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MAXIMISING THE ECONOMIC BENEFITS OF GREEN RETROFITTING OF EXISTING BUILDINGS IN MALAYSIA

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ABSTRACT

Through implementing sustainable construction, Malaysia has progressively contributed to tackling climate change. However, the focus on new green buildings tends to overlook the environmental impacts of existing buildings. Recognising green retrofitting as a means to achieve sustainability, this research aims to maximise economic benefits such as capital appreciation, higher rental revenue, and improved cost-saving elements from green retrofitting existing buildings, thereby reducing the need for new construction.The objectives are to identify the process of green retrofitting existing buildings, determine the factors influencing economic benefits, and formulate ways to maximise these benefits in the Malaysian context. A qualitative approach was employed for data collection. A literature review was conducted to better understand the topic, and the issues identified formed the basis of the interview questions. Semi-structured interviews with five (5) practitioners involved in green retrofitting projects in Malaysia were carried out to gather insights. Content analysis was used to interpret the data.The study proposes seven (7) stages for green retrofitting: project proposal, project initiation, building assessment, identifying and choosing retrofit options, tendering, site implementation, and validation and verification. Ten (10) factors influencing economic benefits were identified, including market value, building age and lifetime, envelope performance, occupant behaviour, technology, project management, external support, client resources, expectations, and public awareness. Additionally, four (4) key strategies are recommended to guide consultants in maximising economic benefits: adherence to green rating systems, post-retrofitting maintenance, government initiatives, and engagement with building owners.This research supports the effective implementation of green retrofitting in Malaysia, helping consultants deliver retrofit measures that optimise economic outcomes and inform client decision-making.

Keywords: Economic benefits, existing buildings, green retrofitting, sustainability.

1.0 INTRODUCTION

Recognising the importance of environmental sustainability, sustainable construction has gained greater attention in Malaysia. Green buildings are an environmentally friendly construction. It is a significant part of the country's economic development. However, despite the awareness of reducing construction impacts by adopting sustainability and green concepts, it is concerning that new developments are prioritised, neglecting the presence of existing buildings in Malaysia (Che Husin et al., 2019; Jagaragan et al., 2017). Existing buildings account for 30 percent of total energy use (Leung, 2018). Consequently, total energy consumption is anticipated to rise with the need for new development. While greening initiatives for an existing building are comparatively low in Malaysia (Yu et al., 2011), retrofitting existing buildings is a way to achieve green development goals. Green retrofitting is the process of adapting sustainable solutions, whether wholly or partially, such as integrating appropriate new technologies or green features to existing buildings that were not implemented or installed during the previous construction process to achieve sustainability.

Despite the notable advantages of retrofitting compared to demolition and reconstruction, retrofitting methods and implementation are not extensively employed in Malaysia (Che Husin et al., 2019). While the government encourages greening more existing buildings and has taken various initiatives, not all decision-makers take the extra steps to reap the benefits of green retrofitting. That being the case, green retrofitting existing buildings is only feasible if demanded by tenants, investors, and building owners because, after all, the decision to adopt such practices lies in their hands. Nevertheless, previous research on green retrofitting existing buildings in Malaysia focused primarily on the introduction and implementation, challenges and barriers, factors to retrofit and the study of potential retrofits in selected buildings. Therefore, the retrofit strategy’s numerous environmental, social, and economic benefits must be considered to fulfil energy-saving targets and create a high-quality living environment.

