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STAKEHOLDER AWARENESS AND ACTION PLAN TO IMPLEMENT VERTICAL GREENERY SYSTEM IN PUBLIC-SCHOOL BUILDING

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ABSTRACT

The Vertical Greenery System (VGS) is an innovative architectural element included in the building façade, encourages sustainable development, and enhances educational activities. The incorporation of natural elements into the school facade presents building thermal cooling, energy conservation, and aesthetic appeal. Nevertheless, the lack of understanding within the Malaysian government and apprehension of the potential cost implications associated with construction and maintenance have emerged as obstacles hindering its implementation. The current research on VGS implementation in Malaysia focuses on commercial and residential areas, and low in public-school buildings. This study's objectives are to evaluate the determination of stakeholders, potential challenges faced, and understanding of VGS as a passive façade design towards its application. A more exploratory approach is used to gather the data through semi-structured interviews among six Architects serving in public-school projects. The result shows that all respondents are aware of the usage of VGS and acknowledged that the application of VGS helps the classroom's thermal comfort, offers social interactions, and enhances façade visualization. Two primary concerns regarding VGS adaptation were discussed: people and economic factors. This research concludes the recommendation of action plans and the need for Architects to be well prepared with technicality and economical terms before adaptation.

1. INTRODUCTION

VGS's potential in Malaysia was explored as early as in 2008, as numerous commercial and residential structures in Malaysia, particularly in the city centre of Kuala Lumpur, have adopted VGS both indoors and outdoors. As it provides a connection between people and nature, VGS improves the quality of the environment in urban areas by establishing safer places and urban rehabilitation (Tang et al., 2023; Irga et al., 2023; Matheson et al., 2023; Campiotti et al., 2022). The demand for greener cities to bring back nature into the urban landscape, and one of the possible solutions to these issues is enhancing the biophilic design (Pedersen, 2023; Lehmann, 2023; Cacique, 2022; Yeom et al., 2021). Malaysia has roughly 8,000 plant varieties, 2,500 of which thrive without soil and can be investigated for vertical greenery plant types (Isa et al., 2022; Bustami et al., 2018).

Greening a school's environment can benefit children's cognitive development, physical, psychological, and social well-being, and, as a result, their learning ability (Fernandes et al., 2023; Vella-Brodrick & Gilowska, 2022; Almeida et al., 2021). Hence, installing these systems in schools can be beneficial in enhancing students' overall well-being and the built environment. The usage of VGS in public schools, particularly in classrooms, can create a suitable interior thermal environment (Fonseca et al., 2023; Isa et al. 2022; Pacini et

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al., 2022; Zomorodian et al., 2016). The positive influence of plants in a classroom setting increases student performance and positive student impressions of the classroom and teacher (Danielski et al., 2022; Liu et al., 2022; Doxey et al., 2009).

In Malaysia, however, the majority of VGS implementation studies have focused on individual structures, such as commercial and residential buildings, with only a few researches on public buildings (Isa et al., 2022). The current research intends to provide insight into the VGS implementation in public-school buildings from other countries in terms of their significant values towards social factors. Awareness of VGS implementation has been identified as one of the key contributors to achieving the sustainable design of social well-being in public school buildings. As such, the research aims to fill the gap in assessing the readiness of VGS adaptation in public-school buildings in Malaysia in terms of environmental, economic, and social benefits.

2. LITERATURE REVIEW

2.1 The Significance of VGS Usage in Public Buildings

In 2018, the potential of Vertical Greenery System (VGS) in Malaysia was investigated, and various public, residential, and commercial buildings began to install it, especially in the city center of Kuala Lumpur (Bustami *et al*., 2018). The importance of looking at VGS usage among public buildings considering public buildings play such an essential role in society, they have a tremendous visual impact on public image, but modernizing façade design will also boost the well-being of public building users (Convertino et al., 2022; Charoenkit and Yiemwattana, 2017).

