

## A perspective study on green cleaning for Malaysian public hospital

N A Ramli<sup>1,2</sup>, E M Zawawi<sup>1</sup>, N R M Arif<sup>1</sup>, N S Mahbob<sup>2</sup>, Z Sulaiman<sup>2</sup> and N N Zainol<sup>3</sup>

<sup>1</sup> Faculty of Surveying, Planning and Architecture, UiTM Shah Alam, Shah Alam Malaysia

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

<sup>3</sup>Department of Urban Studies, Imperia Institute of Technology, Malaysia

<sup>a</sup>aqlimaramli@gmail.com, <sup>b</sup>emmamarinie@salam.uitm.edu.my, <sup>c</sup>norri550@salam.uitm.edu.my, <sup>d</sup>syima@utar.edu.my, <sup>e</sup>zamharira@utar.edu.my, <sup>f</sup>nurulnadiyah@imperia.edu.my

**Abstract:** Cleaning being a major contributor to the operations and maintenance expenditure and also Indoor Environmental Quality (IEQ) issues. Improper and ineffective cleaning can harm the environment and poses greatest risk to health. The use of traditional cleaning products presents a variety of human health and ecological concerns; and may contribute to poor IEQ. As an effort to reduce the issue of operations and maintenance costs and IEQ issues in a building, it is important to establish a green cleaning programme to ensure that the buildings are cleaned in a green way. Numbers of scholars has pointed out the factors which had prevented the green cleaning implementation in hospital buildings. Nonetheless, the significance of these factors has yet to be practically explored in the Malaysian context. Hence, the aim of the paper is to identify the most critical factor that prevents the implementation of green cleaning in Malaysian hospital building. A questionnaire survey and personal communication (i.e. interview) was conducted which involved two groups of respondents. They are the hospital maintenance staff (*Cleansing Service Department*) and cleaning contractors. Frequency and criticality index calculations have been used to rank these factors according to the level of importance. The result showed that an “unclear components and requirements of green cleaning” indicated as the most critical factor that prevent the implementation of green cleaning in Malaysian hospital building. In the concern for a successful implementation of green cleaning, it is hope that the findings of these studies can be enlightenment to the cleaning contractors as well as the hospital maintenance management team in Malaysia.



## 1. Introduction

In the beginning of 1990's, Malaysian Healthcare Industry has been developing sharply and steadily. Within the year 2011 to 2015, under the 10<sup>th</sup> Malaysian Plan, the healthcare industry has been recognized as one of the National Key Economic Areas (NKEA). Across the years, the Malaysian Healthcare Industries has been constantly prudent with the Malaysian Healthcare System but had undergone a revolutionary alteration [1]. Nonetheless, in the present day of the healthcare industry, it is time to re-evaluate the existing healthcare system. These are due to the endless increase in cost, the worsening profitability, resource inadequacy and the dissemination of diseases.

With a building normal life expectancy of about 100 years [2], a building goes through several phases in its lifespan beginning with its creation and erection, maintenance and management right through to destruction and removal. Throughout these phases, maintenance and management of the building plays a sizeable aspect and should be one of the core business decisions in any management itinerary [2]. In spite of its considerable impact on the management expenditures, maintenance and management aspect have always been largely ignored throughout the phases of the building [3]. It is acknowledged that generally the phases of a building plays primary elements in influencing the environmental aspect as well as the human aspect and more likely to increase with population growth and the fluctuations of economic issues. In order to minimize the impact of the latter, a sustainability model has to be adopted into the entire phases of the building especially the maintenance and management aspect [3].

As mentioned on the above, maintenance and management of the building consists of sizeable aspect including cleaning. Cleaning, ranked as the most functional and crucial of the building facility maintenance within the maintenance and management aspect in comparison to other maintenance operations of a hospital building such as lighting, Mechanical & Electrical services, plumbing inclusive of sanitary services, air-conditioning services etc [24]. According to Ministry of Health (MOH) official website, all the maintenance and management services are controlled by Hospital Operation Section (HOS) team under Engineering Service Division. The HOS itself comprise of six services, namely; Facility Engineering Maintenance Services (FEMS), Biomedical Engineering Maintenance Services (BEMS), Linen and Laundry Services (LLS), Healthcare Waste Management Services (HWMS) and Cleansing Services (CLS). The cleaning activity has been allocated under CLS, which supervise the cleaning of wards, clinics and other areas in the hospital building include operating theaters, laboratories, pharmacies and the surrounding area.

