

IN-HOUSE GREEN KNOWLEDGE PRACTICE FOR HOSPITAL BUILDING MAINTENANCE

Mohammad Affendy¹
Liu Yao²
Diyana Kamarudin²

¹Faculty of Engineering Technology, Universiti Malaysia Pahang, Malaysia

²Faculty of Industrial Management, Universiti Malaysia Pahang, Malaysia

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Abstract: *This research was to develop a knowledge practice model for the green hospital building maintenance. The proposed model was developed in a three-phase process: the information gathering phase using questionnaires, interviews and document analysis; the potential usefulness of the model was review on 8 BM managers. The results of the survey indicated that the model has the potential to improve the existing corrective and reactive maintenance management practices towards green maintenance practices. Well managing of the hospital building will be able to inspiration the quality of the hospital buildings that remain safe, long, and fine-looking and meet the standard without any harm and difficulties. Accordingly, this study will have highlighted the issues that impact in the hospital building occupancy as to develop the sustainable building value.*

Keywords: *Green Operational, Building Maintenance, Hospital*

Introduction

The research is to highlights the green practices for hospital building maintenance (BM). The BM a part of maintenance of hospital facilities. According to Rani et al. (2015) pointed out that hospital need to upgrading the being practice approaches of maintenance task being carry out due to succeed better service of the facilities. A study by Amankwah et al, (2017) had mention that hospital BM management lack of practising of green maintenance. Thus, the necessity to adapt green practices in the day-to-day operation for the hospital.

Integrated of Green Operational in Building Maintenance

Building Maintenance (BM) is a very essential aspect in maintaining a value and functionality of a building being occupied. BM is one of the vital area, which has great intention in building industry. (Olanrewaju, 2008; Amani et al ,2012). The aim of BM is to preserve a building in its original operational state and achievable, therefore it works purpose efficiently (Al-Zubaidi 1997); Zawawi et al. 2009). BM hospital practitioners are required to understanding the

scenario of BM and hospital practicing green application. The approaches of green enhancement have become vigorous feature of the BM activities. Green practices has been the major issues within BM industry players nowadays. The participation of developed countries together with Malaysia are towards in green technology as a fundamental agenda in the urban developed future. (CIDB, 2011). Therefore, green practising appointed to form sustainable knowledge gap in order to awareness of green hospital environment (Yik,2006). Furthermore, Chan (2014) highlights a well regularly maintained and refurbished will outcome the sustain and efficiency of the building properties.

BM as well as the integration of processes within an organisation to maintain and develop the building services which support and improve the effectiveness of its primary activities”. Building also required to be maintain effectively as it was main activities of urban city (Horner et al. 1997; Al-Zubaidi 1997 Zakaria et al., 2012). The condition of building must be in well planned for users. Adenuga (2010) highlights that a buildings are required to provide a conducive and safe environment for numerous daily activities and remain for post occupancy.

Un-proper manageable waste of BM workplace, low awareness of participation in ensuring safety and health of BM area was the issues (Paterson, 2008; Seow, 2012). Furthermore, means that without proper and adequate knowledge of sustainable development, those scenarios are scenes that will continuous for several periods. the environmental elements in sustainability include climates change, air pollution, ozone depletion, oceans, wildlife, soil, land use, waste, and noise pollution.

Green Maintenance Perspectives for Hospital Building Maintenance

Currently, this is green maintenance was challenging the BM sector and the BM teams. To achieve sustainability in hospital BM is practices guided by indicators and performance targets, able to assess integrate within dimensions of sustainability, environment society and economy.

The nature of hospital buildings is complex in accommodate facilities, the BM hospital department faces more challenges in managing such activities. Thus, buildings become more complex in design and facilities. Building require to rapid maintenance and being as main activities at global cities also to retain as its previous good conditions. (Al-Hammad et al., 1997; Horner et al. ,1997; Al-Zubaidi 1997). Hospitals as a place to provide patient care for community (Kinney,2010) thus the need of green sustainability for the BM activities and occupants activities. According to Zainol et al. (2015) mentions that a concept of application in green buildings focusing at the level of operation maintained with the safety, health for occupants and users. Sahamir and Zakaria (2014) stated that healthcare services are water and energy intensive, managing hazardous and non-hazardous materials and reducing of polluting emissions. AmanKwah (2017) highlight several of element for hospital sustainability focusing on energy, environment, ventilation and lighting.

