The Relevance of *Green Building* in Creating a Healing Environment in Hospital Designs in Malaysia

Kerelevenan 'Green Building' dalam Membentuk Suasana Pemulihan pada Reka Bentuk Hospital di Malaysia

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Abstract

Green building is presently the buzz word in the construction industry in Malaysia. With the presence of Green Building Index rating tool, the building is perceived as an opportunity for developers and building owners to design and construct green as well as to achieve sustainable buildings that can save energy and water, healthier indoor environment, better connectivity to public transport, and adoption of recycling and greenery as well as reduce impacts on the environment. In the case of hospital buildings, where patients seek medical treatment and hospital staffs provide continuous 24 hour support, achieving sustainable building for a healing environment is important. In an effort to create an environment that is physically healthy and psychologically appropriate for hospital buildings, this paper aims to critically review the relevance of the green building concept in a sustainable development of a hospital. First, thematic reviews on the concepts of healing environment and green building, as well as the available rating tools for green buildings from other parts of the world were carried out. Assessment on the Green Building Index rating tool for hospital buildings in Malaysia was performed on the two public hospitals. Interviews were also carried out using structured questionnaire surveys on the selected respondents such as medical (doctors and nurses), management and maintenance personnel to gauge their views on green building concept for hospital. Preliminary findings indicated that the Green Building concept is perceived by staff to be relevant in hospitals in order to achieve an environment that is physically healthy and psychologically appropriate for patients, staff and visitors. The paper also highlighted other factors needed to achieve the green building rating scale for existing public hospital buildings in Malaysia.

Keywords *green building, healing environment, hospital design, sustainability*

Abstrak

Green building adalah kata kata terkini dalam industri pembinaan di Malaysia. Dengan adanya peralatan penarafan Green Building Index, bangunan dilihat sebagai satu peluang untuk pemaju and pemilik bangunan untuk mereka bentuk dan membina berasaskan hijau dan pada masa yang sama bagi memperolehi bangunan yang mampan yang boleh menjimat tenaga dan air, persekitaran dalaman yang lebih sihat, ketersambungan kepada pengangkutan awam yang lebih baik, penggunaan kitar semula dan suasana hijau serta mengurangkan impak kepada persekitaran. Dalam kes bangunan hospital di mana pesakit mendapatkan rawatan dan staf hospital menyediakan khidmat berterusan 24 jam, menghasilkan bangunan mampan untuk persekitaran pemulihan adalah penting. Dalam usaha menghasilkan persekitaran yang sihat secara fizikal dan psikologi untuk bangunan hospital, kertas ini mengkaji secara kritikal relevannya konsep green building pada pembangunan mampan sesebuah hospital. Pertama, kajian tema terhadap konsep persekitaran yang menyembuhkan dan green building, juga peralatan penarafan green building yang sedia ada daripada tempat-tempat lain di dunia. Penilaian terhadap penarafan Green Building Index bagi bangunan hospital di Malaysia telah dilakukan terhadap dua hospital awam. Soal selidik juga telah dijalankan menggunakan kaji selidik soalan berstruktur terhadap responden terpilih seperti staf perubatan (doktor dan jururawat), pengurusan dan selenggara untuk mengukur pandangan mereka terhadap konsep green building di hospital. Dapatan awal menunjukkan konsep green building dilihat oleh staf sebagai relevan kepada hospital untuk mencapai persekitaran fizikal yang sihat dan psikologi

Jurnal Perspektif Jil. 7 Bil. 3 (39-46)
ISSN 1985-496X

yang membantu pesakit, staf dan pelawat. Kertas ini juga mengetengahkan factor-faktor lain yang diperlukan untuk mencapai skala penarafan green building untuk hospital sedia ada di Malaysia.

Kata kunci *green building, persekitaran memulihkan, reka bentuk hospital, kemampanan*

Introduction

'Green' is presently the buzz word in the construction industry in Malaysia. With the adoption of Green Building Index rating tool, the building is perceived as an opportunity for developers and building owners to design and construct green, sustainable buildings that can provide energy savings, water savings, a healthier indoor environment, better connectivity to public transport and the adoption of recycling and greenery for their projects and to reduce impacts on the environment.