Numerous counts of cleaning services carried out per day with a primary portion of the facilities management expenses which facilitated about one-third (30%-33%) of overall maintenance and management finance provision [18]. These are an indication of the significant impact on the maintenance and management cost and the integral function of cleaning within the healthcare building. In comparison to the other maintenance operations (mainly M&E, plumbing, security services etc.) within the breakdown of the maintenance and management estimated costing [4], cleaning services (inclusive of the cost for machinery & tools, chemical elements and largely the cost of resources such as manpower etc.) has been clearly expressed as the most costly.

Indoor Environmental Quality (IEQ), a standard should be taken into account when introducing sustainability into a building. Cleaning service being a primary factor to the maintenance and management aspect, inappropriate and inefficient cleaning can impair the environment and poses risk to human health [26]. Intrinsically, it would have a substantial impression to the IEQ issues [25]. In trying to keep to the traditional chemical materials to administer the cleaning processes, it will only bring forth a poor IEQ reading [26 and 27] by introducing concerns about the well-being and environment which in turn will ultimately influence the building performance.

To implement a green cleaning programme with the determination to lessen the maintenance and management expenses as well as the IEQ issues, hospital buildings should be cleaned effectively and

efficiently in a green manner. There are few factors that prevent the execution of a green cleaning and this study has established five main factors. These factors are imperative to ensure the effectiveness of the Green Cleaning Programme that is to be introduced to Malaysia. As green cleaning is new here and without sufficient researched and practices, it is fundamental to organize an analysis to establish the criteria and adopt it in accordance to the order of prominence and significance.

## **2. Hospital Operations and Maintenance**

Regardless of how remarkable the design of the hospital building, it will only continue perform if the building is maintain and operated appropriately. Furthermore, being amongst the major vulnerability buildings, hospital building has a sizeable influence on the surroundings what with its 24/7 usage. Henceforth, the hospital building must be maintained and operated on the sensitivity towards safety & health, comfort and others.

In many kinds of building, in order to ascertain a building is maintained and operated in an effective manner, the maintenance and management aspect has to be a continuous activity. Much like other building, a hospital building entails a proper maintenance to ensure the facilities and buildings are in excellent state. As such, the requisite for green maintenance practice in hospital building [4]. The ecological value is continually affected through maintenance by the reduction in waste, contaminants and other sources; which in return influences the financial operations with the reduction in the consumption of water and energy utilization and ultimately cost with an inadvertent effects to people's security & safety, solace, health and productivity [6, 7, 8, and 9]. With this, an introduction to sustainable maintenance, it can be characterized as maintenance procedure that attained the system merit of the existing body of conceding the aptitude for attaining the merit for the forthcoming body [5].

Notwithstanding the various writings and findings on hospital that is accessible, a disparity existed on the nature of the way the hospital is administered, upheld and worked [4]. Many kinds of maintenance services throughout the hospital maintenance and management aspect it encompasses cleaning services. Cleaning services can be considered as an uppermost building maintenance services throughout the maintenance and management aspect in relation to building maintenance services such as Mechanical & Electrical services, plumbing inclusive of sanitary services, air-conditioning services etc. [10]. Therefore, it is essential to conduct an analysis on the cleaning facet of the hospital buildings considering that it is a primary portion of the management expenses [11].

