

FRAMEWORK OF GREEN BUILDING MAINTENANCE

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ABSTRACT: Building maintenance can be used for services, facilities, facades, elements and structures and each maintenance activity is different in their classification. All buildings require maintenance to allow buildings to continue to operate, keeping their value as high as possible and extending their lives. Building maintenance is also important to provide a safe and better working environment and to maintain the aesthetic value of the building. However, its less concern on building maintenance towards green building residential project. Therefore, this paper its to study and identify the building maintenance criteria towards green building residential project. The extensive literature review from the latest 10 years of publication has been use to run this study. Perhaps, the expecting finding may contribute and enhance the existing knowledge towards this issue.

Keywords: Building maintenance, green building criteria, green building maintenance

1. INTRODUCTION

Every building element requires care to restrict the deterioration and exposure of the elements which eventually thirst. According to [1,2, 3] it is important for buildings to have the activity of building maintenance to keep them in good condition of working. The same authors, also in line with [2, 4, 5], agree that, generally building maintenance is defined conclusions from the different definitions as a combination of technical and related administrations actions to ensure that all building items and elements is working and work in satisfactory and acceptable standards.

As a fact that Building Maintenance can be used for facilities, services, elements, facades and structures and each maintenance activity is different in their classification while; All buildings require maintenance to allow buildings to continue to operate, keeping their value as high as possible and extending their lives [6, 8, 10]. According to the same author, to get good maintenance practices in the building, it is important to take into account the whole maintenance management aspect which is standard maintenance, maintenance planning, statutory control, maintenance information, cost management, maintenance organization, service delivery, maintenance document, and sustainability. Everything must be well designed to provide a good application for building maintenance. Strategy of maintenance is one of the important elements to be carefully selected based on these factors such as building size, user standard, budget and functionality, as well as any relevant factors reflected to the Building Maintenance [7, 9, 12]

In order to achieve Malaysia's Advanced Economy by 2020, gazetted as an important milestone in the Eleventh Malaysia Plan 2016-2020 [11, 13, 15]. Where in The Eleventh Malaysia Plan has developed six core strategies which one of them focuses on continuing green growth for sustainability and endurance. This is where the place in country will begin green growth, particularly in the development of the new project. Besides, it will also be a lifeway for Malaysians. They are not only either the public or government sectors put their effort to take the initiative in developing green environment and culture, but also NGOs and private companies [14, 15, 18].

Therefore, this study is to seek for the main criteria of building maintenance of conventional building to emerge with the green building particularly for residential types of

project. Even though the application of green building in Malaysia is still at the initial stage, but in a few buildings in Malaysia, there are some successful applications of green building [19, 20]). Nevertheless, the green building application in this country is still low, especially for residential types of project. Due to the merits of green building offered, the trend of applying such green building is spread in building industry slowly to certain residential building project in urban cities is.

In the building industry, maintenance is a must. It should be practically handled. Maintenance is a work undertaken to keep, improve or restore every part of the building; to extend the life and maintain the value of the building [1, 16, 20] Building maintenance is so important to provide a better and safer working environment and to retain the value of aesthetic for the building [18]. Different type of building also functioned different. Hence, it adopt different maintenance management method [14, 18] With a numerous of benefits available, it pointed out that maintenance for green building should be promoted and used widely over the country.

2. RESEARCH BACKGROUND

The building maintenance strategy that is generally applied in Malaysian buildings is reactive or unplanned based and sometimes the strategy even the criteria not really suit based on the application of the building itself. The strategy claimed as ineffective if it causes frequent breakdown or downtime and require high maintenance cost for repairing also replacement work [12, 14, 19] stress the casues of no specific building maintenance measures leads to poor performance performing a building maintenance to existing building even to the green building.

Moreover, the Urban Wellbeing, Housing and Local Government Ministry carried out a survey and reported that more than 50% of the Malaysia high-rise residential buildings were ranked below average in the assess of property management standards. The survey also found the residents who live in these buildings was feeling dissatisfied with the service quality of current building maintenance management [12, 14, 19]. It is necessary to manage a physical asset in an effective and systematic way as it will affect the value of the site and the facilities.