The call for sustainability or *green building* in the healthcare system is a paradoxical situation. Does it treat sickness or promote the condition of health? In hospital buildings, it is difficult to conceive the link and benefit of sustainability in contributing to the patients' health outcomes. Perhaps, to explain this, discussion evolving sustainability in healthcare facilities should embrace the notion of creating a supportive environment in hospital designs (i.e. healing environment) that is physically healthy and psychologically appropriate. As a matter of fact, it should be the aim of designing a hospital. For this, it is imperative for the physical aspects to be considered in hospital buildings. The physical aspects (i.e. building orientation, day lighting, window design, thermal conditions and others) should be cleverly designed to achieve the balance between principles of economics, social and ecological sustainability without compromising the functionality of hospital building.

This paper aims to critically review the relevancy of *green building* in a sustainable development of a hospital. At the outset, thematic reviews on the concept of healing environment, *green building*, and available rating tools for green building from other parts of the world were carried out. Assessment on the Green Building Index rating tool for hospital building in Malaysia was made on the two public hospitals. Interviews were also carried out using structured questionnaire surveys on selected respondents such as hospital management, hospital staff (doctors and nurses), hospital maintenance and healthcare designers to gauge their views on *green building* for hospital.

Background Study

Hospital Design and Creating a Healing Environment

In hospital buildings, where patients seek medical treatment and staff provides continuous support, creating a healing environment with appropriate physical aspects is important to get sustainable designs (Aripin, 2010). Nevertheless, the restoration of health and well being is not merely a matter of physical science (Day, 2007). The aspect of healing environment in hospital design is important and relevant in the context of sustainable in healthcare facilities. The term *Healing Architecture* (Lawson, 2002) is adopted to invoke a sense of a continuous process in creating an environment physically healthy and psychologically appropriate. A healing environment with appropriate physical aspects would indirectly contribute to patients' outcome such as shorter length of stay, reduced stress, increased patients satisfaction and others (Ulrich et al., 2004). One may agree to the idea that sustainable hospital design in the form of healing environment is achieved if these measurable outcomes could be quantified through appropriate design of physical aspects. Apparently, most scholarly literatures do acknowledge that the existing physical environment we live in has an effect on our well being (Lawson, 2002; Day, 2007 and Todd, 2007).

Much literature on the healing environment has reached a consensus that the physical aspects of built environment could contribute indirectly to the health outcomes of patients and staff in hospital buildings (Weber, 1995; Ulrich, 2000). The relevant researches in the healthcare settings that provide significant improvement of health outcomes includes Alzheimer's disease special-care units, inpatients units, outpatient surgery and emergency departments. In researches relating to healing environments, measures used to quantify health outcomes have been identified (Schweitzer et al., 2004) as the following:

a. Medication use

b. Length of hospital stay
c. Patients satisfaction
d. Provider satisfaction
e. Well-being, mental status, and depression scale scores
f. Pain self-rating
g. Sleep questionnaire, sleep scores
h. Hospital-acquired infection rate
i. Stress behaviour
j. Weight and weight gain (especially in newborns)
k. Patients comfort (self-rating)
l. Physiological indicators such as heart rate, blood pressure, and aspiration

Other typical measures of health outcomes, which have been used in the environmental research projects, mostly conducted in the offices, schools, gardens and residential buildings, include:

a. Well-being
b. Performance
c. Positive functioning
d. Workplace productivity
e. Healthiness
f. Emotional effect
g. Cognitive functioning and positive mood
h. Standardized tests

Green Building and Its Impact to Hospital Design

In reducing the environmental impact in construction industry, *green building* is seen as a solution to achieve sustainable development in built environment (Norwina, et al., 2014). The green building structure adopts the process that is environmentally responsible and efficient of building life cycle, which involves site selection, design, construction, operation, maintenance, renovation and demolition. Among the common objectives for green buildings initiatives are designed to reduce the overall impact of the built environment on human health mentioned above and the natural environment by (1) Efficiently using energy, water, and other resources, (2) Protecting occupant health and improving employee productivity, and (3) Reducing waste, pollution and environmental degradation.

Most literatures come to a consensus that the term *green building* provides the building industry with a common definition of "green" and emphasizes state-of-the-art strategies for sustainable site development, water savings, energy efficiency, materials selection and recycled, minimizing waste and indoor environmental quality. The *green* construction fulfills the social aspect by giving the community a sense of pride with its beautiful landmark structure. The tangible outcome by constructing energy-efficient buildings would lower operating costs and planning ahead to ensure multiple purposes will also save resources over the long term. Most players in the construction industry believe that adopting *green building* would revolutionize the way builders and architects around the world design construction projects leading to push market innovation to stimulate effective, high quality, high performance building practices.

