EDITORIAL PREFACE

GREEN BUILDING MOVEMENT IN MALAYSIA: PAST, PRESENT AND FUTURE

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The sustainable development movement has been evolving worldwide for almost three decades, causing significant changes in building delivery systems in a relatively short period of time. A subset of sustainable development, sustainable construction, addresses the role of the built environment in contributing to the overarching vision of sustainability (Kibert, 2008). It contributes to the achievement of urban sustainability and as one of the integral processes of sustainable development. Sustainable building, on the other hand, is the subset of sustainable construction, as described by Du Plessis (2001, p.10):

"Urban sustainability is the wider processes of creating human settlements and includes areas such as governance. Sustainable building concerns itself solely with the process of creating buildings, while construction includes infrastructure such as roads and bridges".

Green building has been used as a term interchangeable with sustainable building and high-performance building. Its core message is to improve current design and construction practices and standards so that the buildings we build today will last longer, be more efficient, cost less to operate and contribute to healthier living and working environments for occupants, thereby helping to increase productivity. Green building is also about increasing the efficiency with which buildings and their sites utilise energy, water, and materials; protect natural resources; and improve the built environment so that ecosystems, people, and communities can thrive and prosper. There are numerous definitions for green building, for example, "…healthy facilities designed and built in a resource-efficient manner, using ecologically-based principles" (Kibert, 2008, p.5). Robichaud and Anantatmula (2010) described that there are four pillars of green buildings, i.e. minimising impacts on the environment, enhancing the health conditions of occupants, ensuring the return on investment to developers and the local community, and considering the life cycle during the planning and development process. Common elements of these definitions are life cycle perspective, environmental sustainability, health issues and impacts on the community.

Today's high-performance green buildings in Malaysia are a significant improvement over the conventional buildings of the past. They consume significantly less energy, water, and materials; provide healthy living and working environments; significantly improve the quality of the built environment. The concept of green building materials may have been defined and the methods for their evaluation have been developed. However, addressing the issue of closing materials loops by designing buildings for deconstruction and developing disassemblable building products with recycled materials is still considered rare in the context of today's green buildings in Malaysia. The role of nature in buildings is another one of the critical areas needing development for the future of green buildings in the country. Natural systems can provide cooling, wastewater processing, stormwater uptake, food production, and a range of other services for the built environment. To dramatically lowering energy consumption and increasing the use of renewable energy systems, green buildings need to be integrated with advanced energy strategies, such as radiant cooling and photovoltaic systems. Besides improved efficiency and better conservation of natural resources, adjustments of social expectations (comfort, amount of space, mobility, and access) are an essential factor in the development of a more sustainable built environment. In short, progress has been made, but the problematic problems remain unsolved.

There have of course been plenty written on green, sustainable and resilient buildings in Malaysia, in this journal and many others. The theories and practices have been explored by, for example, Hellwig (2015), Shari and Soebarto (2012), and Salam and Nik Ibrahim (2018). Urban and site planning and management have been addressed by, for example, Ghazali et al. (2009), Abdul Shukor et al. (2012), Arabi et al. (2015), Lim et al. (2016),

Mat Raschid et al. (2015), Rakhshandehroo et al. (2017), and Raja Yahya *et al*. (2019). Studies on different aspects of indoor environmental quality have been conducted by various researchers; for instance, thermal comfort by Neama (2013), Mohammad Yusoff et al. (2012), Gital et al. (2015), Ibiyeye et al. (2015), and Maarof and Jones (2019); visual comfort by Mathalamuthu and Nik Ibrahim (2014), and Atan and Nik Ibrahim (2019); and acoustic by Dahlan (2009). The potential system to improve a building's energy efficiency and the potential of integrating renewable energy in tropical architecture have been investigated by, for example, Alavijeh and Zeinali (2015) and Long and Tazilan (2015), respectively. Furthermore, improved wastewater treatment and green material have been proposed by, for example, Mazandarani et al. (2015), and Karsan and Hoseini (2015), respectively. Comparisons of international and local green building rating tools have been well-covered by Shari and Soebarto (2015). More is and will be written about these subjects in the future, and at the end of this Editorial, the trajectory of green building in Malaysia from its more recent origins in the late 2000s to the present and future will be discussed.