The significance of using plants on building façade is not only the shading, reducing heat island effects, noise pollution insulations, heating, and cooling energy demand reduction, and augmentation of diversity but also enhancing its aesthetic value with pleasant ornamental effects. This proposition of supporting nature in building façade and urban environments is in line with four (4) biophilic design categories as part of the natural features, patterns and processes, connection to place, and human-nature relationship (Berto et al., 2023; Watchman et al., 2021; Othman et al., 2018). The primary significances of VGS implementation in public buildings are environment and economics, and the secondary significances are aesthetic and social well-being (Pacini et al., 2022; Gantara et al., 2023; Wong et al., 2010). It has been found recently, that most studies have been converging on how greenery improves the thermal performance of individual buildings and the possible energy savings, but nonphysical benefits, such as health and well-being, have received little attention. The primary benefits of VGS perceived by end-users are enhancing visual quality, bringing nature harmony, reducing stress, and reducing the urban heat island effects (Shuhaimi et al., 2022; Ghazali et al., 2019). In summary, the relationship between biophilic design principles and VGS implementation significance can be categorized in Table 1.

Table 1: *Biophilic Design Principles in Architecture and Relationship with VGS significances*

VGS Significance	Primary		Secondary		
Category	Environment	Economic	Aesthetics	Health and Social Well-being	Psychological
Descriptions of VGS according to category	Restore habitats for animals Biodiversity in urban development Generate clean air	Lower building temperature Cost efficient façade maintenance	A modern addition architecture Photogenic appearance Visual quality and perception Character of building	Reduce stress Increase productivity Increased patient recovery rate in hospice	Provide security; a dense and natural barrier As buffer crowding and noise. Façade is less graphitized.
Main Benefit	Reduce air and noise pollution	Energy saving as thermal insulation	Public art and spaces	Bring nature closer to humans	Therapy and healing
VERTICAL GREENERY – ARCHITECTURE INTERACTIONS					
Biophilic Design Principles	Nature features	Natural, patterns and process	Connection to place	Human-nature relationship	Human-nature relationship
Sources	(Barnett, 1982; Ulrich 1984; Clearwater and Coss 1990; Heerwagen 2000; Kuo and Sullivan, 2001; Dunnet, 2006; Duda, 2009; Elgizawy, 2016; Lundholm, 2006; Jaafar et al., 2011; Wong et al., 2010; Ling, 2012; Oluwafeyikemi and Julie, 2015; Othman et al., 2018; Ghazali et al., 2019; Shepley et. al., 2019; Radić et al., 2019; Velazquez, 2021; Watchman et al.,2021; Shuhaimi et al., 2022; Pacini et al., 2022; Gantara et al., 2023; Berto et al., 2023; Convertino et al., 2022; Adegoke et al., 2023; Madushanka et al., 2022;)				

2.2 The Awareness of VGS Implementation Among Stakeholders in Malaysia

VGS is a unique feature of building façade which requires experts among stakeholders and project parties (Adegoke et al., 2023; Madushanka et al., 2022; & Wong et al., 2010). According to Elgizawy (2016), integrating VGS into the building façade required much closer cooperation between architects, ecologists, developers, and green planners. The awareness, understanding, and collaboration among all parties are still low, which will make the change harder. In addition, the present role of VGS as a 'clip-on' design accessory puts urban greenery principles at risk. This explains the crucial investigation on the level of awareness of VGS among project parties especially the lead project team to ensure the VGS implementation is a successful effort (Chew et al, 2019).

2.3 Challenges and Barriers to VGS Implementation

The primary drawback associated with green walls is the substantial and ongoing maintenance efforts required to ensure the wall remains vibrant, thriving, and in a state of ecological balance (Abuseif et al., 2022; Ling, 2012). It is important to note that there are challenges and issues related to VGS, mostly due to its status as a relatively new green building technology (Akram et al., 2023; Chew & Conejos, 2016). A total of eight (8) difficulties related to VGS were discovered encompassing climatic conditions, biological growth, design considerations, building and installation methods, structural stability, water and irrigation systems, maintenance considerations, and environmental considerations. Table 2 presents a comprehensive overview of the challenges and barriers encountered in the implementation of VGS.

