

IN-HOUSE GREEN KNOWLEDGE PRACTICE FOR HOSPITAL BUILDING MAINTENANCE

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Abstract : *The purpose of this study 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 Knowledge, Building Maintenance, Hospital*

Introduction

The study is interested to highlights the green practices for hospital building. The most complex fields of facilities management is the BM of hospital facilities. Rani et al.(2015) stressed that hospitals required to purposefully make over the outdated methods of maintenance practices to achieve better performance of the facilities. According to Amankwah et al, (2017) stated that hospital BM management was problem such lack and lack of green maintenance practising. Therefore the need to identify green application in the daily operation for the hospital.

Green Movement In Community

Over the past decade in particular, sustainable improvement has become an vital aspect of the BM industries. Green management has been the main discussed topic among BM industry players nowadays. the Country Master Plan (2005 –2015) is of significant importance for the Malaysian construction industry (CIMP 2006-2015). Many countries including Malaysia are now trying to make green technology as a back bone behind every development agenda in the future. (CIDB, 2011).

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.

Building Maintenance Practising For Hospital

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, Khamidi and Idrus, 2011; Amani et al ,2012). BM activities, such as repair maintenance contribution integral part of building industries. The aim of BM is to preserve a building in its original operational state and achievable, therefore it works purpose efficiently (Al-Zubaidi 1997); Chanter and Swallow 2007; Zawawi et al. 2009). BM hospital practitioners are required to understanding the scenario of BM and hospital practicing green application. Therefore, green practising will filling the sustainable knowledge gap and to realisation of a sustainable 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. As hospital buildings are complex in accommodate facilities, the BM hospital department faces more challenges in managing such activities. Thus, buildings become more complex in design and facilities, Zakiyuddin et al., (2016) highlighted that the BM organisation getting more challenges, thus the need of expertise for completion BM tasks. BM for public buildings were not frequently maintained for the reason that most faults cannot be notable at their early phase (Utusan Malaysia, 2006). 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).

Addressing Green Maintenance Issues

Nowadays, hospitals are designed independently by different architects for different service providers with different viewpoints. Hereafter, hospital designs at this time remain not uniform. The need to standardise the new hospital in relation much was not be assessed. While old hospitals may not be sustainable in the like of the new requirements in healthcare buildings.

According to Mohammad et al.(2015) stated that the Government bring together green building as a challenges to achieve the goals of sustainable development. Green building has an main role in achieving the aim of sustainable development which is to protect environment and to improve the quality of human life. (Fisk and Rosenfeld, 1998; Mohammad et al. (2015).

Hospitals 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.

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 must be kept as “safe hospital” will help to guide the approach to assessing the safety of hospitals. A safe hospital is a facility whose services remain accessible and functioning at maximum capacity, and with the same infrastructure, before, during and immediately after the impact of emergencies and disasters.

The proper BM should be really maintained in a good and effective manner. Zakaria et al. stated that a building must ensure that it is in a safe, proper utilised, fulfils all authorized requirements and sustains its form quality. Buildings as physical entities of the built environment such hospital buildings. Building hospitals that are alert to local climate conditions and enhanced for reduced energy and resource demands. Nawawi et al. (2013) stated that all hospital designs are subjected to the Uniform Building By-Laws (UBBL) 1984. UBBL incorporated the minimum requirement on passive design considerations for the users for the purpose of health and safety. According to Braganca et al., (2007) highlights the components for sustainable building such as space system; services; indoor conditions. stability, flexibility, comfort, accessibility and environmental impacts. Furthermore, Nawawi et al. (2013) also stated that foremost focusing for sustainability is in its ability to function, support operation, and serve the users-i.e. patients, staffs, relatives, visitors and medical equipment, efficiently. In addition, Nawawi et al. (2013) highlighted that healthcare buildings has to be designed for hygienic control; control infection of adequate space and capacity for the function; ease of circulation; adequate ventilation; safe and comfortable environment and having supportive healing environment among its design attributes.