Green design and maintenance highlights several practices improving water usage, waste management and recycling features (Fik, 2005; Huff, 2009) and Ismail (2013). The practice of green building is to reduce consumption of energy and material resources throughout the building life cycle. Lu (2012) stated that green buildings are designed to reduce the whole guidance on the external environment such as reducing waste and subject to pollution. Therefore, it is necessary to take into account the use of renewable and non-renewable resources, disposable products, toxic substances and the production of a large quantity of waste (Short & AL-Maiyah 2009).

According to Sahamir and Zakaria (2014) stressed that a sustainability was not consider as a requirement in the hospital sector so far. Hospitals was lagged behind other industries in “green” building initiatives that employ environmentally friendly materials and others building activities and methods. In addition much of hospitals not interest in green building certification than other industries (Saidur et al, 2010). Study by Sahamir and Zakaria (2014) stated that a green building recently as one of the most common areas. Green buildings could be distinct as "healthy facilities designed and built in a resource-efficient manner.

Hospital building must reduce noise pollution and air pollution. Encourage walking and cycling to the facility; promote staff, patient and community use of public transport; site health-care buildings to minimize the need for staff and patient transportation. According to Suwasono et al. (2013) stated that green hospital discusses to a hospital that includes environment as part of value services. Consideration on, strategic location, efficiently water usage, energy and good air pollution, using good material, keeps indoor environmental quality,delivers green education and awareness, non-toxic environment, green cleaning, waste reduction, and friendly working area.

It is well known that BM sites have negative impacts on the local environment and community through noise, air, and water and land pollution. Hospital shall have a plan for recycling of water. Water recycling is reusing treated wastewater for beneficial purposes such as toilet flushing, landscape irrigation, and replenishing ground water basin. This should be consider whereby cleaning activity was classified as a top activity during operations and maintenance stage. (Mat, 2011). Hospital BM must practice green cleaning. The green cleaning form to minimize environmental and human-health impacts and during maintaining. Thus, according to Ziqi Wu (2011) mentions that consideration for sustainability for hospital should foremost be welcoming to patients and to improves their quality of life.

Integrated Green Maintenance and Safety and Health

Issue related to BM was to ensure the workers in safe position. It is important to ensure the safety of BM workers, site visitors and people in the surrounding community should be of maximum. Amaratunga et al., (2002) stated that element of health and safety is the one of requirement in the managing facilities. Zakaria et al. stated that safety and health practices in BM was to ensure that all occupants always comfortable, safe and healthy during occupation of a building. This could integrate within BM scope of work. The health and safety on BM sites, the use of screens and fences around the site will provide security against unwelcome intruders, while also protecting their safety. Nawi (2014) highlighted that important to protect person who is in the building against activities risks. BM sites must be kept tidy at all times and that there are areas designated for waste separation, etc. This is an efficient practice and will improve BM site safety.

According to Nawi (2014) found that Reese (2004) had highlighted several itemise of health and safely in related to maintenance personnel as follows: Provide barriers around hazardous BM areas. Secondly, do not block the BM emergency evacuation area. BM activities where do not leave the equipment and materials under supervision. BM activities on building services such as do not leave exposed conductors of electricity. BM works on cleaning activities such as clean all chemical spills immediately. Protection of public especially alert the public to the dangers such as repairing works on site and adjacent buildings occupied.

The need of the BM manager to ensure that health and safety work procedure are documented and clear guidance. According to Lee (2009) stated that safety and health was very important factors influenced in the final task in term to delegate the maintenance works This was to ensure the BM works not risk to BM personnel and building users.

Hospitals function non-stop and in the process are known to generate huge amount of waste including infectious and hazardous solid waste. Hospitals consume huge water and electricity power. They operate air handling units, leaving environmental footprint in many ways, affecting staff, patients and community at large. Hospitals use toxic chemicals as cleaners, chemical sterilizers and as chemical reagents. Add to these are noise and radiation pollutions from variety of bio-medical equipment and radiological apparatus. Hospital shall demonstrate initiative by maintaining good indoor and outdoor environment such as walkways, greenery, landscaping, waste management, environment friendly transport etc.

The need of hospital building interior for maintaining good indoor air quality, lighting and ventilation. Hospital need to have user friendly architecture elements, well-decorated rooms, comfortable rooms and fresh air for hospital. The inadequate ventilation impact in most hospitals also contributes to the poor indoor air quality and pollution. According to Abduladheem (2013) highlights well design of ventilation and air conditioning provides a healthy and comfortable environment for users such as patients, workers, and public visitors. A well designed ventilation opening was requires careful architectural, environmental and cultural considerations (Todd, 2007; S. Aripin (2007).