Table 2: *VGS Implementation challenges and barriers*

Category	Challenges and barriers	Explanation	Literature Review
Environmental Aspects	Climatic conditions	Heavy rainfall (e.g., winter or dry season) and extreme circumstances related to weather cause VGS foliage to be damaged and plants get dry or withered due to winter and eventual extinction.	(Wong et al., 2010; Perini and Ottelé, 2014; Chew and Conejos, 2016).
	Biological growth	Consider the following: root growth through gaps and fractures; the existence of algae and mould that stain; birds nesting and insect infestation.	
Technical Aspects	Design consideration	The design issues pertain to a low-performing green wall as a result of maintenance and safety problems, such as the provision of an inappropriate plant type and substrate, inadequate photosynthetically active radiation, and the necessity to change plant species.	(Safikhani et al., 2014; Chew and Conejos, 2016; Perini and Ottelé, 2014)
	Structural stability and material durability	Structural stability and material durability (i.e., structural deformations and surface damage to the building envelope) will require material replacement, resulting in increased maintenance and safety concerns. Among these structural and material flaws is the VGS structure's inability to support plants that become too heavy as they mature.;	
		deterioration of the structure, bursting of felt and planter boxes; fractures in the ledges of planter boxes; wear and strain; paint cracks and efflorescence; discoloration and dirt build-up	
	Construction and installation methods	The construction and installation techniques relate to insufficient construction and installation methods (i.e., fixtures that are not securely fastened), which results in operational and maintenance problems, as well as higher lifetime costs (LCCs)	
	Water and irrigation systems	Water and irrigation systems refer to the faulty and ineffective installation techniques of the systems that result in water waste/leakage and inadequate irrigation, as well as the endless repair of irrigation systems.	
	Drainage systems	Drainage systems include problems such as water seepage on the floor/ wall and stagnation; corrosion of windows and ledges as a result of drainage failure; and waterproofing issues and water seepage.	
	Maintenance consideration	Maintenance concerns include safety risks and problems with maintenance access, such as uncontrolled plant growth that destroys the building's wall; a poor maintenance regime (e.g., a lack of maintenance access); and a high rate of dead plant replacement.	

3. METHODOLOGY

3.1 Semi-structured Interview

For this paper, a more exploratory study approach was used by utilizing the semi-structured interview. The semi-structured interview was designed to gather opinions and views from respondents and a semi-structured interview is preferred as it is a more flexible, moderate form (neither too rigid nor too open) and allows the interviewee to provide more information rather than structured ones. The interview sessions were conducted using individual video conferencing meetings and physical interviews. Each session lasts a half-hour to an hour.

3.2 Sampling method

Expert sampling of purposive sampling is chosen as a sampling method for this research. The architects who are currently working in a government organization handling public-school projects, have been directly involved in designing and managing public-school projects for more than two (2) years and have overall experience in public building projects for a minimum of ten (10) years, have basic knowledge of the subject of the research and are willing to be interviewed were chosen as study respondents. The respondents also must have direct or indirect involvement in Vertical Greenery System (VGS) implementation in Malaysia. Out of twenty-five (25) Architects handling the public-school projects, only six (6) were able to respond and were willing to be interviewed due to time constraints.

3.3 Scope of research

Acknowledging the time constraints and other limitations, the scope of this research will focus on assessing VGS implementation in public-school buildings in Kuala Lumpur and not focusing on any types of schools and categories, which includes formal education system in Malaysia from preschool, primary school, secondary school and vocational schools (MOE, 2024). In this study, particular groups of architects have been interviewed. These stakeholders are defined as those who have experience with VGS and are well-versed with the application, parts or parts thereof, and green technology in the built environment. Likewise, Architects are the professional parties who lead others in building design and construction and principal submitting persons in authority approval matters. All of the respondents are working in Government Technical Agencies, Ministry and Government Agencies.

