

Green Cleaning: A Study on Benefits for Malaysian School Building

Nur Aqlima Ramli^{1,2,*}, Emma Marinie Zawawi^{1,*}, Nor Rima Muhamad Ariff¹, Siti Solehah Kadir² and Nurul Nadiah Zainol³

¹ Faculty of Surveying, Planning and Architecture, UiTM Shah Alam, Shah Alam Malaysia

² Lee Kong Chian Faculty of Engineering and Science, Universiti Tunku Abdul Rahman, Sungai Long, Cheras, Malaysia

³ Department of Urban Studies, Imperial Institute of Technology, Malaysia

Abstract. Cleaning is one of the important activities during the operation and maintenance stage to any type of core business. Schools nowadays are looking seriously at the cleaning aspect as they realize the availability of health and environmentally friendly facilities that encourage academic performance and staff welfare. These concerns are due to the conventional cleaning practices and products used to keep the school clean. The cleaning contractors are responsible to understand that chemicals with high levels of volatile organic compound (VOCs) emissions and other carcinogens plus dust from poorly filtered vacuums can have a negative impact on the health of students, staff and janitors. Thus, it is a good time for the building managers to make a move to green cleaning practice in school, as a rising number of green cleaning products that are much more effective are available. This study was hence conducted to identify the critical benefits that can be gained through the implementation of green cleaning practice in Malaysian school. Twelve benefits were identified from the literature, and a questionnaire survey that involved green cleaning experts was carried out. Frequency analysis and Importance Index calculation were performed to rank the benefits. The result indicates that "improve indoor air quality (IAQ)" and "provide a safe and healthy environment to occupants and janitors" are the most important benefits of green cleaning practice during operation and maintenance stages in Malaysian school. The findings of this study can provide a significant contribution to the built environment industry. By knowing the benefits that can be gained through green cleaning implementation, efforts can be carried out to explore measures that can be taken to implement the green cleaning practice in Malaysian school or other types of building.

1 Introduction

Sustainability development is becoming a current approach by the industrial players especially in the construction industry, which involves a progressive transformation of the environment, economy and society [1]. According to The Brundtland Commission, sustainable development defined as "the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs" [2].

In Malaysia, PAM (Pertubuhan Arkitek Malaysia / Malaysian Institute of Architects) and ACEM (the Association of Consulting Engineers Malaysia) have established an environmental rating system known as Green Building Index (GBI) specially made for Malaysian new construction and existing building to evaluate their environmental design and performance of the building. The evaluation has been conducted according to the six (6) main criteria; (i) Energy Efficiency, (ii) Indoor Environment Quality, (iii) Sustainable Site Planning & Management, (iv) Materials & Resources, (v) Water Efficiency, and (vi) Innovation. This GBI has been one of the industry's initiatives targeting to assist the building industry towards

sustainable development. One of its significant roles is to ensure all the existing buildings are refurbished or maintained in a green way (green maintenance).

2 School cleaning and maintenance

Operations and maintenance is an ongoing activity for every type of building to ensure the building and facilities continue performing well and in good condition [3]. Schools are used heavily and occupied by students, teachers and staffs. According to a study by [4], around 30% to 35% of the nation's population is in school buildings daily. Besides, several school buildings and grounds are becoming "centres of community" and used for evening and weekend activities. These indicate that schools are occupied by more users for more hours than before [5]. Thus, the school building needs to be properly maintained in order to make the building continuously functioning well and can be used safely.

United States Environmental Protection Agency (EPA) has stated that almost 50% of the nation's schools have problems especially on indoor environmental quality (IEQ) aspect [5]. This happened due to several

* Corresponding author: aqlimaramli@gmail.com and emmamarinie@salam.uitm.edu.my

reasons; poor facilities installation, building design, ventilation, and maintenance (cleaning) [9-11].

The large building area and the number of occupants, lack of storage space, backlogged building repairs, and furnishing that store dust require special and proper cleaning services [3],[6-7]. Majority of schools cleaning services are using conventional cleaning practices and products, which lead to indoor pollution. Besides, the occupants are also unnecessarily exposed to chemicals commonly found in traditional cleaning products. Thus, every school building is supposed to be cleaned more frequently and effectively to avoid indoor pollution or any health issues. A study by [8] has mentioned that conventional cleaning practices and products are critically becoming causes for health and environmental issues (Table 1), hence are strong reasons to adopt prevention practices.

Table 1. Effects of conventional cleaning to health and environment.