Overview of this special issue

This special issue of Alam Cipta contains a collection of nine extended papers from the 2nd Malaysia University-Industry Green Building Collaboration Symposium (MU-IGBC 2018), hosted by the Malaysia Green Building Council (malaysiaGBC), in collaboration with Universiti Putra Malaysia, Universiti Kebangsaan Malaysia, Universiti Teknikal Malaysia Melaka, and University of Reading Malaysia. The MU-IGBC 2018 aimed at high-quality research and offered the platform for advancing and progressing efforts in green building-related topics. The objective is to share and exchange research findings, ideas, experience, and techniques that gave impacts to the green building industry. With the central theme "Energising Green Buildings", the MU-IGBC 2018 is programmed to invigorate the green building design, research and practice among local researchers, academics, professionals, and government officials. The MU-IGBC 2018 was held in Bangi, Selangor, Malaysia, and attracted a total of 77 full paper submissions, spanning over numerous active and emerging topic areas. The conference program committee selected 56 full papers to be presented at the conference.

The nine extended papers for this special issue were selected from among all the accepted papers by the special issue guest editor based on the relevance to the journal and the reviews of the conference version of the papers. The authors were asked to revise the conference paper for journal publication and in accordance with customary practice to add 30% new materials. The revised papers again went through the normal journal-style review process and are finally presented to the readers in the present form.

The papers in this special issue cover a wide range of the scope of green building in the Malaysian context. Two papers in this special issue address the passive design strategies to optimise indoor environmental quality. In 'Assessment of the indoor thermal condition of a low-cost single-storey detached house: a case study in Malaysia', Amir et al. argue that the issue of thermal comfort in the design of low-cost housing in Malaysia has always been neglected, leading to the unliveable indoor thermal environment. They suggest that adding bubble foil roof insulation is one of the solutions to reducing the indoor air temperature of this type of housing.

The second paper addressing the passive design strategies is 'Preliminary evaluation of airflow in the atrium of building in hot and humid climate' by Mohammad Yusoff, Mat Sulaiman and Muhsin. It calls for greater awareness on the importance of providing sufficient airflow paths (i.e. access corridors that connect inside to outside) at appropriate locations to achieve adequate air velocities inside a naturally ventilated atrium.

Another two papers address building energy efficiency issue and recommend measures to reduce energy consumption. The first paper is by Ahmad Ludin et al. titled 'Energy efficiency action plan for a public hospital in Malaysia'. The authors address the electricity consumption issue of a public hospital in Kuala Lumpur. Their preliminary energy audit suggests that the hospital could save up to 3.82% of electricity consumption, equivalent to a cost saving of about RM150,000 per year if the hospital conducts an unplugging campaign; replace all existing desktops to laptops; carries out regular maintenance; replace its old refrigerators with energy-efficient ones.

The second paper related to energy efficiency, 'Air conditioning energy profile and intensity index for retrofitted mosque building: case study in Malaysia' by Hussin et al., argues that most of the existing mosques retrofitted with air-conditioning in the country have much higher energy indices than the recommended value in the Malaysian standard. Based on a field study results of five selected retrofitted mosques, the authors recommend a few energy conservation measures, namely synchronisation of air-conditioning operation according to prayer times; set up of new comfort temperature; implementation of scheduled maintenance of the air-conditioning system; and application of appropriate air-conditioning zoning system.

Khrit et al. 's paper, 'Comparison of measured and modelled mean radiant

temperature in the tropical urban environment', argues that the validation studies of RayMan1.2 simulation software in estimating the mean radiant temperature of an urban setting have mostly been conducted in moderate to high latitude locations. The paper fills the research gap by comparing the measured, and simulated mean radiant temperature of a Malaysian urban setting and the results suggest that the software needs to be improved for simple and complex urban settings in the tropical climates.