In summary *What and Why Green Buildings?*

1. *Green buildings* are designed **to save energy and resources, recycle materials and minimize** the emission of toxic substances throughout its life cycle.

2. **They harmonize with the local climate**, traditions, culture and the surrounding environment.

3. *Green buildings* are **able to sustain and improve the quality of human life** whilst maintaining the capacity of the ecosystem at local and global levels.

Jurnal Perspektif Jil. 7 Bil. 3 (39-46)
ISSN 1985-496X

4. *Green buildings* **have many benefits,** such as better use of building resources, significant operational savings, and increased workplace productivity.

Building green sends the right message about a company or organization – that it is well run, responsible, and committed to the future.

Creating a sustainable building for a healing environment is a need, especially where a hospital building is in use for continuous 24-hour operation. "Green" initiative to achieve sustainable building is a relevant agenda for hospital designs (from inception to completion as well as its operation). In the U.S, the green hospital movement began in early 90s following the U.S. Green Building Council (USGBC)'s release of their Leadership in Energy and Environmental Design (LEED) standards for building construction.

A study carried out by the US Environmental Protection Agency (EPA) in 2006 entitled "How Healthcare Impacts the Environment", states that hospital buildings, which provide continuous medical support of 24-hour, impact the environment by the following:

1. Generating approximately 7,000 tons per day of waste, including infectious waste, hazardous waste, and solid waste.
2. Using mercury in medical devices, equipment, light bulbs, etc.
3. Using materials that may have toxic effects: PVC, DEHP, cleaning materials, heavy metals in electronics, pesticides, batteries.
4. Consuming large amounts of energy in buildings and car fleets, and generating significant greenhouse gas emissions.
5. Consuming large amounts of water for domestic use and heating/cooling as well as landscaping.

However, very little has been said about hospital buildings in Malaysia going *green.* In Malaysia, the effort to establish Green Rating Tools for buildings in the tropical climate has been initiated by *Pertubuhan Arkitek Malaysia* (PAM) collaborating with Consulting Engineers Malaysia together with an NGO called The Malaysian Green Building Confederation (MGBC), sometime in August 2008. The outcome of that effort, the Malaysian Green Building Index (GBI) was established and launched in 26 April 2010.

The impact of *green* hospital building (i.e. the physical aspects of healing environment) is to benefit all users of the healthcare facility: staff, clinicians, administrators, patients and families. It should influence the way in which the quality of public hospital environments in Malaysia are created. To a certain extent, the 'new' environment that is expected as an outcome from this study would consequently benefit patients especially those with special illnesses, such as schizophrenia, dementia, Alzheimer's disease and others. In general, a hospital building can only be defined as Green Hospital if one or more of the following initiatives are considered from the inception to completion of the building construction and maintaining its greening agenda throughout its operation:

1. chooses an environmentally friendly site,
2. utilizes sustainable and efficient designs,
3. uses green building materials and products,
4. thinks green during construction, and
5. keeps the greening process going.

By adopting green in hospital design, it is hoped that hospital buildings create environmentally friendly atmosphere that promotes both physical and spiritual healing. One of the reasons for moving towards a greener approach to healthcare is the positive impact on patients' and staff's health and well-being which includes shorter length of stay and better ventilation system which improves the well being of patients and staff.

Green Building Rating Tools

The Green Building Rating Tools adopted in various countries depending on the location and climatic conditions are listed in Table 1.

Table 1 Green rating tools adopted by other country including Malaysia

No.	GREEN Rating Tool	Country
1.	BREEAM (Building Research Establishment's Environmental Assessment Method)	United Kingdom
2.	CASBEE (Comprehensive Assessment System for Building Environmental Efficiency)	United States of America for Japan
3.	LEED (Leadership in Energy and Environmental Design)	United States of America
4.	Green Star	Australia
5.	BCA Green Mark	Singapore
6.	Green Building Index (GBI)	Malaysia

Comparison among the Green Rating Tools as listed in Table 1 were carried out and the findings are:

1. All Green Rating Tools evaluate Energy Efficiency (EE) as the main factor for evaluation and not all factors are considered for evaluation in many Green Rating Tool.
2. Indoor Environmental Quality (IAQ) are the concerns of all Rating System except BREEAM.
3. BREEAM and Green Star have ten (10) factors to evaluate.
4. GBI did not cover the factors on Land Use & Ecology, Emission, Water Efficiency, Waste, Pollution, Regional Priority, Awareness & Education, Location & Linkages, Environmental Protection and Local Environment.