3.4 Interview Structure and Criteria

Next, after a literature search and narrative reviews were conducted, a set of interview questions was developed from the research gaps to assess potential and proposed approaches for developing VGS at public schools in urban settings. The decision on interview questions is set from getting to know the respondent's background and broader knowledge of VGS, general interest questions that are easy to answer as preparation for respondents towards more specific questions. In the middle and near the end of the session, the set of interview questions is harder which include the technicality and economic aspects of VGS implementation in public-school. The outcome of the in-depth interview is to analyse the awareness of stakeholders in the government sector on VGS implementation. The same questions were used for everyone as described in Table 3.

Table 3: *Interview Structure and Criteria*

Interview Structure	Description	Criteria
Part A: Respondent Background	Profession	Architect in the public sector
	Experience in Public-school	At a minimum of 2 years experience in design and managing public-school projects.
	Overall experience in a public building project	A total of a minimum of 10 years of experience
	Experience in VGS	Direct or indirectly involved in the VGS application
Part B: The Awareness of VGS	The awareness of VGS implementation in Malaysia	Specify the VGS implementation by giving a building example in Malaysia
	The significance of VGS towards public school	Explore the views and knowledge on the benefits of VGS
	Challenges of VGS Adaptation in public-school	Specify and elaborate on challenges
Part C: recommendation	Action plan	Recommendation of next step for the design team prior VGS implementation

Source: (Author, 2024)

The content data analysis method was used to describe the data analysis process and how the findings can help the researcher achieve the research goals based on the semi-structured interview and literature reviews. Individual responses were transcribed verbatim by listening back to recorded online meetings (Mp-4 files) or voice memos (Mp-3 files). The recorded interview documents were written in English using Microsoft Word. Next, data were coded in variables, and networking the codes in ATLAS.ti 9 software. After analysing the codes and networking, the conceptual network diagrams' preferred layout and design were chosen. The layout plays an important role in ensuring that all the information fits in and is easy to read and structured. Figures 1 to 3 illustrate the conceptual network diagram produced in ATLAS.ti 9.

4. RESULTS AND DISCUSSION

Part A: Respondent Background

The semi-structured interviews featured six (6) respondents (R) from different stakeholders in government organizations who were involved in public school design and projects. Six (6) respondents are deemed acceptable because it satisfies Creswell's (2014) recommendation for a sample size of five (5) to twenty-five (25) respondents for a qualitative study in which this study aims to comprehend individual's diverse roles as stakeholders and their experiences in Vertical Greenery System (VGS) implementation in public-school. The definition of a stakeholder in this study is a person who led the project and has a major responsibility for monitoring the public-school's project progress daily (Kerzner, 2022). All the respondents selected for this study fit the study's goal and definition. The detailed respondents' background is described in Table 4 below.

Table 4: *Study Respondents*

Organization	Respondent, R	Current Position Level	Total no. of experiences (years) 1 5 10 15 20
A	(R1)	MM	* * * • • • • • • •
	(R2)	MM	* * * * * • • • • • • • • • • • •
	(R3)	UM	* * * * * • • • • • • • • • • • • • • •
B	(R4)	UM	* * * * * • • • • • • • • • • • • • • • l l
	(R5)	MM	* * * • • • • • • • • • • • • • • •
	(R6)	MM	* * • • • • • • • • • • • • • • •

Note:
A: Architect in Development Division, Government Ministry
B: Architect in Education Division, Government Technical Agency
UM: Upper management – Grade 48 above, **MM:** Mid-management – Grade 41 above
* Experience in public school projects (Total no. of years), l Experience in government projects (Total no. of years)