Research by Zainul Abidin (2010) found that the economic benefit of green retrofitting existing buildings still needs to be fully understood relative to environmental and social benefits. Besides, because profits drive them and only focus on gaining more investment returns, they are less likely to implement retrofitting (Zainul Abidin, 2010; Gou, Lau & Prasad, 2013; Che Husin et al., 2019). To fill such a gap, this research is intended to gain insight into the dynamics of green retrofitting of existing building investments in Malaysia. This research focuses on maximising the economic benefits of green retrofitting in the Malaysian context to assist green consultants in recommending appropriate retrofit measures and influencing the client's decision-making process to green retrofit. Ultimately, it will provide evidence for obtaining a higher investment return from green retrofitting existing buildings while mitigating the consequences of new building construction and achieving sustainability. The study will also endorse the global agenda to achieve Goal 7 of the Sustainable Development Goals (SDGs) and the government's initiative to focus on environmental sustainability in the Construction Industry Transformation Plan (CITP).

2.0 LITERATURE REVIEW

Malaysia's pace of growth in the built environment is rapid, with environmental, social, and economic implications as it seeks to become a developed country by 2050 (Che Husin et al., 2019). The number of existing building stocks in Malaysia outnumbered the number of green buildings, totalling 41,747,608 (National Property Information Centre, 2017). Also, green buildings are primarily new builds instead of being retrofitted (Hong, Ibrahim & Loo, 2019: Jagaragan et al., 2017). So, even when each new building uses net-zero energy technology, the effect on the overall energy used for the existing building will take decades to be felt (Ab. Azis, Sipan & Sapri, 2013). Che Husin et al. (2019) also argued that green retrofits are not commonly applied and practised in Malaysia.

Thus, the vast volume of GHG emissions from existing buildings would eventually become catastrophic for the environment. Moreover, even though energy efficiency strategies in Malaysia are continuously improving, construction key players still need to react well to the energy efficiency programs to retrofit the existing buildings because of numerous difficulties that hinder the decision-making process (Jagaragan et al., 2017). Consequently, despite Malaysia's positive involvement in the environmental revolution, few projects employ retrofitting strategies. Be that as it may, the government and construction players must coordinate all options available to achieve energy conservation goals and increase Malaysians' understanding of green retrofitting existing structures in preparation for its adoption.

2.1 The process of green retrofitting existing buildings

Typically, there is a workflow in a standard building project from start to finish, depending on the project's development. However, the workflow for green retrofitting existing buildings remains unclear. According to Che Husin (2017), Malaysia has no standard regulation or code of practice for green retrofitting existing buildings. The execution of green retrofitting projects is solely based on the design reference guide given by GBI, the GreenRE rating standard for existing buildings by the Real Estate and Housing Developers' Association Malaysia (REHDA); Building Sector Energy Efficiency Project (BSEEP) for passive and active design; and Malaysian Standard MS1525:2014 (Che Husin, 2017). Nikman Lee et al. (2020) also agreed that there is still a lack of emphasis on the critical phases for green retrofit.

On the other hand, although the concept of green retrofitting to achieve substantial energy savings is close to constructing a new green building, the processes are entirely different (Nikman Lee et al., 2020). This is because retrofitting is performed on any building, and it is up to the building's owner to decide on its key goal and scope (Yasin et al., 2017). Therefore, before embarking on a retrofitting project, it is crucial to be aware of the measures and processes involved, as specific processes used in one project might not be relevant to other projects. Hence, refined from the studies of Ma et al. (2012), Nikman Lee et al. (2020), Okorafor (2019), and Geldenhuys (2017), the processes can be divided into three stages of green retrofitting an existing building: pre-retrofit, during the retrofit, and post-retrofit. The processes are shown in Figure 1 below.