Health issues	Environment issues
(i) Exacerbations of asthma, and other breathing problems. (ii) Harmful to the nervous system, reproductive organs, kidney, and liver. (iii) Eye irritation and headaches. (iv) Hormone disruption. (v) Cancer. (vi) Poor design of cleaning equipment can cause injuries to the janitor.	(i) Water pollution. (ii) Increased waste. (iii) Cleaning products made from scarce, non-renewable resources.

Despite the availability of many kinds of literature and studies on the school building, it remains to be seen how school building is managed, maintained, and operated. There are several types of maintenance activities during O&M stage of a building and this includes cleaning. Cleaning has been categorized as one of the critical building maintenance activities during O&M stage compared to other building maintenance activities (i.e. air-conditioning, sanitary/plumbing, mechanical and electrical, lighting etc.) [12]. Cleaning also stands in a major part of facilities management expenditure [13]. Hence, it is essential to explore further about the cleaning aspect of the school building. them.

3 Green Cleaning

Clean can be defined as a condition, which is free from any unwanted matter, while cleaning is the basic process or activities of removing the unwanted matter in achieving a clean condition [3],[14].

The first thing that will concern parents in school is regarding a healthy and safe environment for their children to accommodate. In providing a healthy and safe environment, the school building requires special and proper maintenance services to their building and facilities. However, the maintenance aspect of the

building, especially 'cleaning', often seems to be overlooked [15]. Aforementioned, cleaning has adverse effects especially on the social (health), environment, and economic aspects. As an example, the use of conventional cleaning product, which contains a high level of the volatile organic compound (VOCs), can lead to various health issues to the students, teachers, staffs, and janitors [16]. Conventional cleaning process and products will also lead to poor indoor environmental quality (air pollution) [17-18] and this will cause an uncomfortable feeling, unwell feeling, and distraction to the building occupants. Hence, it will reduce staffs' motivation to work and students' learning process in school [4].

Green cleaning refers to the usage of environmentally friendly cleaning procedures and products which are intended to preserve the quality of the environment (reducing use of chemicals, water and energy) and human health [9-10]. It is one of the sustainability approach [6] [11-10], [15], which aims to produce a good and positive impact on the economy, society, and environment.

School buildings need green cleaning. In Malaysia, there are researchers and industrial players, who have suggested to the Malaysian government pertaining to green cleaning enforcement [19]. Nevertheless, there are no specific regulations or standards set for green cleaning until today [3],[19]. There is also no specific requirement for green cleaning stated in the GBI. The GBI has only pointed out issues pertaining to the use of environmental friendly cleaning product whereas green cleaning is more than just using the product. Green cleaning involves all janitorial activities, processes, procedures, training and initiatives, which are designed to ensure that the occupants and environment will be protected [19]. Thus, it is significant to explore the green cleaning concept and its contribution to the economy, society and environmental aspect.

Therefore, this study was hence carried out as a starting point of green cleaning research, especially for the Malaysian context. The objective of the study is to identify the critical benefits that can be gained through the implementation of green cleaning practice in Malaysian school.

4 The study

Figure 2 below indicates the processes involved to achieve this study.

4.1 Collecting Information

The researcher collected all the information regarding school building issues and green cleaning from primary sources (interview) and secondary sources (journals, articles etc.). The interview sessions have been carried out purposely to gain a view from industry players pertaining to the green cleaning awareness and benefits.

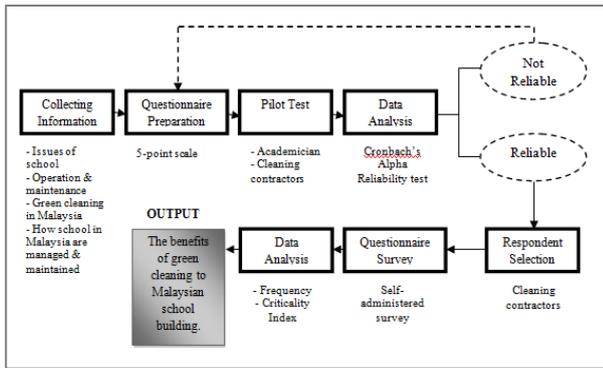


Figure 2. The study's research diagram

4.2 Questionnaire Preparation

The questionnaire designed for this study involved closed-ended questions (5 Likert scale). The Likert scale is commonly viewed as 5-point scale starting from "strongly disagree" to "strongly agree", and with "neutral" in the middle. The 5-scale has been selected to ensure any respondent who is unable to choose if they "agree" or "disagree", will be able to choose "not sure" or "neutral" view (neither agree nor disagree) concerning the statement given.

4.3 Respondent Selection

This study comprises only one group of the respondent, namely cleaning contractors (managers). They were selected due to the role they play in the cleaning services in the school building. The scope of cleaning for school building covers cleaning of classrooms, administration rooms, toilets, cafeteria, field etc. The cleaning service providers involved are from 85 registered cleaning contractors with the Malaysian Association of Cleaning Contractors (MACC) specifically cleaning service provider for school.