Source: (Author, 2024)

Based on Table 4, all the respondents from R1, R2, R3, R4, R5, and R6 have overall experience in the construction industry of more than 10 years despite working in public or private sectors. R3 has an overall 18 years of working experience and R4 has an overall 20 years of working experience. R1, R2, R5, and R6 have an overall 10- 15 years of working experience in total. In terms of working experience with public school projects, R2, R3, and R4 have five (5) years of experience, followed by R1 and R5 have three (3) years of experience, and R6 of two (2) years of experience. In Organizations A and B, there is a maximum 5-year policy of job rotation, where one officer cannot hold a position in one particular job for more than 5 years. This reflects the data gathered during interviews and presented in Figure 4.1. Based on their positions and experiences in a public-school project, it is fair to assume that all respondents have a basic understanding of public-school design and implementation. Moreover, the longer the respondent's experience in the construction field, the greater his or her familiarity and awareness of the subject.

Part B: The Awareness of VGS among stakeholders

4.1 The Awareness of VGS Implementation in Malaysia

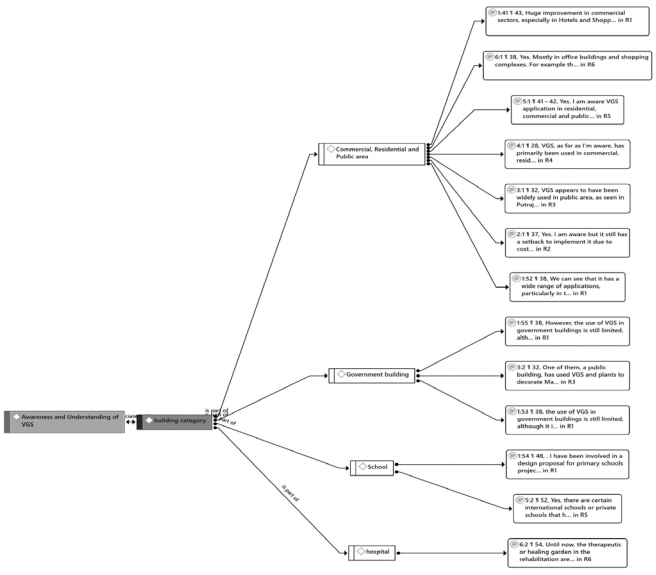
Based on the respondents' awareness of VGS (Table 5), all respondents are aware that VGS is widely used in commercial, residential, and public areas. This responds to study by Chew et al. in 2019 mentioned that awareness of project parties especially the lead project team is still low. Apart from that, R1 and R3 are aware of the implementation of VGS in government buildings, while R5 mentioned that VGS has been adopted in school buildings in Putrajaya, and R6 stated that VGS is applied in hospital buildings in Kuala Lumpur.

Table 5: *Respondent's Awareness of VGS Implementation according to Building Category*

Awareness	R1	R2	R3	R4	R5	R6	%
Commercial, Residential and Public area	l	l	l	l	l	l	100
Government building	l		l				33.3
School	l				l		33.3
Hospital building						l	16.7

Source: (Author, 2024)

All reactions on VGS awareness and implementation from respondents in various building types have been coded and designed in the preferred layout using qualitative approach and generated using ATLAS.ti software (Ronzani et al., 2020) as shown in the network model (Fig. 1). Some suggestions from respondents for future references to conduct a case study to gather lessons learned on the successful buildings in Malaysia that implemented VGS to study about the variety of flowers and plants selections. R6 mentioned, "the successful VGS implementation at Menara UOA, Bangsar which has a variety of colours and richness of flowers. In my opinion, the VGS implementation in Menara UOA is successful due to its colours and flower selections, types of leaves, and the shades cast towards the building occupants and surrounding area." This suggestion was also mentioned in previous studies conducted by Bakar et al. (2014) and Shuhaimi et al. (2020) mentioning that implemented in Menara UOA back in 1999 was a success. The next building suggested by R2 was the Crops for the Future building, University of Nottingham Malaysia, as she mentioned, "This building has a connecting corridor in between blocks, where we install cable, and plant creepers, to plant flowers and fruits".