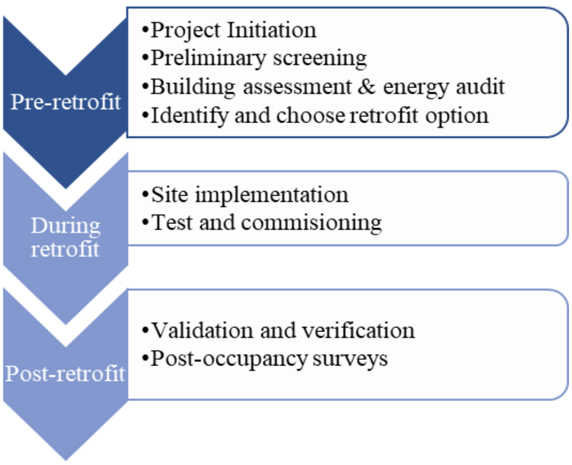

Fig. 1: The process of green retrofitting existing buildings

2.2 Factors influencing the economic benefits of green retrofitting of existing buildings

Green retrofitting measures make the project more economically viable (Al-Kodmany, 2014), so greater payback is advocated in the long term. Even so, the contradictory views on initial costs and payback period and the client's cost restriction to pay for green retrofits inevitably restrict further steps to incorporate green retrofitting (Weerasinghe & Ramachandra, 2020; Che Husin, 2017). Therefore, to increase the potential demand for adapting green retrofits to existing buildings, return on investment (ROI) factors such as capital appreciation, greater rental revenue, and enhanced cost-saving elements are expected (Isa, Abd Rahman, Sipan & Ting, 2013; Zainul Abidin & Mokhtar Azizi; 2016). The costs associated with going green in building projects can be categorised into hard and soft costs. Technically, the final decision to green retrofit would affect these costs, but the effect happens due to certain factors. There are nine factors influencing the economic benefits of green retrofitting of existing buildings found in past literature, as listed in Table 1.

Table 1: Factors influencing the economic benefits of green retrofitting

No	Factors Influencing the Economic Benefits	Authors
1	Building market value	Ayyad & Fekry (2016); IMT (2013)
2	Building age and lifetime	Ayyad & Fekry (2016); Che Husin et al. (2019); Bruce et al. (2015); Ma et al. (2012)
3	Building envelope performance	Ayyad & Fekry (2016); Che Husin et al. (2019); Mohd-Rahim et al. (2017)
4	Occupant behaviour	Ayyad & Fekry (2016); Che Husin et al. (2019); Ma et al. (2012); IMT (2013); Mohd-Rahim et al. (2017)
5	Technology	Mohd-Rahim et al., (2017); Ma et al. (2012); Zainul Abidin & Mokhtar Azizi (2016)
6	Management	Mohd-Rahim et al. (2017); Zainul Abidin & Mokhtar Azizi (2016)
7	External support: Government policies and regulation	Ma et al. (2012); Zainul Abidin & Mokhtar Azizi (2016)
8	Location and accessibility	Bruce et al. (2015); Ma et al. (2012); Oloke et al. (2013)
9	Client resources and expectations	Ma et al. (2012)

2.3 Ways to maximise the economic benefits of green retrofitting of existing buildings

In general, cost benefits and energy savings are the key drivers towards retrofitting an existing building. However, the benefit only accrues to tenants, known as the "split incentive" problem, whereby building owners make energy-saving investments that mainly benefit tenants. However, they may be willing to pay less extra rent than the energy savings implied (Kok, Miller & Morris, 2012). Therefore, the various factors mentioned must be considered to achieve the economic benefits. Most seminal authors from past literature have defined appropriate retrofit options to ensure the effective implementation of green retrofitting of existing buildings. Overall, the most mentioned retrofit options include building fabric insulation, building envelope, windows retrofit, green roof, energy-efficient equipment, low energy technologies, water-efficient fittings, solar photovoltaics (PV) systems, management and maintenance, as well as recycling and waste management practices.

Each of these measures would have a different effect on the performance of retrofit buildings. Furthermore, it can be concluded that applying the whole-retrofit approach that incorporates fabric, system, and renewable measures yields the best-retrofitting outcome by incorporating all the green building features, significant value enhancement in green retrofit projects in the range of 10% to 20% could be realised (Geltner, Moser & Van de Minne, 2017). However, no known study has specifically outlined how to maximise the economic benefits of green retrofitting. Based on previous literature, it can only be deduced that using local materials, following green building rating systems, maintaining after green retrofitting, government initiatives, and discussion with the building owner could be a significant way to accomplish this.