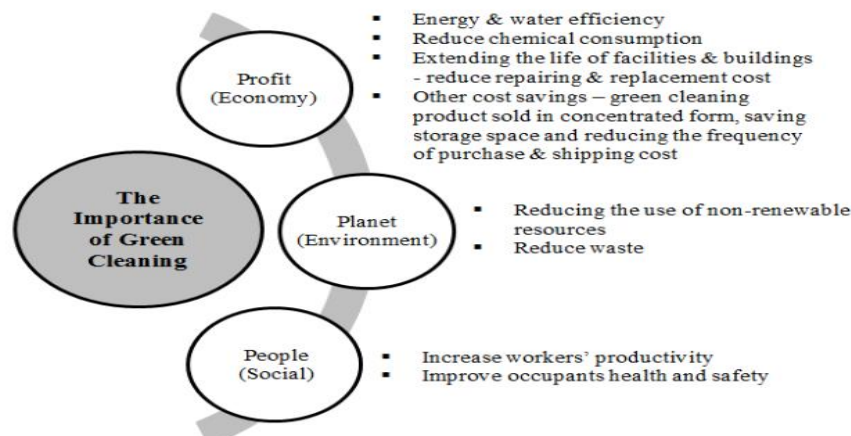
## **3. Green Cleaning**

The desire to preserve the surroundings of a hospital building with minimal pathogen (bacterium, virus or other microorganisms) level which is imperative for circumventing difficulties during the convalescence process and care of patients is the reason the cleaning of hospital buildings are implemented. In comforting the patients and their families, promoting healthful, safety and an appealing place by means of the hygienic surface give the imprint of quality upkeep minus the health threat [12]. Whilst cleaning is needed in all economic sectors, the healthcare industry requires it to operate as a double purpose of surface cleanliness mainly, contamination hindrances and control. Intrinsically, hospital needs a rigorous and regular cleaning with a wide variety of merchandise, methods and measures. Consistently, [12], hospital area may be characterized by two distinct factors in facilitating environmental cleaning:

- Non-medical areas – wherein an area that does not affect the residence hospital; this comprises areas of public access i.e. lobbies/waiting rooms, offices, corridors, elevators, stair areas as well as common areas.
- Medical areas – wherein an area that is directly associated with the residence hospital; this encompasses residence/patients sections (inclusive of nurse stations), medical rooms, lavatories, outpatient rooms, diagnostic and treatment areas.

Cleaning to protect health without harming the environment is delineated as Green Cleaning. It is achieved by using processes and materials by ensuring that the cleaning is performed with the interest of all the building residences' well-being and the environmental health [14]. The objective is the reduction of the consumption of chemicals substances, water and energy. Minimizing environmental and human-health impacts are the aim of green cleaning, whilst maintaining and/or refining the effectiveness of the cleaning procedures [15]. Green cleaning is linked to the notion of sustainability [14, 15, 16, and 17]. Implementation of green cleaning will have an encouraging correlation between the economy, society and environment. When participating a green cleaning practice, it is not sufficient by simply insinuating the usage of an environmental friendly cleaning product in a hospital building without taking into account the measures and techniques requirements. Inappropriate and negligence in the usage of the cleaning product will not only lead to ineffectiveness in cleaning but may also cause more harm to the environment [18]. A variety of chemical substances have been applied in the cleaning practice (removing dust and killing microorganism) which routinely performed in hospital building. Increasing evidence which showed the ingredients of the chemical substance give unintended negative impacts on the environment and occupants' health. Patients and staff are more exposed to cleaning chemicals which can cause dermatitis, endocrine and neurologic effects, cancer, asthma, and other respiratory disorders [28 and 29]. Cleaning chemicals may contribute to the pollution of outdoor air and water supplies, damage to ecosystems, bioaccumulation in animals and plants, and ozone depletion [28]. Reference to [19] and [20], the green cleaning provisos should tackle the types of supplies and machineries/tools used, the efficiency of using the product, coupled with a suitable coaching and staffing levels, as well as supervision and resident accountability in order to create the healthiest building achievable. Hence, the green cleaning requisite should be distinct from ensuring that the cleaning processes of a building are conducted in an effective and efficient manner.