4.4 Questionnaire Survey

A self-administered survey has been conducted involving 85 selected cleaning contractors. The respondents were given two weeks to complete the survey. After two weeks, the number of returned questionnaire was 71 cleaning contractors.

4.4 Data Analysis

The validity of the questionnaire content was tested by conducting a pilot test that involved 30 selected respondents ranging from academicians to professional. In addition, the reliability issue has been covered by conducting Cronbach's Alpha test. The collected data have been analysed using the statistical methods; frequency and Criticality Index.

Cronbach's Alpha was used to verify the reliability of the survey instrument. Based on Table 2, the final values of Cronbach's Alpha for this study is 0.780 for the questionnaires, indicating that the instrument is reliable

to be used in this study. According to Litwin (1995), when the final values of Cronbach's Alpha are above 0.7, it indicates that the survey instrument utilized in the research is reliable and internally consistent.

From 85 questionnaires that have been distributed to the related respondents, 71 questionnaires were successfully returned. The data were then analysed using frequency calculation. This was then followed by criticality index calculation to rank the factors according to the level of criticality. The formula that has been used is as follows:

$$\text{Criticality Index} = \frac{5n_1 + 4n_2 + 3n_3 + 2n_4 + n_5}{5(n_1 + n_2 + n_3 + n_4 + n_5)}$$

where,

- n_1 = number of respondents who answered 'strongly agree'
- n_2 = number of respondents who answered 'agree'
- n_3 = number of respondents who answered 'neutral'
- n_4 = number of respondents who answered 'disagree'
- n_5 = number of respondents who answered 'strongly disagree'

Fig. 1. Criticality Index formula

According to the data gathered, the study has shown twelve (12) benefits that can be gained through the implementation of green cleaning in the school building. The benefits are in terms of social, environmental, and economic aspects. The result from the questionnaire survey is indicated in Table 2 below. list.

Table 2. The result of the questionnaire survey.

Benefits	Cronbach's Alpha if Item Deleted	Criticality Index	Ranking
Social benefits			
Provide a safe and healthy environment to occupants and janitors.	0.798	0.9211	2
Improve occupants' and janitors performance.	0.833	0.7831	9
Enhance school image.	0.773	0.6676	12
Reduce absenteeism and sick leave.	0.771	0.8507	8
Environmental benefits			
Improve indoor air quality (IAQ).	0.911	0.9521	1
Reduce waste.	0.741	0.8676	7
Reduce environmental pollution from chemical use.	0.721	0.8761	5
Reduce the excessive use of natural resources (i.e. energy, water, chemical etc.).	0.812	0.8704	6
Economic benefits			
Reduce operating cost due to the reduction of energy consumption, water and cleaning product usage.	0.699	0.9099	3
Increase the value of the building and rental income.	0.742	0.6930	11
Reduce cost to purchase cleaning product due to efficient usage.	0.723	0.8568	4
Reduce medical expenses due to higher rates of injury and illness.	0.845	0.7606	10
Cronbach's Alpha: 0.780			

Based on the result above, the benefits of "improve indoor air quality (IAQ)" and "provide a safe and healthy

environment to occupants and janitors" are ranked as the most beneficial benefits that can be gained through the implementation of green cleaning in the school building. A good IAQ produced by a good cleaning practice thus leads to a safe and healthy environment and improves occupant's productivity. This result is highly supported by a study by [3], [20- 21], which states that by adopting green cleaning programme can help to reduce and solve the issues of health and indoor pollution in school as stated in Table 1 above. Thus, the school board and administrators, teachers, green teams, and cleaning contractors should work together on the development of green cleaning policy. Parents, students, and health professionals can also play a role in educating and promoting the green cleaning programme to the school community. A healthier school environment can lead to a better working and learning environment especially to students and staff, hence a favourable impact on their performance and achievement. them.

3 Conclusion

This paper states clearly the significance and benefits of green cleaning implementation in school buildings during operations and maintenance stages. The implementation of green cleaning should be one of standard practice in school building operations and maintenance. Many researchers and industrial players (cleaning contractor and GBI facilitator) have emphasized the importance and benefits of the green cleaning especially to sustainable development principle (economic, social, environment). Nevertheless, there is no specific standard or regulations specifically for green cleaning in Malaysia. Aforementioned, the GBI rating tool does not particularly underline the requirements of green cleaning. Hence, it is crucial to look at this approach carefully, which emphasizes the components and requirement of green cleaning, persons to be involved, how it should be implemented etc.

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