Therefore, a clear identification on the criteria of building maintenance practicing in green residential building truly

appreciated to overcome the stated issues. Gazzetted by Ministry of Energy, Green Technology and Water (KeTTHA) is to improve green technology and environment (KeTTHA). Meanwhile, the Malaysian Institute of Architects / Association of Malaysian Architects (PAM) and Association of Consultants Malaysia (ACEM) have developed the Green Building Index (GBI) [3][5] as an assessment tool for assessing and evaluating the building green status. Malaysia Green Technology Corporation (GreenTechMalaysia) has also been formed to enact legal mechanisms for regulating and enforcing green technology, and to determine the role of each government agency involved in the implementation of green technology in the country (Rahman et al., 2013).

There are also many green technology exhibitions and conferences that have been held and established in Malaysia itself, for example in the region the largest green technology exhibition and conference, Green Technology and Water (KeTTHA), Ministry of Energy, Greentech International and Eco and Conference Malaysia Product (IGEM) Exhibition every year since 2010. This suggests that Malaysia has looked and moved towards the sustainability with the essential requirements of water efficiency, energy efficiency, materials and resources management, sustainability and planning, quality closed environment as well as new innovations.

Although the GBI rating tool is introduced, it can play the role as a benchmark for buildings to accomplish the green status. One of the criteria for assessing GBI's assessment is to ensure existing buildings are proper upgraded and refurbished to remain relevant and new buildings keep relevant in the future [11, 12]. The relevance speaks out loud on the building maintenance towards green building. However in Malaysia particularly, there is a problem where the non-existence of framework or guidelines which specify on building maintenance, Malaysia is not being fully observed and explored where it is always been rejected.

That are very advance in green technologies such as Germany, Canada, Japan and America, they already have their own guidelines for green building system which may leads to proper building maintenance strategy and procedure [10, 12]. Therefore, it can lead to determine the existing tools to measure building maintenance performance towards green building to extend the existing knowledge not only on GBI but also to any relevant tools defining in building maintenance particularly for green building residential types of project.

Therefore, to determine the existing tools to measure building maintenance performance towards green building particularly for Malaysia really much appreciated as Malaysia as for now moving forward to develop and deliver more green residential building. Even so, as compared to Singapore where have the same climate and weather, Malaysia is said to be far behind in terms of policies, practice, technology and research done in this area; Malaysia is lacking of government guidance, incentives and the support of green building standard organization this shows that the short of research and knowledge on maintenance system which mainly for tropical climate has led to a zero interest in using the system among the developers and owners of the building [12, 14, 20]. Maintenance can be said as a main part of the process in

managing green building system after the completion of construction and installation stage. Therefore, this research to investigate the barriers factors in practicing building maintenance to green residential building particularly for Malaysia scope.

The emerging of two conceptual ideas of building maintenance and green building may lead to developing to new conceptual framework on for to managing the green building and to do the routine maintenance process towards those building. The new developing framework may also lead to clear and better understanding and to enhance the existing knowledge towards the said concept.

There are many difference criteria for building maintenance so that we are going to identify the criteria of building maintenance which practicing in different type of building. Table 2.4 show the criteria of building maintenance from different references and the maintenance for different type of building too. For author 1 to 3 is doing the research for building maintenance on normal building; L. Jawahar Nesan et al define the criteria for building maintenance particularly for material and [3][15] is giving the criteria for building maintenance on heritage building. Among the 46 criteria, the most popular criteria that discuss by the authors are safety & security.

Table 1 criteria for building maintenance

Authors	Nik- Mat et al. (2011)	Olanrewaju (2009)	Roslan Talib et al. (2014)	L. Jawahar Nesan et al. (2015)	Mahmoud Sodangi et al.(2013)	Total
Assurance	√					1
Reliability	√	√				2
Responsiveness	√					1
Relevance	√					1
Timeliness	√					1
Validity	√					1
Cleaning & landscaping	√			√		2
General maintenance	√					1
Lighting	√					1
Air conditioning	√					1
Lifts/ escalators	√					1
Mechanical & electrical	√		√			2
Sanitary & washing facilities	√		√			2
Access, signage & parking	√					1
Safety & security	√	√	√	√		4
External finishes	√		√			2
Internal finishes	√		√			2