Points allocated for Malaysian Green Building Index is shown in Table 2

Table 2 Points allocation of Green Building index for Malaysia

Evaluation Factor	Non-Residential (%)	Residential (%)
Energy Efficiency (EE)	35	23
Indoor Environment Quality (EQ)	21	12
Sustainable Site Planning & Management (SM)	16	37
Materials & Resources (MR)	11	10
Water Efficiency (WE)	10	12
Innovation (IN)	7	6
Total	**100**	**100**

Classification of Rating
Platinum (86+), Gold (76 – 85), Silver (66 – 75), Certified (50 – 65)

This study focuses on hospital buildings and therefore, the Non-Residential Rating Tools will be used for evaluation during the field surveys.

Methodology for Field Survey

Assessment on the Green Building Index rating tool for hospital building in Malaysia was made on the two public hospitals. The two hospital buildings were selected based on the common denominators and established criteria. However, the results of the points scored by both hospitals cannot be revealed due to confidentiality. In this study, interviews were also carried out using structured questionnaire surveys on selected staff of the hospitals as respondents which included the Management, Staff (doctors and nurses), Maintenance and Healthcare Designers, to gauge their views on *green building*. The analysis of the survey was carried out using SPSS.

The questionnaires were numbered and codes were established for each public hospital in the case study. Then, the responses were coded accordingly. The responses from the close-ended

Jurnal Perspektif Jil. 7 Bil. 3 (39-46)
ISSN 1985-496X

questions were coded and labelled for input into the statistics software. The answers from the open-ended questions were logically grouped and synthesised. The data were analysed using SPSS, version 17. The methods adopted in analysing the responses of the four target-groups were frequency, cross-tabulation, descriptive and multiple responses analyses. Cross-tabulation assessment was employed to ascertain the relationship between one dependent variable to other variables.

Response Rates

In total, 64 questionnaires were issued to the respective respondents of the two target-groups (hospital personnel and healthcare designers). 52 completed questionnaires were returned and processed. The overall successful response rate for the four survey questionnaires in the fieldwork was 81%. A breakdown of response rate by target-group is illustrated in Table 3.

Table 3 Response rate of the questionnaire survey for both public hospitals

Target-group		Number of questionnaires issued		Number of questionnaires returned		Response rate %
1. Hospital Management		2		2		100.0
2. Hospital Staff	Doctors	20	50	12	42	84
	Nurses	30		30		
3 Hospital Maintenance		12		12		100
4. Healthcare designers		10		5		50
Total		**64**		**61**		**81**

Table 4 Breakdown of response rate by each hospital

Target-group		Hospital 1		Hospital 2		Total
1. Hospital Management		1		1		2
2. Hospital Staff	Doctors	6	21	6	21	42
	Nurses	15		15		
3 Hospital Maintenance		5		7		12
4. Healthcare designers		5				5
Total		**27**		**29**		**61**

Discussions and Findings

The findings of the questionnaire survey of the four target groups are summarised and discussed as follows.

Hospital Management and Hospital Staff (Doctors and Nurses)

a. Majority of hospital staff support the green agenda.
b. Due to the nature of their priority that patient life is more than anything else, the policy of green hospital building is absence or limited to Non-smoking zone only Policy of Length-of-Stay (LoS) is more prominent then green policy.
c. Suggested more awareness programs on *green building* and sustainability agenda to all levels of hospital staff.
d. Accessibility to greenery is limited by the staff and visitors.
e. Less dependent on car.
g. Efficient public transportation would be able to solve vehicle congestion problem to both hospitals.
h. Suggested training on human resource for Green and Energy Expert.