In 'The impact of air gaps on the performance of reflective insulations', Lim et al. describe that the thermal performance of reflective insulation depends on the thermal resistance (R-value) of its materials and assemblies as building components. Through some experimental tests, the authors rank different types of reflective insulation materials with various enclosed air gaps based on their R-values. The result is that big bubble foil with 50mm top air gap and 75mm bottom air gap has the highest R-value or is the most effective insulation method in a hot and humid climate like Malaysia.

The review paper included for this special issue, 'Review article: skewed wind flows energy exploitation in the built environment', is by Abdullah et al. When it comes to building-integrated renewable energy using wind power, particularly in an urban environment, the paper argues that vertical is more durable and efficient than horizontal axis wind turbine. In supporting this argument, the paper critically reviews previous studies on the skewed wind flow phenomena in an urban setting, the aerodynamics of wind turbines in skewed flow, and wind turbines on building rooftops.

Yusof and Osmadi's paper, 'Assessing green practices and their impact on the environmental and financial performances of construction projects', highlights the current debates on whether green construction practices lead to a better environment and economic profits. This paper provides a better understanding of this issue through results from quantitative research involving a questionnaire survey among different groups of Malaysian construction industry stakeholders. The result is that green project integrated practice and waste management practice are the two areas of green practices that have a significant and positive relationship with the project's environmental and financial performance. The authors then propose different actions to be taken by different groups of stakeholders to ensure the environmental and economic goals of the project are met.

The last paper, 'Building Information Modelling (BIM) for sustainable industry: the Malaysian architect's perspectives' by Ahmad Jamal et al. addresses the issue of slow uptake of Building Information Modelling (BIM) in the Malaysian construction industry, especially among architects. For green buildings, BIM can be used in the design development phase to conduct modelling and simulation to improve the building's environmental performance. Through quantitative research, the authors describe several measures that should be addressed to improve the current situation. Most of these measures are related to "people", such as support from professional bodies, better education, enforcement from authorities, as well as improvement in research and development.

Trajectory of green building in Malaysia

It must be admitted that the green building concept is still relatively new in Malaysia, about a decade in duration. Before 2009, there was no rating system and very few products, tools, or publications supporting the local sustainable construction and green building practices. Now, there are more than five green building rating tools being implemented in the country and an abundance of resources that provide services, information, and execution support for green projects. A decade ago, there was scant knowledge about this new field. Today, general knowledge about it is relatively commonplace, but strategies for resolving the major problems of buildings and their impacts remain difficult.

This special issue does not address a wide range of issues, e.g. water, materials, waste, indoor environmental quality, etc. due to the constraints of time and complexity. However, there is an emerging body of literature on these topics (for example, Lachimpadi et al., 2012; Lim et al., 2017; Mirrahimi et al., 2016; Janet Yip et al., 2018; Marsono and Balasbaneh, 2015). The future of the sustainable built environment is currently being impacted in an unprecedented manner by the issue of climate change (Santamouris, 2019). The central economic, environmental, and social issue of the next several decades will be energy, both its cost and its impacts. Malaysians will likely be forced to consider shifting to a different energy source that is likely to be more diverse and far more costly. For the built environment, the emphasis on energy as an arbiter of directions and value will increase and accelerate in the future. The dominant measuring stick for all aspects of green building will be energy. Green building rating tools developed and implemented in Malaysia, such as Green Building Index (GBI), GreenRE, Ph JKR and MyCREST have started to reflect this shift in priorities by allocating the highest total number of points to energy assessment category. Currently, the most important driver for adopting green building practices in Malaysia is energy conservation (Niroumand et al., 2013). These tools will soon reflect a future of higher cost, more diverse energy systems based mostly on renewable resources. The

increased use of renewable energy will further facilitate the growth of green buildings in Malaysia.