3.0 METHODOLOGY

The study's research strategy is qualitative. Exploratory research is used when more information about the subject is needed. Because green retrofitting has yet to be extensively implemented in Malaysia, qualitative research is deemed appropriate for this research. This is because there is flexibility in how and when the questions are presented and how the interviewee can react (Edwards & Holland, 2013).

A literature review is conducted to understand the research topic and achieve the three main objectives: the process of green retrofitting, the factors influencing its economic benefits, and ways to maximise these benefits. The information and references from the literature review are significant in this research because they will serve as a foundation for preparing primary data collection.

The data collection method chosen for this research is semi-structured interviews, which aligns with this qualitative research. Expert sampling is employed for sample selection, which entails forming a sample group of people who can explain using their experience or those who specialise in a specific area (Etikan & Bala, 2017). In brief, the targeted respondents are professionals from construction firms or companies directly or indirectly involved in green retrofitting projects. This includes green building consultants such as architects, Green Building Index facilitators, mechanical and electrical engineers, and other practitioners involved in green retrofitting projects. Five green retrofitting projects were found for data collection for this study. One respondent from each of the five projects was interviewed to validate the findings, capable of producing reliable and credible data to meet the research's purpose.

For this research, the answers from the semi-structured interview will be evaluated and analysed using content analysis. Qualitative content analysis transforms a large amount of text into a well-coordinated and succinct summary of key findings (Erlingsson & Brysiewics, 2017). The data is transcribed into paragraphs using Microsoft Word 2013 to generate and construct the results and findings.

The limitation of a small sample size of data collection due to adopting semi-structured interviews is acknowledged.

4.0 RESULTS

4.1 The process of green retrofitting of existing buildings in Malaysia

The first objective is to discuss the process of green retrofitting existing buildings in Malaysia, as identified from the semi-structured interview. Respondent 2 was only involved in the green retrofitting proposal stage because the project was not realised and only progressed for the proposal; as such, only the proposal was briefed in detail. Table 2 shows the summary of the process specified by the interviewees.

Table 2: Process of green retrofitting existing buildings in Malaysia

Category	Process	R1	R2	R3	R4	R5
Pre-retrofit	Project proposal	✓	✓	-	-	-
	Project initiation	✓	-	✓	✓	✓
	Building assessment (structural and energy audit)	✓	-	✓	✓	✓
	Identify and choose retrofit options	✓	-	✓	✓	✓
	Tendering	✓	-	✓	✓	✓
During retrofit	Site implementation	✓	-	✓	✓	✓
Post-retrofit	Validation and verification	✓	-	✓	✓	✓

i. Project proposal: In this stage, the client approaches a green building consultant to green retrofit a building. However, since the project proposal stage is where the client has yet to agree to green retrofit their building, the green consultant would only propose measures based on the GBI rating tool deemed appropriate based on the client's budget.

ii. Project initiation: This stage starts when the client wishes to proceed, and they would inform the consultant about the project's needs and goals. A gap analysis is conducted in which green consultants analyze the current condition of the building by conducting a site visit and certifying the building as it is. During the gap analysis, the consultant will determine what is required for the building to achieve the minimum standard for efficiency according to MS 1525 and what is required to get Certified, Silver, Gold, or Platinum level. A cost-benefit analysis is also provided at each level of ratings for the client to decide.

iii. Building assessment (structural and energy audit): After selecting the level of retrofit to pursue, the building's structural and system plans are obtained from the client. The green consultant is called to conduct two types of audits to assess the building's existing conditions: structural audits and energy audits. These audits are performed manually or using a calibrated model using software. Once completed, the GBI template is utilised to conduct performance evaluations to determine certifiable criteria. If the client decides to pursue green certification, the GBI template will serve as a guideline.