The consideration of clinical waste in hospital for sustainable. According to Affendy (2009) and Affendy et al. (2015) stated that BM manager must environmental sustainability which create environmental responsible of handling toxic materials which attention must be scheduled in-term of handling the activities. Thus, managers responsible to manage clinical waste collection in order it consist of hazardous and toxic waste in the hospital. In order to maintain sustainable, hospital has to be operated with minimum effect of waste. In fact, hospital waste contribution is one of hazard pollutants to the environment.

The proper handling and disposal of clinical wastes generated from hospitals is essential in order to mitigate against opposing health and environmental significances. According to Yong, et al. (2009) and Razali (2010) highlighted such a proper handling of clinical waste management were vital to avoid health risks and damage the environment. All the clinical waste handlers must use the protective gears. Furthermore, Suwasono et al. (2013) highlighted the process of waste collecting for managing non-medical waste, the hospital staffs sort wet and dry waste into two different containers, with black plastic bag on each container, which have been provided on each room. Then, three times a day, the cleaning service officers collect and carry the waste to hospital garbage dump.

According to Sahamir and Zakaria (2014) stated not many of hospital buildings at local community being conferred green sustainability approaches. According to Olanrewaju (2008); Khamidi (2010); Zakaria et al (2011) highlighted that maintenance continuously affects the quality of environment by reducing waste, pollutant and other resources; reducing energy and water consumption and people's comfort, health, safety.

According to Kibert (2005) stated that the practice of sustainable building refers to the creation and operation of a healthy built environment. The core of sustainable may apply to the hospital maintenance which are protecting nature and eliminating toxics. In addition, (Abidin.

2009; Abidin et al,2010) highlighted that developers understand ‘sustainable activities’ from the environmental perspective. Furthermore, Abidin (2010) stressed that building activities will affect the sustainable development from its impact to the output. Also lack of exposure towards sustainability may create harm to the community (Abidin, 2009).

Green BM for Hospital within Building Services

Enshassi et al., (2009) highlighted that fault defects that affect the green maintenance for hospital building such as include plumbing broken-down, inadequate or faulty ventilation, uncooling systems, inadequate sound proofing; and inadequate fire protection systems. In relation to building services for hospital building the need to enhance green maintenance activities. According to Zawawi et al., (2011) highlighted BM maintenance comprises of lighting, telecommunications and sanitation and HVAC, need inspection rapidly. The BM manager need to considered difficulties and challenges interm of repairing and cleaning of hospital buildings. (Straub, 2003; Zawawi et al., 2011).

Methodology

This section describes research design, sample selection, strategies to access respondents, data collection and data analysis used in this study. The process was consists of several process for the outcome of proposed green action for BM departments. The process as follows as identify BM criterions; integrate with the green maintenance; interviews within BM departments; integrate BM criterions within observation and proposed green action for BM hospital maintenance department.

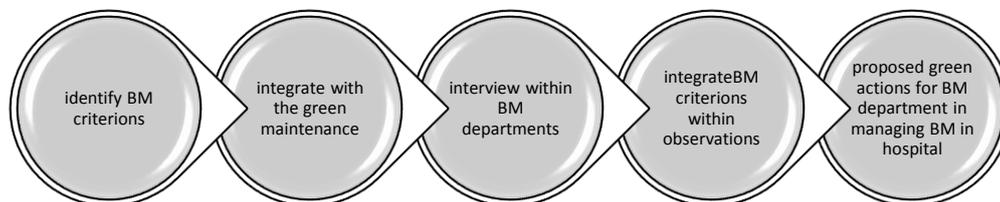


Figure 1: The green building maintenance framework

Research Method

In this study, the data was collected by questionnaires, interviews and observations. The selection of the respondent based on the BM practised in the workplace. The survey was conducted for evaluation of green practices at several hospitals. Managers in BM were interviewed and several places with specialities were observed.