In term of architectural and civil activities, hospital BM must generate green practices. According to Nawi et al., (2013) stated that BM structure is a vital component in the field of architectural and civil engineering. The need to have intention on building structural defect maintenance. Adenuga et al (2010) and Adenuga (2010) highlighted that the need to have BM principles for public buildings because some are in very poor and unacceptable conditions of structural and decorative poor condition. According to Isa (2011) stated that BM defect on building structural may cause during construction failure. Due to this, most defects are not properly recorded and resolved, and may affecting maintenance costs. Isa (2011) mention that designers play to eliminate defects. Factors such as poor specifications, selection of materials, workmanship and supervision the common cited causes of defects, poor design decisions are identified as the most significant contributor to the defects.

According to Enshassi et al., (2009) highlighted that several types of defects that affect the green maintenance for hospital building such as include faulty plumbing , 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., (2009) stated that building services elements in BM such lighting, HVAC, telecommunications and sanitation are considered to need most maintenance attention. The maintenance managers of healthcare facilities need to considered challenges from the repair, maintenance and cleaning of hospital buildings. (Straub, 2003; Zawawi et al., 2011). According to Abdul et al. (2016) stated that heating ventilating and air conditioning (HVAC) is the equipment that provides environmental comfort inside of a building.

Green Maintenance Practices For Hospital

Currently, this is green maintenance was challenging the BM sector and all its stakeholders, mainly the BM teams. To achieve sustainability in hospital BM is essential view practices guided by indicators and performance targets, able to assess integrate within dimensions of Sustainable Development: environment, society and economy.

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).

Green design emphasizes a number of features (Fik, 2005; Huff, 2009): reducing energy use; improving aeration; using passive solar heating and cooling; considering the life-cycle impact of building materials; improving water-use, -capture, and -recycling; and the integration of climatic- and site-features (Ismail, 2013). The practice of green building is to reduce consumption of energy and material resources throughout the building life cycle. According to Nielsen et al., (2009) highlighted that green maintenance should focus on reducing energy, waste and water in the BM.

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 aim of green cleaning is 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.

Green Safety And Health Practices For Hospital Maintenance

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. Nawati (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 demolition 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 planning for maintaining good indoor air quality, lighting and ventilation. The consideration of clinical waste in hospital for sustainable. According to Affendy (2009) and Mohammad (2015) stated that BM manager must create environmental handle toxic materials which attention must be planned in-term of handling the activities. Thus, managers must able 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 dangerous 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.

According to 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.

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).

Internal building must have a good circulation of ventilation air for hospital. Hospital need to have user friendly architecture design, 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).

Research Method

To achieve the purpose of study, data collection was carried out by questionnaires, interview and observation. 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 practices for hospitals through observation in the case studies.

GREEN COMPONENT	ACTIVITY	ISSUE	EFFECT ON ENVIRONMENT	SOLVING	INDICATORS
Green segregation	Paper usage, disposal tissue	Garbage, paper and boxes	add to unnecessary landfills	Collection of waste, recycling	Monitor paper usage
	Hospital department building	Electricity, heating, water	Effect on climate and waste	Using modern technology for less consumption	
Green maintenance	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 cleaning	Fabric cleaning	Towels for single use	Much chemical for cleaning towel	If possible, usage of multi use towels	Follow up towel 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	Pharmacy	Packaging drugs	Unnecessary landfill	Patient information, ask if they bring own bag	Use biodegradable plastic or paper bag
Green cleaning	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
Green cleaning	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
Green cleaning	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.

Table 2 Relationship between hospital specialities observed within the green practise

Roles in BM	GREEN ELEMENTS /BUILDING	1	2	3	4	5	6	7
BUILDING SERVICES ENGINEER	Mechanical and Electrical	MP	MP	MP	MP	MP	MP	MP

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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