iv. Identify and choose retrofit options: The green consultant will establish a short list of low-, medium-, and high-cost items, categorised according to which measures will give more additional GBI points. The client's priority is also considered because each client has different aims. The consultant will then estimate the project's cost with the contractor. Finally, the payback period can be easily calculated.

v. Tendering: The tendering procedure is similar to conventional construction. Besides, the type of contract used depends on the retrofit level that the project aims for. A contract is usually required for extensive retrofits. Furthermore, a tax incentive claim must be made prior to construction and must be approved and agreed upon.

vi. Site implementation: Once the contractor is chosen, implementation begins. Contractors perform conventional construction work but must adhere to an additional component: the green criteria.

vii. Validation and verification: The green consultant would monitor the project to verify that whatever retrofit is implemented meets the initial aim. The energy usage and cost of electricity will be recorded during the operation to evaluate the effectiveness of energy-efficiency drives. The report will be assessed by a certifier, who will subsequently arrange site verification. Finally, the post-occupancy survey must be undertaken. Furthermore, the study revealed that the stage of project initiation and identifying and choosing a retrofit option are the most critical stages to the success of a green retrofitting project. This is because gap analysis during project initiation establishes the project's goals. So, it must be based on more than assumptions or any rule of thumb from past projects.

Additionally, the consultant must assist clients in identifying the most appropriate measures to determine the certification level and the amount of money the client must spend on its performance. Choosing the best retrofit options is also crucial for maximising the economic benefits, as adopting the best energy-saving technology lowers energy consumption. This will lower operating costs and electricity bills, as reflected in the client's monthly electricity payment. Funding and maintenance are also crucial because cost constraints limit the client's ability to adopt better technologies that may provide a higher financial return. Maintenance throughout the building's operations helps ensure that the retrofit measures operate as intended to achieve maximum economic benefits.

4.2 Factors influencing the economic benefits of green retrofitting of existing buildings

The second objective of this study is to determine the factors influencing the economic benefits of green retrofitting existing buildings. Table 3 summarises the interviewees' perspectives on the factors.

Table 3: Factors influencing the economic benefits of green retrofitting existing buildings

No	Factors influencing the economic benefits of green retrofitting	R1	R2	R3	R4	R5
1	Building market value	✓	✓	✓	✓	✓
2	Building age and lifetime	✓	✓	✓	✓	✓
3	Building envelope performance	✓	✓	✓	✓	✓
4	Occupant's behaviour	✓	✓	✓	✓	✓
5	Technology used	✓	✓	✓	✓	✓
6	Project Management	✓	✓	✓	✓	✓
7	External support: Government policies and regulation	✓	-	✓	✓	✓
8	Location and accessibility	-	-	-	-	-
9	Client resources	✓	✓	✓	✓	✓
10	Client expectations	✓	✓	✓	✓	✓
11	Other factors	Public awareness	-	-	Public awareness	Public awareness

i. Building market value: All respondents agreed that the property's value would increase when retrofitted green, especially when the building is certified using the GBI rating tool—furthermore, rental and sales value rise, and the occupancy rate increases for retrofitted buildings.

ii. Building age and lifetime: Respondent 1 asserted that if the building is too old to retrofit, the economic benefits will be impacted, as much money must be spent to keep it standing. On the other hand, Respondents 2 and 3 believed that air-conditioning and lighting systems are the two major energy consumers. So, the economic benefits would only be affected to some extent. Nevertheless, Respondents 4 and 5 believed it relies on how the building has been operated and maintained throughout the years.

iii. Building envelope performance: All respondents agreed that higher building envelope performance would result in more significant economic gains. Although the emphasis is on active design, running the air conditioner at full blast may not be necessary if the structure is appropriately designed because it already has adequate ventilation.

iv. Occupant behaviour: If an occupant leaves a room unattended with the air conditioning or lights on, this human behaviour will eventually affect energy use. Good building performance includes occupants' contributions, so if the occupier wants to reap the most economic benefits, they will lower operational costs following the green retrofit.