Durability			√		1
Material sustainability		√	√		2
Compatibility			√		1
Health and Safety			√		1
Material economy			√		1
Material availability			√		1
Functional performance			√		1
Thermal performance			√		1
Acoustical			√		1
Structural components		√			1
Roof component		√			1
Life cycle cost	√				1
Maintenance planning	√				1
User's satisfaction	√				1
Retaining cultural significance				√	1
Clear maintenance policies				√	1
Management plan				√	1
Management processes and procedures				√	1
Change in attitude				√	1
Maintenance prioritization				√	1
Regular inspection				√	1
Information management				√	1
Maintenance staff training and expertise				√	1
Conservation consciousness				√	1
Financial planning and budgets				√	1
Monitoring and review system				√	1
Planned maintenance approaches				√	1
Organizational culture and structure				√	1
Integration with corporate strategy				√	1

By referring to table 2 which about the criteria of building maintenance on green building. Among the 12 factors which pointed out by 5 different authors, it shows that the green building maintenance is more referred or concern on the criteria of thermal performance, life cycle approach and energy.

Table 2 criteria for green building

Authors	Ashok Kumar et al. (2013)	Nurul Nadijah Zainol et al. (2014)	Abdul Lateef Olanrewaju et al. (2015)	Alan M. Forste et al. (2015)	Shafikah Saharuddin et al. (2017)	Total Referred
Criteria						
Drainage system					√	1
Waterproofing membrane					√	1
Structural deck					√	1
Thermal Performance	√				√	2
Wall and roof	√					1
Lighting	√					1
Solar energy	√					1
Life cycle approach			√	√		2
Material and component			√			1
Energy		√		√		2
Resources emission		√				1
Building facilities		√				1

3. METHODOLOGY

Table 3 shows that the journals referred for the research and total journal referred on the year of published journal between 1996 to 2018. Based on table 3, eight (8) references are used from the journal were published on 2016 as there were many information which related to topic discuss.

Table 3 Journal referred for research

Year of Published Journal	Total Referred
2018	5
2017	11
2016	4
2015	2
2014	9
2013	4
2012	2
2011	3
2010	7
2009	1

2008	1
2007	0
2006	0
2005	0
2004	0
2003	0
2002	0
2001	0
2000	0
1998	1
1997	0
Total journal Referred	50

4. RESULTS AND FINDINGS

From the extensive study in the literature review towards seeking criteria for building maintenance and criteria for green building, the summary of the idea can be concluded as Figure 1 below. Where the framework can be used to clearly define the maintenance procedure can be made to green building by combining the two criteria has been discussing previously in Table 1 and Table 2.

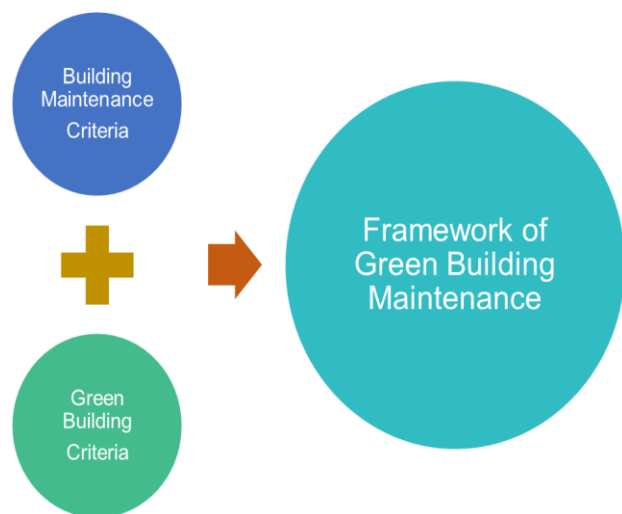


Figure 1 Framework of Green Building Maintenance

DISCUSSION AND RECOMMENDATION

From this research, we hopefully can enhance an existing knowledges which provide addition criteria for the green building maintenance assessment. The most referred criteria from each of the table which the table of criteria for building maintenance on conventional and green building and assessment tools of green building. All these criteria will put in the questionnaire and distribute to our target respondent and see whether the answer we collect back is agreed to all those criteria or not.

In summary, building maintenance is a very important work or can be say as a work which must have to carry on after the after the completion of construction and installation stage. There is the problem of lack of standard guideline for building maintenance in Malaysia; at the same time we can also see the growing numbers the of green building in construction industry Malaysia, therefore we have to find look for the existing tools and get our own suitable criteria of assessment tools to assess the maintenance work on green building. This will ensure the people in Malaysia who satisfied to the place they live or stay and live safety in the building.

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