Results and Discussions

Table 1: Green element application in hospitals

GREEN ELEMENT	ACTIVITY	ISSUE	EFFECT ON ENVIRONMENT	SOLVING	INDICATORS
Green maintenance	Maintenance appliances	Electricity, heating, water	Effect on energy usage	Using modern technology for less consumption	Monitor usage of energy
	Electronic equipment	Batteries and fluorescent lights	Used batteries and fluorescent lights are a cost for disposal processes	Collect and take to proper discharge place	Exchange intervals of fluorescent lights or proposed to use solar energy
Green segregation	Paper usage, disposal tissue	Garbage, paper and boxes	add to unnecessary landfills	Collection of waste, recycling	Monitor paper usage
Green transportation	Logistics	Logistical problem	Traffic emissions, air pollution, noise	Planning on delivery, transporting	Reduce traffic congestion by zoning transportation such as emergency, visitors and staffs
Green cleaning	Fabric cleaning	Towels for single use	Much chemical for cleaning towel	If possible, usage of multi use towels	Follow up towel usage
	Storage	Optional of storage	Unused of medicine are a cost of disposal process. Require more space for storage	Effective storage management	Amount and value of expired product
	Patients return of unused and expired medicines	Medical waste	Environmental problems if not discharge properly	Use of small packaging and information to recycling	The amount of returned medicine per year
	Pharmacy	Packaging drugs	Unnecessary landfill	Patient information, ask if they bring own bag	Use biodegradable plastic or paper bag
	General practitioner	Environmental hazards	Toxic effects on the environmental	Provide guidelines on prescription	Reminder to the practitioners

Table 1 shows the green practices for hospitals building through observation case studies. Most of the green practices apply throughout green cleaning. Through observation the need to have need a comprehensive management. If the clinical management waste poorly managed, it will cause adverse effects to in-house managements. As summary, the green maintenance principles were highlighted the ecological building materials; the usage of energy efficiency in hospital building; and the green management of the maintenance task and waste monitoring originating.

Table 2: Integrated of green practices within hospital specialities

BM PERSONNEL	GREEN INDICATOR /BUILDING	1	2	3	4	5	6	7
BUILDING SERVICES ENGINEER	Mechanical and Electrical	HP						
SAFETY MANAGER	Fire Safety	HP	HP	HP	HP	HP	LP	HP
MANAGER CARE UNIT	Clinical waste			HP			HP	
FACILITY MANAGER	Green recycle	HP						HP
	HP- Top priority LP – less concern Departments/Specialties 1 Pharmacy ; 2 Lifts/Lobby/Reception/Staircase; 3 Medical and surgical;4 Radiology ;5 Dietetic ; 6 Diabetic resources; 7: Medical storage							

Table 2 shows the connection within hospitals departments being observed throughout green maintenance attention at several departments at the hospital. Four main areas concentrating the mechanical and electrical, fire safety and clinical waste and green recycle was responsible in integration within green practices at the hospital departments. The highest priority at specialities such as at the pharmacy area, medical and surgical tracks by medical storage indicates the practising of green approaches.

Findings

Analysis was performed on data that has been collected in two aspects which consists of green maintenance and safety and health for hospital practising in green maintenance. The findings of the study, summarise the element of green maintenance practices in the BM of hospital buildings in ECR, all core element of GBM must be considered. The need to have green hospital operation focusing to attention to the sustainable approach for daily maintenance operation. Effective BM not only ensure good working environment, but also contributes to upkeeping the green practicing value of the hospital buildings. This is important to address recently, green practices in hospital buildings. Thus the BM managers for green hospital need to appoint green practices as well as to fulfil the sustainable hospital.

Conclusions

A hospital is not just a building, but a facility with complex purposes, which essential to be organized so that all facilities can be provided safely and efficiently. Overall, the results of this study considered that the BM values through green practice could be apply as a basis to develop maintenance principles in the BM industry in Malaysia for the hospital building users. Throughout this study found that hospitals building was consists of numerous functions that requires different working environment that relates to people, equipment, and the BM activities. The hospital project comprises different features from the most usual projects of residential, office or service buildings. Finding, various design requirements, hospital buildings are need to fulfil and operated to meet the sustainable development requirements. Therefore, green practice for hospital design must considered maximize the use of natural light and ventilation while considering the building orientation; building materials should be free from toxicity and be environmentally friendly; the facilities should increase the sense of a healing environment, and clean water usage for users. In other perspective, a green hospital design hopes to provide users with energy savings and a comfortable environment through innovative designs and green

maintenance. The study concludes that, the challenge the hospital BM industry is facing today is not only to complete projects within time, cost and quality, but to integrate various constraints such as economic, environmental and social needs in the act of building. By adopting green with approaching of sustainable BM, it can reduce the overall energy use and maximize potential for renewable energy supply, minimize waste, conserve water resources, enhance water quality, incorporate water sensitive design and minimize vulnerability to flooding, minimize polluting emissions to water, air and soil and minimize noise and light pollution.

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