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Abstract

Purpose – Green building construction was adopted as a strategy to reduce energy consumption and the overall impact of the built environment on our natural environment. However, in Malaysia, previous studies have reaffirmed that green office buildings consume a substantial amount of energy, compared to their counterparts in Singapore. Moreover, there is still a significant performance gap between predicted energy measurements and actual operational energy consumption of green office buildings in Malaysia, due to occupants' behavioural discrepancies. Therefore, the purpose of this paper is to develop energy efficiency practices for occupants of green office buildings in Malaysia. The developed practices integrate technology, organisation policy, and occupants' behavioural strategies, in order to reduce the energy consumption of green office buildings in Malaysia.

Design/methodology/approach – To achieve the research goal, a mixed (quantitative and qualitative) research method was used to collect data from the research population. In total, 53 respondents working in a green office building complex in Kuala Lumpur Malaysia were surveyed using a questionnaire. Additionally, three top management staff of the green office building and two Malaysian construction professionals were interviewed. The study adopted convenience sampling technique in selecting the research respondents. The data from the questionnaire were analysed using SPSS software (version 22) while the interview data were analysed via thematic content analysis.

Findings – The findings suggest that the integration of technological strategy (use of BIM tools, sustainable building materials, etc.); organisational strategy (develop, implement and evaluate action plans, use of monitor/control systems, etc.); and occupants behavioural strategy (training, incentives, occupants energy efficiency guide, etc.) will critically reduce energy consumption of green office buildings in Malaysia.

Originality/value – Based on the findings, energy efficiency practices are developed to guide occupants in reducing the energy consumption of green office buildings in Malaysia. This strategy will contribute to reducing the performance gap that exists between predicted energy and actual energy use of green office buildings in Malaysia. However, the developed energy efficiency practices need to be validated to ascertain its workability in the green office building context.

Keywords Malaysia, Efficiency, Office, Green, Energy, Building

Paper type Research paper

1. Introduction

Buildings globally consume approximately 40 per cent of total electricity produced and emit about 30 per cent of carbon dioxide (CO_2) (JKR and CIDB, 2016). However, extensive research and development have been done to enhance building performance through energy simulations and "green" building concept. Green buildings are constructed using resource-efficient and environmentally responsible processes throughout the building's life cycle, to mitigate energy consumption, greenhouse gas emission, etc. (EPA, 2016). Moreover, various rating tools have been adopted by different countries, to ascertain whether the green building meets certain standards. In the USA, there is Leadership in Energy & Environmental Design (LEED). In the UK, the Building Research Establishment

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Environmental Assessment Method (BREEAM) was established. The green building index (GBI) is one of the green building rating tools in Malaysia.

Due to the need for resource efficiency and enhanced workers output, several offices are adopting the green building concept. Adoption of green office building practices provides the triple-bottom-line benefits of sustainable development, in terms of environmental, economic, and social aspect (Nilashi *et al.*, 2015). Some of the environmental benefits include: air and water quality improvement; waste reduction; and natural resource conservation (CIDB, 2016). Other possible economic benefits could include: reduction of operation and maintenance costs; life cycle economic performance optimisation, etc. (Ahn, 2010). Also, the perceived social benefit includes: occupants' productivity improvement and occupants' healthy living.

Nevertheless, many researchers have argued that most green office buildings are not energy efficient as claimed. According to Turner and Frankel (2008), 28 per cent of green buildings in the USA consumed more energy than their conventional counterparts. A recent study by Zaid *et al.* (2017) confirmed that green office buildings in Malaysia consume more energy than conventional office buildings; due to lack of information, poor management policies, and occupants' comfort criteria (Zhou *et al.*, 2013). Occupants' satisfaction disparity is among the major causes of variation in energy consumption of green office buildings (Junaidah *et al.*, 2015). As stated by Frankel (2008), Ashuri (2010) and Zaid and Kiani (2016), the actual energy consumed by green office buildings in Malaysia is higher than the predicted energy due to occupants' behavioural discrepancies.