v. Technology used: According to the respondents, the air conditioning and lighting systems are the primary energy consumers in a fully air-conditioned building. Therefore, the consultant must assess the many technologies in the simulation to determine the best cost-cutting strategy with the highest payback. Furthermore, while discussing economic benefits, the cost primarily comes from energy efficiency, as minimal capital investment eventually results in a higher return on investment.

vi. Project management: Project management impacts economic gains by ensuring that any features installed during retrofitting are taken care of and not simply disrupted by others. Thus, the project management team must examine all aspects to regulate and verify that everything is on schedule, not over budget, and within the project's requirements.

vii. External support: A considerable amount of government incentive significantly increases the ROI, maximising the economic benefits. Accordingly, the availability of renewable energy programs or tax incentives for energy efficiency will encourage more developers to retrofit their existing buildings. This particularly entices building owners and developers and attracts buyers and renters.

viii. Location and accessibility: All respondents believed that location is not a factor in achieving economic benefits; however, the rationale for the building to be retrofitted is one apparent reason. The location of existing buildings is fixed and does not affect economic gains.

ix. Client resources: The availability of resources influences how far the retrofit can invest in better technology. Suppose the client has adequate resources and is prepared to invest more in building technology or enhance the building's overall efficiency. In that case, there is a greater likelihood of obtaining a better ROI. Nonetheless, Respondent 5 argued that a considerable capital cost or investment is sometimes required to get a high ROI.

x. Client expectations: The consultant must often recommend measures based on the client's goals and requirements. To comply, instead of implementing a complex system, the consultant would recommend technologies that are simple to implement and will be appreciated by the client.

xi. Public awareness: Public awareness is critical, and raising knowledge among the public and the client is beneficial. Therefore, instilling a green mindset to disseminate knowledge on running and maintaining the property over time is essential. As a result of enhanced knowledge, there will be more demand from the public, boosting the overall worth of the building and providing higher economic benefits.

Overall, in achieving the economic benefits, the study discovered that client expectations, technology used, and external support are the most critical influences. This is because the return on investment (ROI) for some of the systems and devices used has a direct monetary advantage in optimising the economic benefits of green retrofitting. Moreover, the client's expectation and willingness to engage in green retrofitting is critical. Suppose a client expresses an interest in a particular requirement; the consultant will follow through on it because if the client is uninterested in the technologies invested, it would be a waste when they fully use it. So, no economic benefits can be generated if a building with much technology is not used effectively. Besides, the building industry is always looking for possibilities in the government's incentives, as a considerable amount of this incentive also increases the ROI.

4.3 Ways to maximise the economic benefits of green retrofitting of existing buildings

The third section recommends ways to maximise the economic benefits of green retrofitting existing buildings. Table 4 illustrates the research findings from the semi-structured interview. Overall, the respondents agreed upon only four of the five ways derived from the literature.

Table 4: Ways to maximise the economic benefits of green retrofitting of existing buildings

No	Ways to maximize the economic benefits of green retrofitting	R1	R2	R3	R4	R5
1	Use of local materials	-	-	✓	-	-
2	Follow green building rating systems	✓	✓	✓	✓	✓
3	Maintenance after green retrofitting	✓	✓	✓	✓	✓
4	Government's initiative	✓	✓	✓	✓	✓
5	Discussion with the building owner	✓	✓	✓	✓	✓
6	Other factors	-	-	-	-	-
7	Retrofit technologies suggested	Active design	Active design	Active design	Active design	Active design
8	Challenges and solutions	Lack of client's awareness	Client's budget	Client's budget	Lack of client's awareness	Poor operation team

i. Use of local materials: Only Respondent 3 agreed to use local materials, believing that because Malaysia is now producing green technologies at a lower cost, local materials would help achieve economic benefits. Meanwhile, others opined that using local materials is only advantageous from a sustainability standpoint. Hence, using local materials is believed to benefit the country more economically than the client.

