

ANALYSIS OF SUSTAINABLE MAINTENANCE BEHAVIORS IN HOUSING OPERATION

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While building maintenance is now recognized as a measure for sustainable development, the impacts are increasing and pose risks to sustainable development. However, attempts to increase consideration of sustainable practice in residential buildings have not yielded positive results. Behavioral practice has potential for change, so in this study the behaviors of maintenance service providers are explored to investigate the understanding of the supply side in the sustainable housing supply chain and marketplace. The results indicate that the major factors that impact sustainable maintenance behavior is a poor understanding of maintenance organizations towards sustainable residences. A maintenance behavioral model is presented to prompt interest in sustainable-maintenance management.

Keywords: Maintenance organizations, Housing stock, KABC model, Maintenance plan.

1 INTRODUCTION

This report is part of ongoing research in sustainable building maintenance management. It explores the behavioral issues in sustainable maintenance practices and process. Sustainable issues in maintenance management are not established. Buildings place a heavy burden on earth resources, most of which are finite and non-renewable and endanger the health and welfare of communities. Without maintenance, a building cannot serve its purpose as it will be unsafe, trigger sickness, be too expensive to own/operate, and not offer value for money.

Sustainability could be broadly divided into technical and qualitative sustainability. Technical sustainability has received considerable attention while qualitative has not. Technical sustainability involves using “sustainable” technologies and materials in planning and construction of buildings. They aim to save energy and water, promote social interaction, and ensure healthy living styles, securities and environmentally-friendly design. Qualitative sustainability is a factor of the culture and behavior of the stakeholders. However, it is tempting to think that sustainable construction is only a function of technical sustainability. It is argued that qualitative sustainability is more significant as it “stimulates” the acceptance or rejection of technical sustainability. The requirement to situate sustainable development in maintenance operations make the role of maintenance organizations more complex and sophisticated, with them taking over unfinished housing that does not meet with sustainability requirements, yet is required to provide sustainable maintenance.

2 BACKGROUND AND THEORETICAL FRAMEWORK

Based on the latest UN report, RM 1.7 trillion would be required every year by 2050 to mitigate climate change (UN 2014). The impact of buildings on climate change, resource depletion, waste, pollution, and social integration is enormous. For instance, buildings consume more than 40% of the world energy, release 1/3 of CO₂, use about 25% of harvested woods, release about 50% of fluorocarbons, produce 40% of landfill materials, use 45% of energy in operations, emit 40% of greenhouse emissions, and use 15% of world's usable water (UNEP 2014). When other CO₂ emissions attributable to buildings are considered, such as emissions from the manufacture and transport of building construction and demolition materials, and transportation associated with urban sprawl, the result is an even greater impact on sustainable development. Housing stock is a significant part of this profile. In Malaysia, about 90% of the buildings are homes. Based on these statistics, housing stock is part of the threat to sustainable development.

In 2014, about 112 residential buildings in Malaysia were certified under the Green Building Index. Compared with the existing 4,769,328 housing stock (NAPIC 2014), the proportion and contribution of green buildings are negligible. The Malaysian population is projected to grow significantly over the coming years, but the annual rate of housing replacement is less than 1%. This has two immediate implications. First, the homes that will be in used in the next 100 years or more are not sustainable. Second, the need for sustainable maintenance management will be on the increase for the housing stock to be a solution for sustainable development. The consequence of climate change, pollution, environmental degradation, and resource depletion is the proliferation of solutions in sustainable technologies and materials for the housing sector. However, it is now clear that despite the advancement in technology and government regulations, significant changes have not been achieved towards sustainable housing. The missing motivator is stakeholder involvement in the supply chain and marketplace – specifically, the stakeholders' culture/behaviour. Still, we are aware that this may not be the current dominant thinking in the industry. We also recognize that decisions made about design and construction have implications on maintenance, but many of the decisions concern technical sustainability and maintainability, which are not necessarily maintenance management.

Sustainable housing are residences that meet the sustainability requirements in all respects, not just design and construction. Maintenance contributes to sustainability in a number of ways, including keeping noxious waste at the barest minimum level, reduction of emissions by ensuring durability and availability of the buildings (Sherwin 2000), and providing feedback to design/construction teams. Poor maintenance means more burden on both human and environmental resources (e.g., more burning of coal, oil, gas, and wood). Therefore, if a residence is maintained to reduce energy and water consumption, curtail CO₂, enhance stakeholder productivity, reduce resource depletion and pollution, and increase the well-being and social harmony of the community, then such a home would be part of sustainability solution.

