energy management and carbon emission reduction. Fasna and Gunatilake (2019) advocate targeted educational initiatives to enhance awareness, emphasizing the necessity of structured programs to promote sustainable building practices.

D. Behavior of the People's Around

The effect of people's behaviour can greatly affect the consequences of their actions towards new movements, such as green retrofit methods that might be new to some places. Green buildings are growing rapidly in China, but environmentally unfriendly behavior remains a challenge for green retrofitting (Liu et al., 2020; Huo et al., 2023). Their people's behaviour significantly impacts the nation, and government decisions, including green initiatives, aim to enhance their quality of life. But, as mentioned by Yaduvanshi and Park, 2023; Monteiro et al., 2017), conflict happens in the community of the person's behaviour, causing trust to be lacking, and no further advice can be given. They tend to stay the same as how they used to, without being able to work together.

E. Lack of Incentives to Apply Retrofit

In increasing the number of participants and applications of methods required by the government, incentives must be provided to the applicants to help them start the project. However, research shows that inadequate builder incentives discourage construction practitioners, as subsidies fail to cover costs (Amoah & Smith, 2022; Periyannan et al., 2023; An et al., 2023; Fasna et al., 2019). Incentives and subsidies support builders in starting green retrofitting, improving existing buildings by upgrading their use or function. Bergman and Foxon (2020) highlight that incentives drive innovation, but creating them is complex due to investment, costs, and financial cycles.

F. Risky Investment for Client

Making an investment that focuses on a green world, carbon-free, and low energy can be a risky investment in the opinion of some owners as the material and technology are new, with lots of rumours on how the material is weak, and the technology has low resilience compared to the old school methods (Bergman & Foxon, 2020). The client or also the owner of the building definitely will not take any risky steps that can make them lose money, building, and value of the assets. Once changes are made, the value will change, and if the changes are made in poor condition, the owner will lose capital. This is supported by Welch et al. (2023), who say how risky it is in the passive house design can affect the radon level. At the same time, the investment made to go for the passive house becomes a loss to the client. That is why it become one of the challenges to implement green retrofits, as it is too risky.

G. Lack of government support

The construction industry is always working closely with the government, and it need to play its role. But the complete opposite is happening, where the government lack to drive the methods into practice and establish policies for these methods (Bergman et al., 2020; An et al., 2023). It is to promote sustainability that aims to

change the construction industry into a better industry that will not cause harm to the environment (Alam et al., 2019). Without the government's strong action, it will be impossible to start the regular application of green retrofit methods in Malaysia as the managing body of Malaysia did not emphasise the action towards sustainability. The government should be the one that initiates the action, pushing the construction industry to go green. Liu et al., 2020; Huo et al., (2023) also mentioned that the policies created by the government can be a stepping stone to encourage green retrofit methods. The policies can be under financial, economy, energy, or many more that are suitable.

H. Lack of Knowledge

Advancement in knowledge can create a barrier to understand the concept of green retrofits that might be difficult for the common person who is not familiar with the terminology. Lack of knowledge about green retrofits is a lack in the person, and as time goes by, the latest information and the lack gap become bigger and bigger (Welch et al., 2023; Amoah et al., 2022; Periyannan et al., 2023; Monteiro et al., 2017). This type of lack creates a gap in terms of understanding and mindset, which causes hurdles for green retrofits to be able to enter the community easily. This is supported by Yaduvanshi et al., 2023; Fasna et al.,2019), that the public knowledge regarding the methods and the environment will create a great opportunity for sustainability to stand strong in the country, like how they will start demanding energy-efficient items, a high-quality environment, and fully utilise the existing buildings already in Malaysia.

I. Lack of Skilled Expert

Caputo and Pasetti (2015) stated that one of the challenges that can be faced is the lack of skilled experts that hinder the action to exploit the skills and manpower of the locals. Like the green retrofit methods are currently discussed, without experts who know what retrofits is and how it works, it is hard to apply this method in the construction industry. The outcome will be disappointing, and the standard of quality will be up to standard (Alam et al., 2019; Alabid et al., 2022). Dowson et al. (2012) also stated the need for an appropriate skill suitable to the situation to ensure the smoothness and quality of the outcome. A skilled expert can help achieve the construction standard that lowers the risk of accidents or low-quality issues commonly happening in the construction industry (Amoah et al., 2022; Bergman et al., 2020). Construction is complex and cannot be seen as light matter as all the actions or methods introduced shall have proper guidance and the person in charge.