ii. Follow green building rating systems: All respondents agreed that the green building rating system is an appropriate guideline for the consultant. Specifically, the Non-

Residential Existing Building (NREB) assessment criteria must be followed for existing buildings. Accordingly, using the green rating tool helps clients save even more money in the long run and achieve economic benefits because the energy bill will be very low.

iii. According to all five respondents, maintenance after green retrofitting is the most efficient strategy for maximising economic gains. If a system installed is misused and not maintained, retrofitting efforts are ineffective, and obtaining a satisfactory-performing building is possible. Hence, maintenance ensures that overall operating costs can be reduced and investments remain profitable.

iv. Government initiative: All respondents agree that government initiatives are a way to obtain economic benefits. Therefore, when the government provides initiatives, the desire for individuals to retrofit their buildings increases.

v. Discussion with the building owner: Finally, all respondents agreed that discussing the retrofitting measures with the building owner is a viable way to achieve economic benefits. Building owners will value them more if they understand the measures implemented. Consulting with the building owner is preferable because it helps the consultant understand their preferences and needs when suggesting retrofit measures. Besides, it allows the consultant to advise them on the level of certification necessary from the outset.

Moreover, all respondents agreed that among all retrofit technologies, heating and cooling reduction through active design is initially promoted and typically based on the building's current state. Because the passive design is easier to implement, the consultant should start with the passive design, if feasible. In addition, the respondents specified several challenges in achieving economic benefits. First, the need for more awareness of clients makes it difficult to persuade them to invest in retrofitting efforts. Hence, case studies illustrating the wide variety of advantages can be developed, and the client must be informed of the benefits early on to increase their budget. Also, the client's budget is a challenge, as an inadequate budget limits the consultants' ability to propose the best retrofit technologies. To address this, the green consultant must show them the potential costs of implementing the proposed measures. A poorly equipped operation team is also a challenge because if the building is adequately maintained, the objective of retrofitting is wholly recovered. Thus, how the building is maintained is critical to reaping the economic benefits. Accordingly, training is required to ensure that the client or operation team properly understands how to operate the facility.

5.0 DISCUSSIONS

The green retrofitting of existing buildings includes the project proposal, initiation, building assessment, identifying and choosing retrofit options, tendering, site implementation, and validation and verification. During project initiation, a cost-benefit analysis is performed at each rating level, which allows the client to choose which degree of certification to pursue and how much they must pay to upgrade to the nearest rating. This is consistent with Summers' (2009) results that developing a budget indicates precisely how far the project will progress in the retrofitting process, whether it is a simple or major retrofit. Then, during the building assessment stage, Okorafor (2019) mentioned in the literature study that energy audits are performed using energy mapping and walk-through surveys. Nevertheless, no mention is made of the guidelines it employs. Thus, the interview discovered that energy audits are generally conducted in Malaysia following the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Guideline standards.

Then, the auditing team will identify, select, and generate recommended measures based on manual logging or calibrated software using IESVE. However, since using the IESVE software depends on the availability of a vast amount of information, it is preferable for the consultant to start with manual logging and build a model based on the data provided. In addition, the interview revealed that recommending retrofit technologies depends on the client because everyone has a unique set of goals. Moreover, a retrofitting project may be difficult and complex depending on the scale of retrofit works and the available resources. Ma et al. (2012) also acknowledged that implementing such retrofit measures could cause significant disruption to the building and occupants' activities. That being the case, it is critical to conduct green retrofitting to adhere to the green standard while also considering various factors that may restrict the project's efficacy.