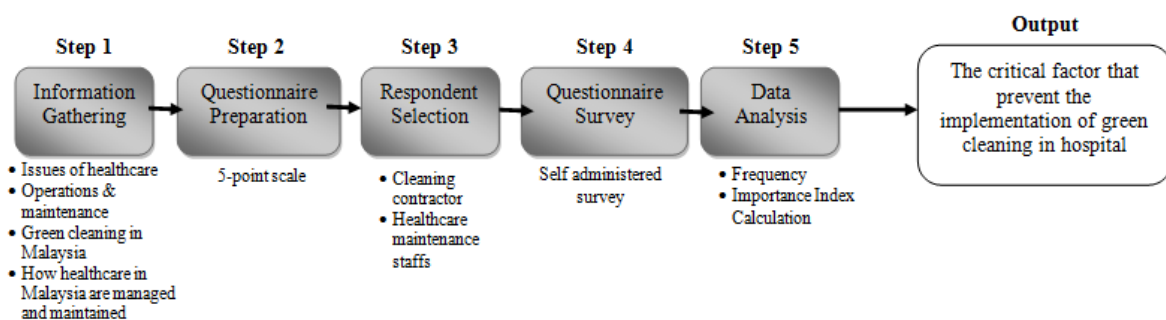
The importance of the green cleaning procedures was highly supported by the aforementioned reviews of hospital buildings. Contrariwise in Malaysia, the specific standard or regulations has not been established for green cleaning, although there are a few researchers that recommend the Malaysian Authorities need to emphasize and enforced green cleaning in their guiding principle [4, and 21]. Green Building Index (GBI) rating tool is a recognizable green rating tool for buildings in promoting the endurance of systems and processes in the built environment. Unfortunately, there are no specific requirements emphasized on the GBI rating tools for the green cleaning. A general reference to green cleaning in the GBI rating tools are limited to the usage of environmentally friendly materials. However, it is not restricted to that aspect but also incorporates all janitorial services inclusive of methods, measures, training and schemes against the protection for the health of the residents in its design whilst also not causing more harm to the environmental [21]. Consequently, it is imperative to comprehend the idea of green cleaning and its inputs to a sustainable advancement.



**Figure 1.** The importance of green cleaning implementation for sustainable development (*Sources [4]*)

#### 4. The Study

Figure 2 below shows the steps taken to achieve this study.



**Figure 2.** The study's research diagram

##### *Step 1: Information Gathering*

The researcher gained all the information about issues of hospital and green cleaning from primary sources (interview) and secondary sources (articles, journals etc.). The interview sessions have been conducted purposely to get the view of the practitioners regarding the factors and most critical factor that prevents the green cleaning implementation in Malaysian hospital building.

##### *Step 2: Questionnaire Preparation*

The questionnaire designed for this research employed closed ended questions i.e. the Likert scale of five ordered responses levels. The Likert scale is frequently seen as 5-point scale starting from “strongly disagree” until “strongly agree”, on the other with “neutral” in the middle. The five scales chosen is to make sure that the respondents who are unable to decide if they “agree” or “disagree” will be able to state their “not sure” or “neutral” views (neither agree nor disagree) regarding the statement given.

### Step 3: Respondent Selection

This study encompassing two groups of respondents, namely; hospital maintenance staff from MOH Cleansing Service Department (head of department and operation engineer) and cleaning service providers (manager and supervisor). They were chosen due to the role they play in the cleaning services in public hospital. The hospital maintenance staff (*Cleansing Service Department*) monitor and coordinate the cleaning services which has been conducted by the cleaning service provider. The scope of cleaning for hospital covers cleaning of wards, clinics and other areas in the public hospital building include operating theaters, laboratories, pharmacies and the surrounding area. The hospital maintenance staff involved are from 14 general public hospital (700beds and above) and has operating for over 15years. The general public hospital as Table 1 below;

**Table 1.** General public hospital in Malaysia

Hospital Kuala Lumpur	Hospital Sultanah Aminah
Hospital Melaka	Hospital Sultanah Bahiyah
Hospital Permai, Johor Bahru	Hospital Sultanah Nur Zahirah
Hospital Pulau Pinang	Hospital Tengku Ampuan Afzan
Hospital Raja Perempuan Zainab II	Hospital Tengku Ampuan Rahmah
Hospital Selayang	Hospital Tuanku Jaafar, Seremban
Hospital Sultan Ismail, Johor Bahru	Hospital Raja Permaisuri Bainun

Cleaning service has been outsourced and awarded to three (3) cleaning service providers for three (3) different regions (northern, central and southern). All these 3 providers involved in this study. The cleaning service providers for Malaysia hospital building namely;

- Radicare (M) Sdn. Bhd.: Wilayah Persekutuan Kuala Lumpur, Selangor, Pahang, Terengganu, and Kelantan.
- Edgenta Mediserve Sdn. Bhd.: Perlis, Pulau Pinang, Kedah and Perak
- Medivest Sdn. Bhd.: Negeri Sembilan, Melaka, and Johor

### Step 4: Questionnaire Survey

A self-administered survey was carried out involving 30 public hospital maintenance staffs (*Cleansing Service Department*) and 30 from selected cleaning contractors. The respondents were given a month to complete the survey. After a month, the number of returned questionnaire is 52 where 25 of the respondents were from hospital maintenance staff and 27 from cleaning contractors.