J. High Capital

The initial capital must be sufficient to proceed with green retrofits, as these projects differ from new constructions. A high capital requirement without a firm commitment can lead to significant challenges, potentially resulting in project abandonment (Periyannan et al., 2023). This was the case in Sri Lanka, where a hotel project intended for green retrofitting had to reassess its capital requirements. Implementing major retrofits to enhance building functionality and efficiency demands substantial investment. Alabid et al. (2022) and Amoah et al. (2022) highlight that while capital costs are high, they lead to long-term energy savings. However, this upfront expenditure poses a significant barrier, delaying returns on investment (ROI) (Welch et al., 2023; Bergman et al., 2020). Spending extra costs to get a return after a while is indeed an investment, but not everyone can have sufficient capital to initiate this project.

K. Lack of Regulation and Policies

Government policies and regulations play a crucial role in ensuring long-term sustainability, particularly in promoting green retrofits (Bergman & Foxon, 2020; Periyannan et al., 2023; Monteiro et al., 2017). Effective policies enhance credibility and user confidence, creating a foundation for successful implementation. Without clear regulations, achieving sustainability through retrofits becomes challenging. Welch et al. (2023) highlight that while organizations like PHI and Phius establish their own retrofit guidelines, overlapping criteria limit their broad applicability. To be effective, regulations must be transparent, providing clear guidance for construction professionals to meet sustainability standards.

III. METHODOLOGY

This research employs a quantitative approach to systematically examine the challenges faced by construction professionals in building retrofitting projects. A random sampling method was used to ensure an unbiased representation of industry experts. A structured questionnaire was designed and distributed electronically via Email, WhatsApp, Facebook, and Telegram, reaching 103 respondents, including architects, engineers, quantity

surveyors, and G6 and G7 contractors in Perak, Malaysia who have experience in building retrofitting projects. The primary objective was to identify key challenges in the implementation of green retrofits for transforming existing buildings into sustainable buildings. The questionnaire consisted of both descriptive and analytical survey questions to capture relevant insights. To ensure data accuracy and reliability, responses were analysed using SPSS software (version 30), allowing for a statistical evaluation of findings. This methodological approach ensures that the study's conclusions are well-supported by empirical evidence, contributing valuable knowledge to the field of green building retrofits.

IV. ANALYSIS AND FINDINGS

In this research, there are 218 questionnaires distributed to architects, engineers, quantity surveyors, and contractors G6 and G7 in Perak, Malaysia that involved in the construction industry especially in building retrofitting projects, however only 103 respondents returned the questionnaire. Thus, the respondents' rate for the survey was deemed acceptable, which is 47.24% (103). The data obtained from the survey was valid and sufficient. According to Watt et al. (2002), up to 33% is the average response rate is achievable for online survey.

A. Reliability Analysis

A reliability test was conducted with 47 respondents to ensure consistent results. Cronbach's Alpha scored 0.921 across 31 questions, exceeding the acceptable threshold of 0.77. Based on Kottner and Streiner (2010), a score of 0.77 can be considered acceptable. The higher the score, the more reliable the generated scale is. Hence, this reliability provided confidence to continue with the analysis. Thus, the researcher can proceed to analyse the data and produce the findings.

B. Analysis on challenges of the green retrofit implementation for transforming existing buildings into green buildings

Referring to Table 2, there were eleven (11) variables that have been determined on the challenges of the green retrofit implementation for transforming existing buildings into green buildings.

Table 2 Mean and standard deviation for challenges of the green retrofit implementation for transforming existing buildings into green buildings (n=103)

Section C	Challenges	Mean	Standard Deviation	Rank
1	Insufficient funding	4.18	0.711	1
2	Lack of education	3.87	0.925	11
3	Lack of awareness of the method and sustainable concept	4.05	0.845	5
4	Behaviour of the people's around	4.08	0.723	4
5	Lack of incentives to apply for retrofit	4.13	0.723	3
6	Risky investment for client	3.98	0.840	6
7	Lack of government support	3.96	0.816	7
8	Lack of knowledge	3.91	0.909	10
9	Lack of skilled expert	3.91	0.864	9
10	High capital	4.15	0.733	2
11	Lack of regulations and policies	3.95	0.833	8
	Average Mean	**4.02**		

The average mean is 4.02, which indicates the respondent's agreement with the questions. The result showed that most of the respondents agreed with all challenges of the green retrofit implementation for transforming existing buildings into green buildings. The lowest mean score is 3.87, and the highest mean score is 4.18. The range is still in the agreement statement from the respondents. The standard deviation is used for ranking the variables according to the level of agreement for the variables, especially for variables that have the same mean score. As shown before, the same way of determining ranking would also be used in this data set. The gap between the lowest and the highest is not too far from which indicates the competition between the variables.