The issue of occupants' behaviour is a global concern and several strategies have been established to enable occupants' efficient use of energy in green buildings. In the USA, researchers such as Heschong Mahone (2012) and Moezzi and Janda (2013) opined that energy-behaviour change can be achieved via long-term behavioural persistence and continued participation in energy programmes. In Denmark, the impact of occupants on energy consumption has been reduced drastically using the stochastic models (Larsen *et al.*, 2010). In tropical countries like Indonesia and Singapore, strategies such as energy efficient management framework have been developed for occupants (Zaid *et al.*, 2015).

In Malaysia, there are limited literature on energy efficiency (EE) practices for green office building occupants. Nevertheless, few researchers such as Hassan *et al.* (2015), Aghili *et al.* (2016) and Zaid *et al.* (2017) conducted studies on EE management strategies for green building in general. Shafii (2008) and Zaid *et al.* (2015) confirmed that there is no comprehensive EE practices for green building occupants in Malaysia. Besides, GBI does not rate how buildings are operated rather it only rates how green buildings in Malaysia are designed (Zaid and Kiani, 2016). Thus, there is a need for more involvement on the human aspect to achieve the objective of green buildings in Malaysia.

Employing experienced project team, and use of building information modelling (BIM) at the conceptual stage of green building, will contribute in reducing energy use (LIM *et al.*, 2016). However, understanding the relative impact of technology based, organisational based, and occupants' behaviour-based strategies and combination of the three is a key to enhancing energy performance of green office buildings in Malaysia (Earhardt-Martinez and Laitner, 2010; Moezzi and Janda, 2013). Therefore, the aim of this study is to develop holistic EE practices to guide occupants towards the efficient use of energy. This will help to fill in the gap that exists between predicted energy and actual energy use of green office buildings in Malaysia.

2. Overview of green buildings

Green buildings were introduced to reduce greenhouse gas emission and energy consumption significantly (Albino and Berardi, 2012; GBI, 2018). Thus, Guardian News (2018) defined green building as a modern process of using healthier and more resource

friendly methods and technologies throughout the building's life cycle. Nowadays, most organisations are adopting green technology, to facilitate the accomplishment of organisational goals. Previous studies have indicated that green office buildings translate to improved outcomes for workers and their companies. As reported by Guardian News (2018), workers in green office buildings produce quality output and experience significant health benefits such as better sleep quality and fewer symptoms of illnesses. Thus, companies are under intense pressure to provide an environment where employees can make fast and smart decisions in order to stay competitive.

In order to promote EE and overall sustainability of green buildings, sustainable building rating tools were established by various countries. For example, the US Green Building Council established the LEED as a framework to create healthy, highly efficient, and cost-saving green buildings (USGBC, 2018). In the UK, (BREEAM) was developed for sustainable planning and development of buildings and infrastructure, from new construction to in-use, and refurbishment (BRE, 2018). Other green building rating tools include the Building Environmental Assessment Method, Plus in Hong Kong, the Green Mark from Singapore, and Green Standard for Energy and Environmental Design in Korea (BCA, 2012; Zaid and Kiani, 2016). However, the measurements and scoring system of these green building rating tools depend on their local context.

3. Green office buildings in Malaysia context

The concept of the green office building is an emerging market in Malaysia and currently there are still few green office buildings in Malaysia. According to the GBI (2018) certified buildings summary report, a total of 300 green buildings were certified in Malaysia by March 2017 and majority of the buildings were commercial buildings (offices, malls, airport, etc.). Due to the importance of green office building, the Malaysian Government and several other agencies such as the Work Department Malaysia (PWD), Construction Industry Development Board (CIDB), the Ministry of Energy, etc., have come up with various initiatives and policies. Such policies which include National Green Technology Policy, Low Carbon Cities Framework, green building rating tools aim to promote the adoption of EE measures in Malaysian construction industry (Razak, 2011; Suhaida *et al.*, 2013).

In Malaysia, different green building rating tools exist such as the Green Performance Assessment System, Penarafan Hijau, Green Real Estate, and GBI (Lim *et al.*, 2016). GBI is the Malaysia's first comprehensive rating system, developed by Malaysian Institute of Architects /Pertubuhan Arkitek Malaysia and the Association of Consulting Engineers Malaysia, to facilitate the accomplishment of sustainable development goals in Malaysia (GBI, 2018). GBI evaluates the environmental design and performance of green buildings in Malaysia based on six main criteria: sustainable site planning & management, materials & resources, water efficiency, indoor environment quality, innovation, and EE (GBI, 2018). The EE criterion of GBI is given the most priority, accumulating 35 points out of the total of 100 points.