3 MAINTENANCE ORGANIZATION BEHAVIORS

Human behaviour is defined as the action (and reactions), activity, or process and reaction displayed by a person or an organization. These actions, activities, and processes are usually initiated in response to situations or agents that could be internally or externally induced. The feeling (attitudes) one has about a service or product triggers his/her action (behaviour) towards the product or service. This is consistent with “Expected Utility Theory” in classical economics. While this is a rational phenomenon, people sometime behave irrationally. Maintenance-organization behavior is the behavior that maintenance service providers display in searching for, using, evaluating, and executing maintenance services (including incidental products and associated services) to increase their profitability and the satisfaction of the homeowners. Investigating the behaviors of maintenance organizations is compelling because, despite the proliferation of sustainable products and material and government regulations, significant changes have not been achieved in adopting sustainable building practices or strategies. Maintenance organizations provide various services, such as providing information to the homeowners and design/construction teams, providing services required by the homeowners, educating homeowners on the latest thinking in building management, and managing the waste from building operations. Thus, it is when maintenance organizations themselves have realized the implications of adopting sustainable practices within their businesses that the homeowners, who are mostly inexperienced, could be guided and advised accordingly.

4 RESEARCH DESIGN

Primary data is collected based on convenience sampling. In convenience sampling, a survey is conducted with respondents who are easily accessible. It is an appropriate method when sufficient information on population size is not available but, like other nonprobability sampling, findings may not be generalized to the population. All the survey questionnaires were administered through an online survey starting from 20 October 2014 through 15 January 2015. Specifically, the email of the respondents were retrieved from organizations including Green Building Index Malaysia, Association of Valuers, Property Managers, Estate Agents & Property Consultants in the Private Sector Malaysia, Malaysian Association of Facility Management, the Chartered Institute of Building, Malaysia Branch, and other relevant associations that are involved in the management of buildings.

5 FINDINGS AND DISCUSSION

5.1 Respondents' Profile

Out of the more than 2000 surveys sent out, only 27 respondents provided feedback despite numerous reminders. Nearly 80% of the respondents held some sort of degree. Similarly, about 80% obtained academic background in construction-related disciplines, with 25% within the facilities management. More than 80% held strategic positions in their organizations, with 50% of them manager or director. Some 80% of

the respondents had more than 10 years' working experience. Half of the respondents were from private organizations. A major interpretation of the information above is that the respondents have the required influence within their company and working experience, and have working knowledge in sustainable buildings and maintenance.

5.2 Findings on the Behavioral Issues

The first question to be asked is whether or not the maintenance organizations could recognize and describe sustainable homes. While more than 60% of the maintenance organizations surveyed said that they aim to deliver sustainable building because is part of their business vision (Figure 1), they believe that sustainability is the clients' responsibility.

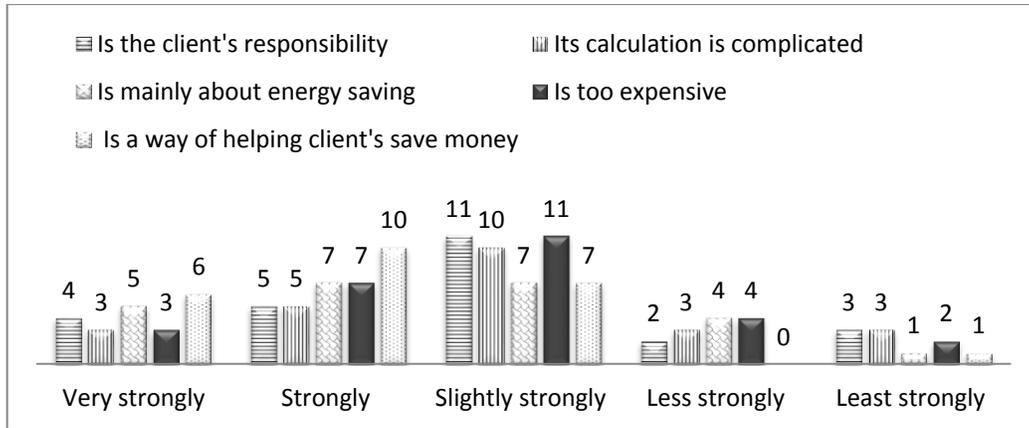


Figure 1. Summary of information on the understanding of maintenance organizations re sustainable buildings.

The interpretation of the findings is that the maintenance organizations do not see providing sustainable maintenance as a way to increase their profits. Thus, it is only when the homeowners demand those services that they provide them. About 80% claimed to use sustainability as way of marketing strategy to clients. On the level of understanding on sustainable housing, most of the respondents admitted that the industry is not clear on what it means (Table 1). In other words, they could not recognize it in form, shape, or benefit. Information in Figure 1 supported this supposition, because only about 20% of them do not agree that sustainable building is expensive. However, the latest findings show that sustainable building is not expensive (Abdul 2014). From the data presented above, it is obvious that the maintenance organizations have some difficulty with what sustainable housing means in practice. The construction industry is not certain on how to provide sustainable buildings other than to install energy- and water-efficient components in the buildings.