The highest mean score is ***insufficient funding*** as the main challenge, with a mean score of 4.18. Most of the respondents agree that this is a challenge for green retrofit implementation for transforming existing buildings into green buildings. Funding or finances always become the main issue in implementing new methods. It is supported by research that mentions how limited funding keeps the implementation on hold, and the government wants the private sector to cover the funding (Bergman & Foxon, 2020). Both sides need to work together to overcome this challenge, and as Alabid et al. (2022) stated, the Scottish government give funds to the people and makes changes to the industry. Thus, project funding is very important before starting a project. Insufficient funds

can be a major challenge to implementing green retrofits in transforming existing buildings into green buildings. Creating proper funding can encounter the issue of insufficient monetary.

The second highest mean score is ***high capital***. The mean score is 4.15, which is not too far from the first challenge. This shows the level of agreement from the respondents with high capital as the challenges of the green retrofit implementation for transforming existing buildings into green buildings. It has been discussed by Periyannan et al. (2023), who said high capital needs commitment and lack of both might lead to bigger issues such as abandonment as the project failed to continue. Welch et al. (2023) also mentioned retrofit projects are unable to be feasible or be in the market as the capital limiting the projection. Capital plays an important role in ensuring the project can be conducted successfully without problems. This analysis of data based on responses shows that high capital is a challenge for implementing green retrofit. Unable to provide project funding makes it impossible for any construction practitioner to apply green retrofit methods.

Moreover, the next challenge is the ***lack of incentives to apply retrofit***. The mean score is 4.13, which portrays the agreement of respondents on this question related to the challenges of green retrofit implementation for transforming existing buildings into green buildings. Bergman and Foxon (2020) explained how incentives play crucial roles by igniting innovations like green retrofit methods that need investment and money to proceed. In addition, Amoah and Smith (2022) also stated that when there is a lack of incentives, construction practitioners are uninterested in applying this method to existing buildings. It clearly shows how incentives can affect the action that one would like to be taken. Any action, method or new requirement needs full coverage, especially in terms of cost. Providing incentives can increase the participation of contractors in green retrofit, but a lack of incentives will turn it into a challenge to implement green retrofit to transform existing buildings into green buildings.

The fourth challenge in the top five is ***the behaviour of the people around***, with a mean score of 4.08, which is still at the level of agreement for the questions related to the challenges of green retrofit implementation for transforming existing buildings into green buildings. Behaviour of the people can create issues as the nature of living is in a community. The people need to understand the concept of sustainable, green buildings and zero carbon to be able to work together. However, as mentioned by the researchers in China, when people do not understand the concept, they are unable to implement the green retrofit into action (Liu et al., 2020). Thus, the behaviour of people cannot be taken lightly as it can greatly implicate the implementation of green retrofit in transforming existing buildings into green buildings. To make a movement successful, a full working team is needed. The same goes with the community; if the positive energy is spread among the team and community, it will not create issues related to behaviour.

Lastly, another top five with a mean score of 4.05 is a ***lack of awareness of the method and sustainability concept***. Respondents believe that lack of awareness of green retrofit methods is one of the challenges to implementing the methods for transforming existing buildings into green buildings. In addition, An et al. (2023) stated that lack of awareness could be one of the major challenges to implementing the green retrofit methods into changing existing buildings to green buildings. Plus, there is a situation in Italy where a lack of awareness of green retrofit is a barrier to improving energy issues (Alam et al., 2019). Consequently, as there is lacking in the awareness, current issues like sustainability and energy efficiency cannot be resolved. It will be challenged to implement green retrofit for transforming existing buildings into green buildings. Any movement towards sustainable, green buildings and energy efficiency is difficult to start.

The other variables following the rank are ***a risky investment for the client*** *(3.98),* ***lack of government support*** *(3.96),* ***lack of regulation and policies*** (3.95), ***lack of skilled expert*** *(3.91),* ***lack of knowledge*** *(3.91)* ***and lack of education*** (3.87). These variables rank between six (6) and eleven (11) based on the responses by the respondents. But, overall, of the result, the respondents agree with the variables. In Chapter 2, there are contradictions between the highest variables mentioned in previous research, which are lack of awareness of the method and sustainable concept and lack of skilled experts, compared to the current result data findings, which show insufficient funding has a high level of agreement by the respondents.

CONCLUSION

This study sheds light on the key challenges of implementing green retrofits in existing buildings. Through a comprehensive literature review, critical obstacles were identified, forming the foundation for a targeted questionnaire. The findings, reinforced by previous research and practitioner insights, confirm the complexities of green retrofit adoption. Thus, it can be concluded that, addressing these challenges is essential to accelerating sustainable transformation in the built environment. Future research should expand its scope, exploring the differing perspectives of clients and contractors to uncover deeper constraints and drive more effective solutions in order to overcome these challenges.