Materials and products for construction remain primarily the traditional materials with which we are familiar. The environmental impacts of materials extraction and waste disposal are rising. These impacts include long-term effects on land, air and water quality as well as the biodiversity that lead to erosion and other local and global consequences. Although the Malaysian government has put an effort to prioritise the importance of managing construction and demolition wastes to mitigate environmental impacts, the recycling rate is still as low as 15% (Esa et al., 2017). Local architectural design practices have started to design with Industrialised Building System (IBS) to reduce wastages of building materials, but the move needs to shift from conventional IBS that still needs substantial manpower, to digital IBS. For example, instead of using precast products that only results in dull and standardised high-rise units, architects can design with the Building Information Modelling (BIM)-integrated digital design system to provide clients with customised solutions. Hopefully, BIM will one day be applied to facilitate the green building certification process as well. The advanced information and communication technologies will play a crucial role to assist the future development of green building in the country. Therefore, more studies are required to explore the best practice of integrating BIM into the various life cycle stages of the green building delivery that is suitable to the local context. In parallel, themes such as deconstruction, durability, adaptability, design for deconstruction, closed materials loops, Factors 4 and 10, and dematerialization, which are almost non-existent in the local green building sector, will slowly be practised. Certainly, these green strategies are imperative for the sector to achieve true sustainability in the future.

One of the outcomes of green building has been better communication and collaboration among stakeholders to enhance the quality of their decision-making in the building and construction processes to incorporate the principles of sustainable development. Theoretically, the knowledge of sustainable development is multidisciplinary in its nature and is covered by various bodies of sciences. That is why the key success factor of a green building design is the application of an integrated design process where multiple stakeholders (planners, architects, engineers, landscape architects, facility managers, and etc.) collaborate early in the design stage. This approach emphasises the development of a holistic design where all design requirements are considered simultaneously rather than sequentially. The tendency for these professionals to function in 'silos', each optimising the outcome for their own benefit, is in turn reflected in the curricula of the educational institutions. Malaysia needs to implement significant changes in how building industry professionals are educated and trained. Universities can take a leadership role by revamping curricula to support sustainable construction, including substantially more cross-disciplinary instruction and collaboration. Developers and building owners can help motivate this change by insisting on the implementation of a system of performance-based fees that incentivizes collaboration and performance.

Although the pace of high-performance green building has been increasing, the rate of change has been far too slow to offset the depletion of resources, local, and global environmental degradation, and other negative consequences of transforming land and materials into infrastructure and buildings. Although GBI has resulted in noticeable change after its introduction, it is time for a significant shift in government policy, from voluntary to mandatory measures, coupled with incentives, that will dramatically accelerate the transformation of the Malaysian construction industry and its products. It is now time for the environmental measures advocated by rating tools to be made as standard practices. This, in turn, would then permit the development of next-generation tools that are more ambitious and innovative and move well beyond current green building practices to notions of restoration and regeneration, as advocated by Attia (2018).

The cost factor remains the most significant barrier that leads to a low level of green home development in Malaysia (Samari et al., 2013; Mohd Nordin et al., 2017). Green housing development increases the housing costs as they involve higher capital upfront. Additionally, it is difficult to obtain green materials in the country, and most of these products are priced higher. Extra expenses are also incurred for appointing environmental consultants, green rating assessment fees, and procurement of new technology. Most speculative developers aim to maximise their profits rather than investing money in the sustainable development concept. Therefore, more robust studies are required in Malaysia to enable evidence-based decision by the client and project team. Some local green building advocates claim that green building does not necessarily cost more if done right. Without any detailed studies on local case studies to validate such claim, the perception of "building green costs too much and is economically non-viable" would persist.

Lack of awareness and understanding of sustainable development is also a crucial barrier to the implementation of green building in Malaysia (Shari and Soebarto, 2012). Many industry stakeholders are not aware of the model of sustainable development. Many building professionals are not informed about the associated benefits of green buildings. Due to limited understanding and

budget constraint, many developers are unwilling to incorporate sustainable development principles in their projects. Besides, low awareness of societies in sustainable development and green building has led to low demand for green homes. Hence, more robust studies are required to validate real performance of green building through Post-occupancy Evaluation (POE). Similarly, vast majority of these studies focus on commercial building stock, the residential buildings and industrial buildings deserve further studies in terms of their real performance. Green building movement in Malaysia is still new, and the changes may be challenging to detect. Hopefully, a future special issue on this subject will be able to point to remarkable changes supporting the shift toward sustainability in this sector.

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