### Step 5: Data Analysis

The data were then analysed using Frequency and Importance Index Calculation.

Based on the data gathered, the study has indicated that there are five major factors that hinder the green cleaning implementation for Malaysian hospital building. The factors are; (i) cost and financial problems; (ii) lack of knowledge and skills of cleaning service provider; (iii) availability of product; (iv) lack of awareness; and (v) absence of green cleaning components and requirements. The result from the questionnaire survey has been shown in Table 2 below.



**Table 2.** The result of questionnaire survey

Factors	SD (1)	D (2)	N (3)	A (4)	SA (5)	Criticality Index	Ranking
Lack of knowledge and skills	0	0	7	8	37	0.9154	2
Cost and financial problems	0	0	8	10	34	0.9000	3
Absence of green cleaning components and requirements	0	0	0	4	48	0.9846	1
Availability of product	0	3	5	8	36	0.8961	4
Lack of awareness	0	0	16	31	5	0.7192	5

SD – Strongly Disagree  
A – Agree

D – Disagree  
SA – Strongly Agree

N – Neutral

According to the result above, the factor about “absence of green cleaning components and requirements” is the most critical factor that hinders the implementation of green cleaning in Malaysian hospital building. This result is extremely supported by a study by [22, 23] which an absence of the requirements is among the key factors of a project failure. Green cleaning program considered as a project and the absence of green cleaning components and requirements, building owners are unable to grasp as to what cleaning contractors are supposed to furnish with their services for an effective and efficient cleaning. With this mindset, the owner or building management would have set the specifications to which the cleaning service providers have to abide by. As a result, green cleaning agenda could not be successfully implemented in a building.

## 5. Conclusion

As green building in Malaysia which is one of the sustainability approaches gave impact to the total human well being, green cleaning were also play an important role to provide clean indoor environment and save costs as well. A complete green cleaning programme will produce a good return on investment because of the green cleaning benefits that can be achieved. Green cleaning programme is one of the approaches for energy saving and reduce the energy cost up to 10%, and also saves water usage up to 70% [16]. Besides, green cleaning generates a healthy indoor environment which enhancing worker's productivity up to 5-7%, enhance attendance by more than 11%, decreases illness by 20-30% [16]. Inefficient cleaning practice because of the absence of requirement cause the hospital missed the chances to receive these profits. Consequently, the study extremely emphasis that it is vital to study the green cleaning practice for Malaysian hospital building, which consists of processes and procedures that should be incorporated in green cleaning practice.

- [1] Castro JM 2009 Health Care in Malaysia. Available at <http://www.expatform.com/articles/health/health-care-in-malaysia.html>. Accessed September 26, 2012.
- [2] Hashim AR 2006 *Maintenance Management And Services (Case Study: Perkeso Building's In Penisular Of Malaysia)* Master Thesis (Universiti Teknologi Malaysia, Malaysia)
- [3] Izran, Nurul, Shardy, Neo and Nur 2014 *Theoretical and Empirical Researches in Urban Management. Critical Factors that Lead to Green Building Operations and Maintenance Problems in Malaysia* **9** 68