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REFERENCES

Alabid, J., Bennadji, A., & Seddiki, M. (2022). A review on the energy retrofit policies and improvements of the UK existing buildings, challenges and benefits. In *Renewable and Sustainable Energy Reviews* (Vol. 159).

Alam, M., Zou, P. X. W., Stewart, R. A., Bertone, E., Sahin, O., Buntine, C., & Marshall, C. (2019). Government championed strategies to overcome the barriers to public building energy efficiency retrofit projects. Sustainable Cities and Society, 44, 56–69.

Amoah, C., & Smith, J. (2022). Barriers to the green retrofitting of existing residential buildings. Journal of Facilities Management.

An, J., Jung, D., Jeong, K., Ji, C., Hong, T., Lee, J., Kapp, S., & Choi, J. (2023). Energy-environmental-economic assessment of green retrofit policy to achieve 2050 carbon-neutrality in South Korea: Focused on residential buildings. Energy and Buildings, 289.

Bergman, N., & Foxon, T. J. (2020). Reframing policy for the energy efficiency challenge: Insights from housing retrofits in the United Kingdom. Energy Research and Social Science, 63.

Caputo, P., & Pasetti, G. (2015). Overcoming the inertia of building energy retrofit at municipal level: The Italian challenge. Sustainable Cities and Society, 15, 120–134.

Chin Yee Ha, Terh Jing Khoo, & Zheng Yik Koo. (2023). Current status of green building development in Malaysia. Progress in Energy and Environment, 25(1), 1–9.

Dowson, M., Poole, A., Harrison, D., & Susman, G. (2012). Domestic UK retrofit challenge: Barriers, incentives and current performance leading into the Green Deal. Energy Policy, 50, 294–305.

Ejidike, C. C., Mewomo, M. C., Agbajor, F. D., & Olawumi, T. O. (2022). Drivers for building retrofitting practice: A systematic review. In Building Smart, Resilient and Sustainable Infrastructure in Developing Countries (pp. 265–272). CRC Press.

Fasna, M. F. F., & Gunatilake, S. (2019). The effective outsourcing of building retrofitting: key decisions and motivators. Journal of Facilities Management, 17(4), 371–384.

Jagarajan, R., Abdullah Mohd Asmoni, M. N., Mohammed, A. H., Jaafar, M. N., Lee Yim Mei, J., & Baba, M. (2017). Green retrofitting – A review of current status, implementations and challenges. In Renewable and Sustainable Energy Reviews (Vol. 67, pp. 1360–1368).

Li, Q., Zhang, L., Zhang, L., & Wu, X. (2021). Optimizing energy efficiency and thermal comfort in building green retrofit. Energy, 237.

Liu, G., Li, X., Tan, Y., & Zhang, G. (2020). Building green retrofit in China: Policies, barriers and recommendations. Energy Policy, 139.

Liu, T., Ma, G., & Wang, D. (2022). Pathways to successful building green retrofit projects: Causality analysis of factors affecting decision making. Energy and Buildings, 276.

Miletić, N., Zeković, B., Ignjatović, N. Ć., & Ignjatović, D. (2023). Challenges and Potentials of Green Roof Retrofit: A Case Study. In Urban Book Series: Vol. Part F813 (pp. 843–852). Springer Science and Business Media Deutschland GmbH.

Periyannan, E., Ramachandra, T., & Geekiyanage, D. (2023). Assessment of costs and benefits of green retrofit technologies: Case study of hotel buildings in Sri Lanka. Journal of Building Engineering, 78.

Tan, Y., Luo, T., Xue, X., Shen, G. Q., Zhang, G., & Hou, L. (2021). An empirical study of green retrofit technologies and policies for aged residential buildings in Hong Kong. Journal of Building Engineering, 39.

Welch, S., Obonyo, E., & Memari, A. M. (2023). A review of the previous and current challenges of passive house retrofits. In Building and Environment (Vol. 245).

Yaduvanshi, N. S., & Park, J. Y. (2023). Citizen building scientist? The opportunity and challenge of citizen involvement in building retrofits. Journal of Building Engineering, 78.

Yang, Y., Sun, R., Dai, J., & Zhu, M. (2023). Evolutionary analysis of stakeholder behavior in green retrofitting of traditional residential buildings based on dissemination and game models. PLOS ONE, 18(3), e0282314.

Zhang, F., Lu, Y., Wang, Y., Jiang, Z., Liu, J., & Chen, J. (2023). Study on dust pollution law and chemical dust suppression technology of non-hard pavement in urban construction sites. Building and Environment, 229.

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