Irrespective of the emphasis on EE, GBI is lacking in terms of energy management strategies, compared to its South East Asian counterpart like Green Mark Singapore and BERDE Philippines (Zaid *et al.*, 2017). According to Mokhtar Azizi *et al.* (2012), the inability of GBI tool to manage energy at the operational phase has resulted in substantial energy consumption of GBI-rated green office buildings in Malaysia. Based on the aforementioned problem, the PWD and CIDB Malaysia launched Malaysian Carbon Reduction and Environmental Sustainability Tool (MyCREST) in 2016. MyCREST aims to reduce carbon emissions, energy use, and environmental impact of green buildings, while taking into account a more holistic life cycle view of the built environment (JKR and CIDB, 2016). Nevertheless, MyCREST is still new in Malaysia and no green office building has been

assessed yet, using MyCREST (JKR and CIDB, 2016). So, this study focussed only on GBI-rated green office buildings in Kuala Lumpur, Malaysia.

Amidst the strategies adopted by stakeholders, green office buildings in Malaysia are still inefficient, especially in terms of energy use. According to Huat (2013) and Zaid *et al.* (2017), green office buildings in Malaysia consume a substantial amount of energy due to poor building design, construction, management strategies, and occupants' behaviour. Larsen *et al.* (2010) suggested that the major cause of high energy consumption in green buildings is because the influence of occupants' behaviour and lifestyle has not been studied to the same extent as the technical aspects. Occupants' behavioural discrepancy contributes to performance gap between simulated energy and actual energy performance of green office buildings in Malaysia (Zaid *et al.*, 2017; Hong *et al.*, 2016).

Previous studies have indicated that occupants' behaviour has a great potential towards energy savings in green building. Yet, only a few studies in Malaysia targeted the occupants comfort criteria. For instance, Huat (2013) developed an evaluation framework for the rating of energy-related design issues that affect the occupants' comfort in Malaysia. Also, Hassan *et al.* (2015) investigated the relationship between environmental behavioural intention and green office building in Malaysia. Thus, the theory of planned behaviour was proposed to promote occupants' friendly relationship with the working environmental. Other studies focussed on energy efficient management strategies for green building in Malaysia. Aghili *et al.* (2016) established five key practices for efficient management of green buildings in Malaysia. Similarly, Zaid *et al.* (2017) established management practices for enhanced energy performance of green office buildings in Malaysia.

According to Zaid *et al.* (2015), there is still a lack of comprehensive EE practices for green office building occupants in Malaysia. In a recent study, Zaid *et al.* (2017) emphasised that further research is necessary to investigate the occupants' behaviour and perceptions on EE, to provide a more effective energy management framework in Malaysia. To develop an efficient energy management framework for Malaysian green building occupants, it is paramount to adequately link Malay traditions and values in green building design, to reduce energy use and enhance the quality of life of the occupants (GhaffarianHoseini *et al.*, 2014). Larsen *et al.* (2010) stated that using the six model hierarchy, i.e. presence and appliances, windows, solid waste, lighting systems and blinds, heating ventilation and air conditioning (HVAC), and hot/cold water will drastically reduce the impact of occupants on energy consumption.

The use of experienced project team, BIM energy simulation tools, and sustainable materials will contribute to healthy indoor quality, which is the main reason for occupants' behavioural discrepancies (CAM, 2017; Lim *et al.*, 2016). BIM is a digital representation of physical and functional characteristics of a facility and a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life cycle (Aranda-Mena *et al.*, 2009). Also, understanding the linkage between simulated and operational measured energy performance will enable researchers to predict energy performance of green building more accurately, thereby bridging the performance gap.

Therefore, this study aims to develop comprehensive EE practices that will positively influence the way green occupants interact with their electrical appliances, so as to reduce energy use of green office buildings in Malaysia. This will be achieved by integrating technology, organisation policy, and occupants' behavioural strategies, in order to reduce the energy consumption of green office buildings in Malaysia. Thereby closing the energy performance gap that exists between predicted energy and actual energy use.