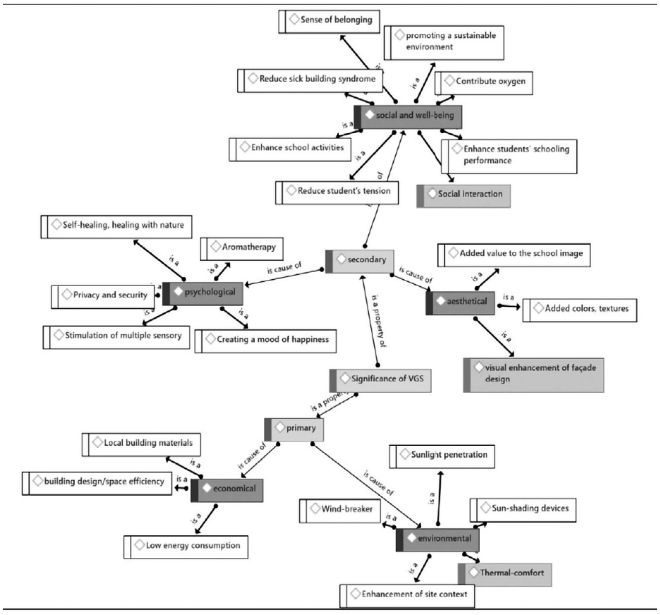
Source: (Author, 2024)

***Figure 1**: Network model on responses towards the awareness of VGS according to Building Category*

4.2 Significance of VGS in Public-School Buildings

This part shows the respondents' views and knowledge on the significance of VGS specifically towards the public-school buildings. All the responses on the VGS significances were categorized as per input in item 2.1 which consists of primary benefits, the environmental and economic, as well as secondary benefits which are aesthetic and social-ecological benefits towards the urban built environment (Pacini et al., 2022; Gantara et al., 2023; Wong et al., 2010. From the data analysis, it was found that thermal comfort, social interaction, and visual enhancement of façade design are the key benefits of VGS in public-school buildings. These key benefits are summarized in Figure 2 according to respondents.

No	Significance	Respondent						Total respondents	%
		R1	R2	R3	R4	R5	R6		
1	Thermal comfort	✓	✓	✓		✓	✓	5	83.3
2	Social interaction	✓	✓	✓	✓		✓	5	83.3
3	Visual enhancement of façade design	✓	✓	✓		✓	✓	5	83.3



Source: (Author, 2024)

***Figure 2**: Key Significance of VGS according to respondents*

From the interview session held, the majority of respondents' insights that the application of VGS helps in natural cooling technique, improve indoor temperature, provides cross-ventilation, and overall improvement of student's thermal comfort in the classroom. This finding was supported by Abd Ghafar et. al. (2018), which revealed that green infrastructure can help address the primary concerns about climate change and urban sprawl by assisting in city cooling, reducing energy loads on buildings, and improving human thermal comfort.

Secondly, the key benefit of VGS in public schools is social interaction. From the interview session held, R1, R2, R3, R4, and R6 believed that the application of VGS helps in social interaction between students, teachers, parents as well as the public. The statement from the respondent was then supported by the Project for Public Place (2015), mentioning that, when streets work well on a daily level of biophilic experience, which includes VGS, they give opportunities for activities such as teaching, learning, and entertaining, particularly for school-aged children. Such focal places of VGS implementation in school boulevards or courtyards provide chances for amusement such as playgrounds, art installations, water fountains, games, and other social gathering spots.