The Hospital Maintenance

a. The GBI tool emphasizes more on the active system rather than passive method in energy efficiency area. Evidence can be seen through the requirement for purging system.
b. Efforts must be made to ensure that the usage of GBI tool for hospital buildings is friendlier. Some of the terminologies require annotations and explanations. Graphical visualization would be more of help to the end-user who will use the GBI tool.
c. As a hospital is a complex of buildings with multiple functions and purposes, the description in the GBI tool is too generic. There is a need to even breakdown to an area for a specific space and function. For example, Operation Theatre – it may require specific description to score marks for green. Thus, recommendation to breakdown the items is highly desirable for hospital functions which would make much more clearer and solve the uncertainty. Perhaps by doing so, the user can gain more points.
d. GBI tool is not seen as a solution provider for existing buildings. Instead, it is more of imposing requirements. Therefore, cost may be incurred to achieve the score.
e. Both hospitals do not adopt/apply renewable energy technology.

Healthcare Designers

a. To achieve *green building* for hospital function requires a set of the body of knowledge on science and not purely intuitive design practiced by the professionals of healthcare designers. Thus, more detailed guidelines would be of help for healthcare designers.
b. Most of the healthcare designers were hesitant to accept the imposition of GBI as part of the requirement for submission of plans to local authority.
c. Passive Design Strategy should be the utmost priority before thinking of active strategy in achieving *green building*. This is evident as all agree that day-lighting benefits patients.
d. Cost will be incurred for green course.
e. There is a strong promotion or imposition of green materials and products. This is seen as a move towards a closed market and can lead to biasness.

Conclusion

Achieving sustainable hospital design through appropriate physical aspects is not an impossible task. *Green building* concept is therefore relevant to be adopted and implemented in hospital buildings in Malaysia. However, emphasizing passive design strategy (instead of resorting to active system) at the early stage of the design is to be given the upmost priority for hospital buildings. Such considerations for hospital buildings are building orientation, in which wards should avoid, where possible, facing east-west direction due to heat gain, daylight should be optimized in day-lighting design to achieve visual comfort to obviate the need for artificial lighting during the day and others. There is also a need for detail guidelines and friendly brochures for healthcare designers, hospital staff (doctors and nurses), hospital management and maintenance in order for them to ensure to understand in achieving *green building* for hospital. Renewable energy must be emphasized and a possible application for a secondary usage.

Acknowledgement

The authors would like to express their gratitude to NAPREC, INSPEN for providing the research grant for the study. This paper would also be impossible without the assistance of the following government departments and private agencies in conducting the case studies of hospital buildings and gathering information of Malaysian healthcare systems: The Ministry of Health Malaysia (MoH), Public Works Department Malaysia (PWD), Directors of State Health, Hospital Directors, Radicare

(M) Sdn. Bhd., Ministry of Higher Education Malaysia (MoH) and International Islamic University Malaysia (IIUM).

References

Aripin, S. (2010). Healing architecture: Daylighting design in hospital environments in Malaysia, *The Arab World Geographer*, vol. 13, no. 2, 2010, pp. 138-149. (Scopus) ISNN: 1480-6800, http://ArabWorld Geographer.socsci.uva.nl/.

Day, C. (2002). *Spirit & place: Healing our environment, healing environment*. Oxford: Architectural Press, Jordan Hill.

Lawson, B. (2002). Healing architecture. *The Architectural Review*, 211(1261), 72.

Norwina Mohd Nawawi, Abdul Razak Sapian, Noor Hanita Abdul Majid, Srazali Aripin. (2014). *Hospital design in tropical Malaysia towards a green agenda*. Proceeding of 33rd International Public Health Seminar, published in TESIS Inter-University Research Centre "Systems and Technologies for Social and Healthcare Facilities", University of Florence, Italy, 2014, pp. 277-290.

Schweitzer, M., Gilpin, L., & Frampton, S. (2004 Supplement 1). Healing spaces: Elements of environmental design that make an impact on health. *Journal of Alternative & Complementary Medicine*, 10, S-71-S-83.

Todd, W. (2007). A room with more than a view. *The Next American City* (14), 40.

Ulrich, R., Zimring, C., Quan, X., Joseph, A., & Choudhary, R. (2004). *The role of the physical environment in the hospital of the 21st century: a once-in-a-lifetime opportunity*. The Center for Health Design.

Weber, D. O. (1995). Environments that heal. *The Healthcare Forum Journal*, vol. 38, no. 2, p. 42.