As for the factors, all respondents agreed on the factors identified from the literature review. However, although there is indeed a value in the location and accessibility of a building, location and accessibility are excluded. This is because the site cannot be chosen, and every measure taken is based on the state of the existing buildings. Thus, location is only considered a factor for the building owner to retrofit, not attaining economic benefits. Moreover, although the age and lifetime of the building are agreed to be a factor, Respondent 1 argued that if the building is too old to retrofit, the client's economic benefits will be limited because a significant amount of money has to be spent merely to keep the building standing. Ayyad and Fekry (2016) also agreed that there is only a limited time to reap the benefits because the building is nearing the end of its useful life. However, Respondents 2 and 3 believe that because lifetime primarily pertains to active components, this aspect has a minor impact on the economic benefit as it may or may not contribute to increasing energy consumption. The consultant must examine various possibilities to discover the best options with the most significant payback.

For ways to maximise the economic benefits of green retrofitting of existing buildings, only Respondent 3 agreed on using local materials, believing that because Malaysia is now producing green technologies at a lower cost, local materials would aid in achieving economic benefits. This is supported by the studies of Prabatha et al. (2020) and Azimi (2013), which show that as more building owners become aware of the potential savings, they will demand new and upgraded green features, allowing for increased production. Nevertheless, because there are few green technology providers in Malaysia, high demand would drive the price to the point where it is no longer affordable. Nonetheless, if the number of providers grows, using local materials would allow the client to reap the economic benefits.

Moreover, according to Azimi (2013), because energy efficiency has the highest score allocation in the NREB Assessment Criteria, it would increase the cost because energy components are expensive. However, from the interview, it was found that going green is less expensive than claimed, as they only need to spend an additional 1.1 per cent on average for the Certified level. In contrast, the average for Silver, Gold, and Platinum is 1.8 per cent, 3.8 per cent, and 6.1 per cent, respectively. Accordingly, using the green rating tool helps clients save even more money in the long run and helps achieve economic benefits due to lower operating costs from energy saving.

6.0 CONCLUSION

In conclusion, this research can fulfil its aim and objectives through primary data collection. It is concluded that green retrofitting existing buildings in Malaysia comprises seven (7) stages: project proposal, project initiation, building assessment, identifying and choosing retrofit options, tendering, site implementation, and validation and verification. This finding is a possible reference source for green building consultants carrying out green retrofitting of an existing building in Malaysia. Furthermore, the study revealed that the stage of project initiation and identifying and choosing a retrofit option are the most critical stages to the success of a green retrofitting project. As for maximising the economic benefits, identifying and choosing the best retrofit options, funding, and maintenance are crucial.

Next, the purpose of investigating the factors is to assist consultants in concentrating more on the factors influencing the economic benefits before beginning to green retrofit an existing building. It demonstrates to clients that there are considerable economic benefits to green retrofitting their existing buildings, which also enhances the future demand for green retrofits. The factors are building market value, age and lifetime, building envelope performance, occupant's behaviour, the technology used, project management, external support, client resources, client expectations, and public awareness. As a result, the consultant must focus more on these factors in optimising the client or building occupant's economic benefits. Furthermore, the study discovered that the factors respondents believe have the most critical influence on the economic benefits are client expectations, technology used, and external support.

Finally, only four of the five approaches described were acknowledged to deliver economic advantages. This includes following green building rating systems, maintenance after green retrofitting, government initiatives, and discussion with the building owner, with maintenance as the most essential. The study also revealed that the best retrofit technologies for economic benefits are active design, passive design, and renewable energy systems. Besides, a lack of client awareness, an insufficient budget, and a poor operation team are challenges in obtaining economic benefits. As a solution, it is advised that more case studies demonstrating the wide range of benefits be developed. Furthermore, the consultant should show them the possible expenses of adopting the recommended solutions so that they can spend their money wisely. Training is also necessary to guarantee that the client or operating team understands how to run the facility effectively.

7.0 FUTURE RESEARCH DIRECTION

Based on the current study's findings, the subject area of green retrofitting implementation in Malaysia can be further expanded, particularly to include ways to enhance the green retrofitting of existing buildings to mitigate the effects of new construction and achieve sustainability.

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