However, when the respondents were presented with a definition of sustainable maintenance management, the results show that the maintenance organizations are not providing sustainable maintenance practice (see Table 2). Although it could be argued that the maintenance organizations could not understand the definition offered to them,

it was simple enough to elicit clear understanding. Certainly, it is not clear what activities and processes make their sustainable practices significantly different from the definition above that justifies the differences in the response. However, this could be interpreted to mean poor understanding about sustainable maintenance management.

Table 1. The industry is not clear on what sustainable building is.

Scale	Very strongly	Strongly	Slightly Strongly	Less strongly	Least strongly
Frequency	9	11	7	0	0

Table 2. Do you practice sustainable maintenance management?

Scale	Yes, largely	Yes, to a less extent	No
Frequency (%)	15	55	33

However, the industry is aware that maintenance is able to contribute to sustainable housing and inevitably a sustainably-built environment (see Table 3).

Table 3. Do you consider maintenance as important in energy, water used, safe and healthy environment and social interactions of the building users?

Scale	Very strongly	Strongly	Slightly Strongly	Less strongly	Least strongly
Frequency (%)	67	30	3	0	0

These findings are as expected. To maintain a house, a lot of resources are required and a lot of waste generated in the construction and operation of the house. The land, materials, water, energy, and other resources that are required to have the house in place are provided by the natural environment. It is also the environment that will receive, store and/or process the waste that is generated in the production and operation of the house. Deductively, a KABC model was proposed for inculcating sustainable issues in the management of housing, as shown in Figure 2, with brief explanatory notes in Table 4.

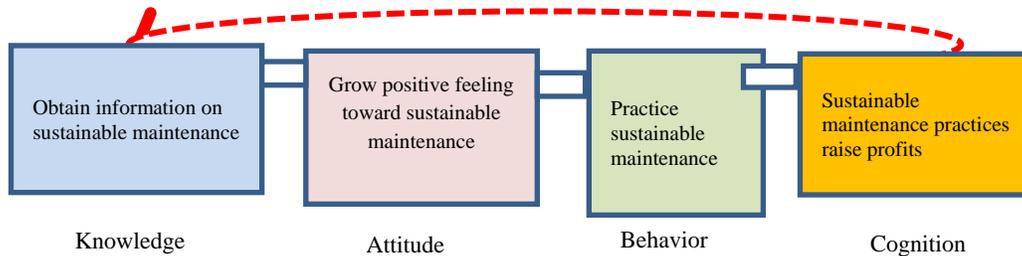


Figure 2. KABC framework for behavioral issues in sustainable maintenance management.

Table 4. Simple interpretations/applications of the KABC Framework.

Denotation	Interpretation
K=Knowledge	You learn that sustainable maintenance could contribute to sustainable development, for which have some concern about (knowledge).
A= Attitude	This would prompt you with some sense of responsibilities (attitude). The knowledge has thereby created a need for sustainable maintenance in you.
B= Behavior	Hence, you decide to take some initiative to practice sustainable maintenance (behavior).
C= Cognition	Satisfied with sustainable maintenance practice, you do more to create more rewards/benefits, and encourage others to practice it (cognition). This will mean giving knowledge and information to the homeowners who are aware of and influenced by your behavior.

6 CONCLUSIONS

This paper seeks to prompt discussion about what is important to the operators/managers of sustainable buildings. It is obvious that the major problem in housing maintenance is not about technology but rather about its management. This paper has drawn attention to some of the practical difficulties that exist within the definition and scope of maintenance, thereby limiting it to serving as a platform to drives sustainable development – but this due to poor perception and does not reflect reality. What is currently practiced is technical sustainability, mainly product-based. The industry, according to the respondents, is significantly less likely to propose the service to homeowners if the homeowners do not demand it.

References

- Abdul, Y. (2014), Delivering Sustainable Buildings: Savings and Payback – Breakfast Briefing, Available at www.breeam.org/filelibrary/Presentations/DeliveringSustainableBuildingsSlides.pdf [Accessed on 23 November 2014].
- NAPIC (National Property Information Centre), Malaysia . Existing Stock, Incoming Supply and Planned Supply of Residential, Shop and Industrial Properties as of Q2 2014.
- UN (United National Environment Programme Report, 2014) Climate change costs to escalate. NST (News Sunday Times) 07 December, 2014 pp. 38.
- UNEP-SBCI (United Nations Environment Programme, 2014) Greening the building supply chain. DTI/1753/PA.