4. Methodology

In order to achieve the aim of this research, a descriptive study method was adopted. First and foremost, a systematic literature review was carried out to understand the theories

behind this research. Afterwards, mixed (quantitative and qualitative) research method was adopted in actualising the objectives of this research. Tashakkori and Teddlie (2010) stipulated that mixed method research is important because it allows the use of two different research instruments to further enrich the research findings. A closed-ended questionnaire and a semi-structured interview were used to survey the population (green office building occupants' and construction professionals in Malaysia) for this research.

The research respondents were selected via convenience sampling technique (CST) because the researcher could not ascertain the total number of construction professionals and green office building occupants in Malaysia. CST is a nonprobability sampling technique where members of the target population that meet certain practical criteria, such as easy accessibility, geographical proximity, availability at a given time, or the willingness to participate, are selected as samples of the study (Etikan, Musa and Alkassim, 2016). The selected samples were then surveyed using questionnaire and interview.

The questionnaire was used to survey green office building occupants to identify their behavioural divergence and how it affects energy use in green office buildings in Malaysia. In total, 53 green office building occupants in Kuala Lumpur, Malaysia, were selected. The green office building complex comprises of different companies and various offices. In order to get the professionals' perspective of the major energy challenges of green buildings, 3 top management of the green office building in Malaysia, and 2 Malaysian construction professionals were interviewed. The construction professionals participated in the construction of the green office complex in Kuala Lumpur. After the survey, collected data were analysed as discussed below.

5. Data analysis

Data from the questionnaire were analysed via SPSS software version 22 while the interview data were analysed using thematic content analysis. The outcome of the mixed method research was triangulated using constant comparative method for a more cohesive discussion, which led to the establishment of EE practices that will guide occupants in reducing energy use of green office buildings in Malaysia.

5.1 Questionnaire analysis

Out of 53 questionnaires distributed to the respondents (green office building occupants), 45 questionnaires were returned and analysed. The questionnaire survey comprised of three sections.

Section A: it was used to sort the background information of the respondents. According to the analysis, 32 of the respondents were male while 13 of them were female. In total, 60 per cent of the respondents have worked for more than ten years while 40 per cent for less than ten years. Also, the nature of the job of the respondents was investigated. In which, 20 per cent of them worked under the administrative section, 20 per cent under the technical department, 10 per cent as desk top clerk, 25 per cent under the management section, and 25 per cent under various other sections which are not specified.

Section B: this section of the questionnaire was used to investigate how occupants adjust building features in their workspace. The analysis of this survey is shown in Figure 1.

According to Figure 1, 37 per cent of the occupants regularly adjusted the heating and cooling units based on their various comfort criteria. However, 15 per cent of the occupants could not operate any of the green building features. In total, 11 per cent of the green office building occupants never switched off their electric bulbs after work. In addition, over 70 per cent of the respondents are not informed of any energy saving measures. This has resulted to energy performance gap and high energy consumption of green office buildings in Malaysia. According to Hassan *et al.* (2015), lack of information, lack of orientation, and poor education have contributed to occupants' behavioural discrepancies, thus defeating the

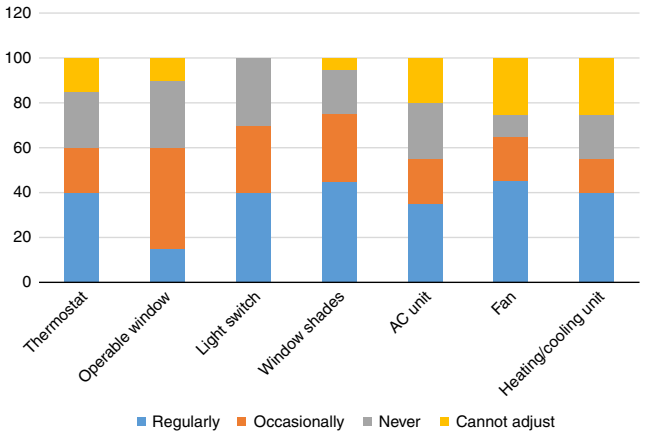

Figure 1.
How occupants adjust building features in their workspace

design intent for low energy consumption. Therefore, occupants should be equipped with necessary information required to guide them towards efficient energy use. As stated by Zaid *et al.* (2015), the establishment of a more effective energy management framework for green office occupants is essential to achieve energy conservation goals in Malaysia.