- [4] Nurul, Izran, Maizan, Neo, and Abdul 2015 *Jurnal Teknologi. Green Cleaning: An Essential Aspect of Malaysian Green Buildings* **10** 65
- [5] Khamidi MF, Ashola OA and Idrus A 2010 *Malaysian Construction Research Journal. Building Maintenance: A Path towards Sustainability.* **7** 47
- [6] Zakaria H, Arifin K., Ahmad S, Aiyub K and Faisal Z 2011 *Journal of Techno-Social. Pengurusan Fasilitas Dalam Penyelenggaraan Bangunan: Amalan Kualiti, Keselamatan dan Kesihatan* **23**
- [7] Olanrewaju AL 2008 *Journal of Building Appraisal. Building Maintenance Management in Malaysia* **4** 207
- [8] Training Toolkit on Community Asset Management for Engineers 2003 Overview of Maintenance. Retrieved from <http://home.wmin.ac.uk/MLprojects/CAMweb/CAM1/Intro.htm>.
- [9] Sakina MA, Fassman E, Wilkinson S, and Adi Irfan CA 2012 *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction Management Practice to Achieve Energy Efficiency Performance (Case Study –Green vs. Conventional Office Building in Malaysia)*
- [10] Nik Mat NEM, Kamaruzzaman SN and Pitt M 2011 *International Building Control Conference. Assessing the Maintenance Aspect of Facilities Management through a Performance Measurement System: A Malaysian Case Study*
- [11] Klungseth NJ and Olsson NOE 2013 *Journal of Facilities. Norwegian Cleaning Research: An Overview and Categorization* **31** 290
- [12] Singapore Environmental Cleaning Guideline (2017). *Environmental Cleaning Guidelines for Healthcare Settings.*
- [13] *Cleaning Standard for South Australian Healthcare Facilities* 2014 Available at [www.sahealth.sa.gov.au/infectionprevention](http://www.sahealth.sa.gov.au/infectionprevention). Accessed July 1, 2017.
- [14] Young J, Schwinghammer K, Steen E and Zaffrann D 2010 *Clean Sweep: How A New Approach to Cleaning Commercial Buildings In The Twin Cities Can Protect Our Health And The Environment while Securing Jobs and Saving Money.* Retrieved from <http://www.bluegreenalliance.org/news/publications/document/CleanSweep.pdf>.
- [15] Kohls J 2010 *Why Green Cleaning Makes Cents for Sustainable Facilities.* Retrieved from <http://www.newequipment.com/Resource.ashx?sn=makingcents>.
- [16] Betco Green Cleaning Workbook 200. *Sustainable Green Cleaning: Cleaning for Health and the Environment.* Retrieved from <http://www.betco.com/SiteCollectionDocuments/Training%20Workbooks/Green%20Cleaning%20Workbook.pdf>.
- [17] Corbett-Shramo J, Wagner D and Esbensen P 2011 *Sustainability Guide: Global Green Cleaning.* IFMA Foundation.
- [18] Berry M A 2011 *Commentary - The Green Movement and Science.* Retrieved from [http://www.ciriscience.org/a\\_286COMMENTARY\\_The\\_Green\\_Movement\\_and\\_Science](http://www.ciriscience.org/a_286COMMENTARY_The_Green_Movement_and_Science)
- [19] Green Seal 2013 *Green Seal Environmental Standard for Cleaning Services* (pp. 18). Washington, DC: Green Seal, Inc.
- [20] CIMS 2011 *Cleaning Industry Management Standard-Green Building.* Lincolnwood, IL: ISSA.
- [21] Atifi N 2012 *Clean Up, Green Up. Business Today, 12,* 30-35.



- [22] Kile JF, Little D and Shah S 2005 *The Importance of Effective Requirements Management in Offshore Software Development Projects* (Doctor of Professional Studies in Computing), Pace University, United States.
- [23] More NT, Sapre BS and Chawan PM 2011 *International Journal of Internet Computing (IJIC)*. An Insight into the Importance of Requirements Engineering **1** 34
- [24] Kamaruzzaman S.-N, Myeda NE and Pitt M 2013 Performance Levels of High-Rise Private Office Buildings Maintenance Management in Malaysia. *Maintenance and Reliability* **15** 111
- [25] IDAHO 2006 H2E 10 Step Guide to Green Cleaning Implementation (pp. 8). Lyme, NH: IDAHO Department of Environmental Quality.
- [26] GGHHC 2008 Green Guide for Health Care.
- [27] Rumchev, Spickett, Bulsara, Phillips and Stick 2004 *Thorax. Association of domestic exposure to volatile organic compounds with asthma in young children* **59** 745
- [28] Environmental Protection Agency. (n.d.). *Green cleaning pollution prevention calculator*. Retrieved May 23, 2011 from: <http://www.fedcenter.gov/janitor/>
- [29] Quan X, Joseph A and Jelen M 2011 *Green Cleaning in Healthcare: Current Practices and Questions for Future Research*. Retrieved from Effect of Employee Training on the Perceived Organisational Performance: A Case Study of the Print-Media Industry