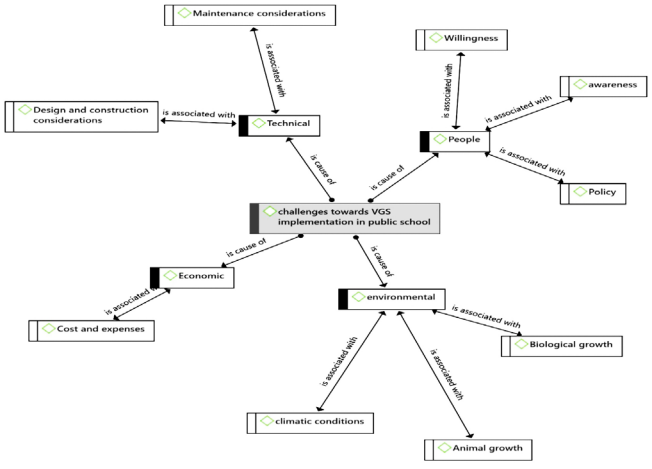
Lastly, the key benefit of VGS in public schools is the visual enhancement of the school's façade. From the interview session held, R1, R2, R3, R5, and R6 believed that VGS contributed the most through the simulation of the visual sensory. Depending on the area,

touch sensory may be applicable as well. The statement is conquered through the research done by Zhong *et al.*, (2021), vertical greenery can provide different visual effects of plants in season, promoting stress reduction.

4.3 Challenges Towards VGS Adaptation in Public-School Building

The collected data about all the challenges faced in implementing VGS in public-school buildings were organised and shown in Figure 3. The implementation of VGS in buildings is characterised by two primary concerns, namely environmental and technical challenges (Chew et al., 2019). However, based on the findings from the interview session, there are two other primary concerns, namely people and the economy. Subsequently, from the data analysis in Table 6, it was found that the major challenges to implementing VGS are cost and expenses. This shows that the allocation of natural capital towards greenery and urban landscape in public-school is still low or insufficient.

Next, the technicality concern is a challenge from the stakeholder's point of view in terms of design, construction, and maintenance consideration of VGS. The third major concern is people's awareness towards VGS adaptation in public-school. Astonishingly, it is found that environmental issues were the least concern which consists of biological growth, animal growth, and climatic conditions.



Source: (Author, 2022)

***Figure 3**. Challenges towards VGS implementation in public school*

***Table 6**: Major Challenges towards VGS adaptation in Public-School Buildings*

Issues and Challenges	R1	R2	R3	R4	R5	R6	%
Technical: Maintenance considerations	✓	✓	✓	✓		✓	83.3
People: Awareness	✓	✓			✓		50
Economic: Cost and expenses	✓	✓	✓	✓	✓	✓	100

Source: (Author, 2024)

Part C: Recommendation

This part attempts to discover VGS adaptation action plans in public-school buildings. Significant improvements or ideas are critical for any organization to progress toward success in the built environment's sustainability. From the interviews, it can be summarized that action plans for VGS adaptation in public-school buildings emphasize the need for Government Technical Agencies to define clear specification and standard in Building Contract. These should cover VGS types, installation methods, and suitable plant species based on the specific school building category. The design and planning should also consider the cost analysis and maintenance requirement, aligning with government policies and project brief. Such detailed specifications ensure that the VGS are practical, sustainable, and fit for purpose, addressing both initial and long-term cost benefits.

Additionally, stakeholder management play important roles, involving end-users and integrating cost analysis comparing the VGS benefits towards school curriculums and education programs, promoting awareness and sustainable design within school activities and infrastructures. Table 7 summarize the action plan recommended by the respondents.