Nevertheless, this study further probed the occupants to identify their specific behaviours that have directly affected energy use in their offices.

Section C: the last section of the questionnaire investigated the specific behaviours of the various occupants that directly or indirectly affect energy use in green office buildings, as shown in Figure 2.

The bar chart indicates the specific varying activities of the occupants which is the major reason why buildings of the same capacity and functions have different energy consumption rates.

Although survey indicated that about 55 per cent of green office building occupants have the attitude of always turning off the light and equipment, 25 per cent of them rarely controlled their appliances. Moreover, 20 per cent of them never bothered to control these appliances and their attitude contributed to the high energy consumption of the green office

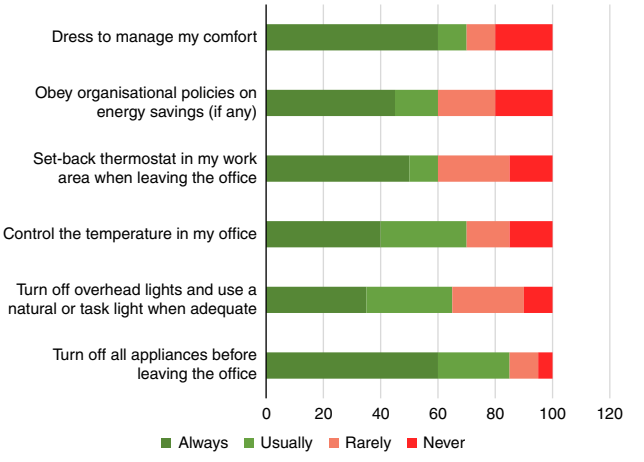

Figure 2.
Behaviours that affect energy use of green office buildings in Malaysia

buildings in Malaysia. Hence, the collaboration between the Malaysian construction industry, organisation management, and the workers is a key objective towards efficient energy use. This is in line with Judd *et al.*'s (2013) opinion that adequate awareness and training should be carried out regularly by stakeholders and the organisation's management, to enable occupants understand the effect of their behaviour towards energy consumption.

The outcome of the questionnaire survey has highlighted that occupant's behaviour towards energy consumption is a significant factor in the concept of green building construction, especially in Malaysian green office buildings. Thus an efficient strategy to overcome the aforementioned is paramount. Having surveyed the occupants of green buildings to understand their interaction with buildings features, it is paramount to investigate the construction professionals, top management and policy makers in the organisation, to evaluate the best strategies for enhancing occupants' behaviour towards the reduction of energy consumption of green office buildings in Malaysia.

5.2 Interview analysis

Five people were interviewed in this research: two construction consultants (architect and mechanical engineer) and three top management of the green office building in Malaysia. The interview investigated occupants' behaviour factor that causes high energy consumption of green office buildings in Malaysia, factors that hinder organisation energy reduction policies in Malaysia's green office buildings, and strategies that can guide occupants to reduce energy use in Malaysia's green office buildings. The interview session was recorded using a recording device, and then transcribed via thematic content analysis. Through thematic content analysis, the transcripts were analysed in order to identify the themes within them. After identifying the themes, the examples of those themes were gathered throughout the transcript, so as to address the research objectives. The gathered themes were tabulated as shown in Table I.

Table I shows the analysis of the interview conducted in this study. According to all the interviewees, occupants' behavioural discrepancies such as EE orientation, poor training, lack of awareness, selfish choice of comfort criteria, and more are significant factors that lead to high energy consumption of green office buildings in Malaysia. Also, occupants' behaviour, lack of information, orientation, and lack of implementation were the major factors affecting organisation's EE policies. The construction professional stressed on the need to involve all stakeholders during the design and construction stage of green building and the use of new innovations such as BIM. Additionally, they suggested that building occupants should be provided with comprehensive information on green elements used in green building construction. Finally, interviewees suggested that integrated green building design, development of energy savings action plans, implementation of the plans, and monitoring and evaluation of EE behaviour of occupants are the key strategies for reducing occupants' energy use in Malaysia's green office buildings. This corresponds to Judd *et al.* (2013) opinion that energy use control is a collective effort that should be followed continuously. Furthermore, organisations should appoint a supervisor who could implement and monitor the energy use of occupants in green office buildings.