***Table 7:** Adaptation Action Plans for VGS in Public-School Buildings*

No.	Adaptation action plans for VGS in public-school buildings	R1	R2	R3	R4	R5	R6	**Total Respondent**
1	Project brief		✓		✓			2
2	Design statement or needs statement (NS)	✓			✓			2
3	Terms of references (TOR)	✓	✓		✓			3
4	PWD specifications and standards		✓	✓	✓	✓		4
5	Stakeholder management	✓			✓	✓	✓	4
6	School design concept	✓						1
7	Education programs or curriculum			✓		✓		2
8	Awareness						✓	2

Source: (Author, 2024)

5. DISCUSSION

The outcome of this research achieved the first research objective as Architects in the government sector are 100% aware of Vertical Greenery System (VGS) implementation in the private sector and other countries. All respondents (100%) are aware that VGS has been implemented in commercial, residential, and public areas. The implementation of VGS in government buildings (33.3%), schools (33.3%), and hospitals (16.7%) are less significant according to the respondents. Apart from that, potential VGS adaptation towards public school buildings and government buildings is appreciated.

Next, it was found out amongst 24 VGS benefits listed and presented to respondents, 'thermal comfort' (83.3%), 'social interaction' (83.3%), and 'visual enhancement of façade design' (83.3%) are three (3) key benefits of VGS in public-school buildings that have been identified which conclude the second research objective. This familiarity and awareness could result from the Architect's experience, exposure, and scope of work in sustainable design in

the construction sector. Most architects are trained to explore the sustainable design element that benefits all. However, there are cost limitations in public sectors, which are portrayed in the results of interviews and comprehended with the third research objective.

Lastly, the third objective has successfully identified and revealed nine (9) challenges of VGS implementation in public-school buildings which are 'climatic conditions', 'biological growth', 'animal growth', 'design and construction considerations', 'maintenance considerations', 'awareness of people', 'willingness of people', 'policy', and last but not least 'the cost and expenses. Three (3) major challenges have been identified following more than 50% of the respondents agree with it, with regards to lack of maintenance considerations (83.3%), lack of awareness from stakeholders (50%), and lack of proper cost analysis of VGS implementation (100%). A recommendation of action plan that need to be taken was introduced for future studies and work of Architect who wish to implement VGS into public-school buildings.

5.1 Limitation of the Study

Although semi-structured interview has advantages in collecting more exploratory results and engaging with respondents, at present several limitations should be noted.

i. This research only focuses on assessing VGS implementation in public-school buildings in general and does not specifically focus on any types of schools and categories.

ii. The scope of the research has been limited to specific stakeholders targeting groups of Architects working in Government Technical Agencies or Ministry which can be extended to other different types of stakeholders in the industry.

Due to the limitation of this research, the recommendations for further research are proposed to interview much broader stakeholders, including the building owner, developers, contractors, and other relevant government agencies that are deemed to be significant for future research. A case study on current VGS implementation in Malaysia, specifically in public buildings is also recommended and scoped down to the school facilities maintenance and operations team for more technical input on maintenance and user experiences. Furthermore, it is advised to implement a VGS prototype that will be used in public school buildings so that stakeholders can have practical experience with the intricacies and technicalities of VGS techniques.

6. CONCLUSION

The need to assess the readiness of stakeholders to implement Vertical Greenery System (VGS) in public school building design is undeniable by Architects. It is beneficial for Architects, especially those working with government agencies, to understand VGS to reduce high costs in maintenance, poor installation, and specification. It is observed that Architects are ready to propose and keen to design a building with VGS since they recognize and comprehend the advantages in terms of the environment, society, economy, and aesthetics. In that scenario, the building owner might be persuaded and eager to benefit from it, making the adoption of VGS more useful and practically executed. Although VGS offers numerous advantages for public-school buildings, its adoption in Malaysia is very low. To promote VGS implementation, good technical specifications and standards of VGS types and systems are required. Engagement with different stakeholders to create more awareness on sustainable cities and buildings, and more impactful studies on cost analysis due to maintenance issues are needed. The adaptation strategies should also be investigated to overcome the setback from users to implement VGS in public school buildings.

Therefore, this research contributes to the body of knowledge as it fills the initial gaps in VGS implementation in public school buildings in Malaysia.

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