5.3 Triangulation of result

The analysis of both research instruments complement each other. Data from questionnaire show that occupants' behaviour varies in regard to energy use and this behavioural variation is a major issue in energy performance of green office buildings in Malaysia. The interviewees also identified that occupants attitude is a major factor that leads to high energy consumption of green office buildings in Malaysia. So they hammered on the need to inform and orientate occupants to change the behaviour on the use of green buildings features. Similar to

Table I. Thematic content analysis of interview data

	What occupants' behaviours cause high energy use of Malaysia's green office buildings?	What hinders company energy reduction policies in Malaysia's green office buildings?	What strategies can be used to guide occupants towards reduction of energy use in Malaysia's green office buildings?
Interviewee 1 (Architect)	Occupants choice of comfort criteria, occupants lack of energy efficiency/ sustainability orientation	Lack of information, non adherence to organisational energy reduction policies, occupants behaviour, lack of comprehensive energy efficiency guidelines, technical issues	Use of BIM, integrated design and construction of green building, leadership principle, commitment on the sides of occupants' and organisations' management, development of action plans, implementation of action plans, monitoring and evaluation of how occupants interact with building features
Interviewee 2 (Mechanical engineer)	Lack of training among occupants on use of electrical appliances, occupants' unpredicted behaviour	Method of building design and construction, lack of monitoring, lack of implementation, poor organisations management	Provision of adequate information on building component to the occupants, information and feedback strategy, energy management system (EMS) to track energy consumption, setting of precise target, policy, implementation of plan
Interviewee 3 (Organisation's management)	Occupants lack of orientation, occupants nonchalant attitude towards energy savings, occupants' selfish choice of comfort, lack of commitment among green building occupants	Poor information on organisation energy efficiency policies, non-replacement of faulty equipment, organisations bogus policies	Continuous change concept, regular workshop on energy efficiency for all occupants, identifying the lapses in previous energy efficiency policies and improving on it, measurement and evaluation of energy use in green office buildings
Interviewee 4 (Organisation's management)	Lack of energy efficiency targets by occupants and organisation, occupants behavioural discrepancy	Variation in occupants energy use, lack of techniques to control the sophisticated electrical appliances, lack of occupants comprehensive guide on energy use	Setting precise goals on energy savings, strict adherence to organisational targets, regular training and development of occupants, use of energy simulation tools
Interviewee 5 (Organisation's management)	Inadequate training, occupants lack of awareness, lack of communication on specific required occupants behaviours, nature of the climate	Occupant orientation on the need to reduce energy consumption, management inefficiency, technical error	Applying necessary techniques required for improvement of energy efficiency of buildings, energy efficiency workshops for all occupants, effective reward systems for occupants who are conservative in energy use

Hassan *et al.* (2015) study, the respondents agreed that integrating technology, organisations policy, and occupants' behavioural strategy is paramount to reduce the energy consumption of green office buildings in Malaysia. Based on this conclusion, the EE practices which incorporates occupants' factors, technical factor, and organisational policy factor is developed.

6. Developed EE practices

The end point of this research is the development of comprehensive EE practices which will guide Malaysia's green office building occupants to reduce their energy use (Figure 3).

Figure 3 shows the developed EE practices that will enable occupants to continually improve the energy performance of green office buildings in Malaysia. The established EE practices consist of three major variables with various sub variables.

Technological strategy which is the first variable indicates that the use of experienced project team, modern technology such as BIM, and sustainable building materials and components is the first step towards EE in green office buildings. A study conducted by Lim *et al.* (2016) affirms that project team has a great opportunity to cut down on energy consumptions by making the right decisions in the early stages of green building design. Also, utilising BIM energy simulation and analysis tool will reduce energy cost and minimise the energy performance gap that exists in green office buildings in Malaysia. According to CAM (2017), selection of sustainable materials will contribute to healthy indoor quality, which is the main reason for occupants' behavioural discrepancies.

Organisational strategy, the second main variable for the establishment of EE practices encompasses the development of comprehensive action plans, implementation and evaluation of the action plan, and the use of monitor and control systems, for energy efficient use within the organisational context. This corresponds to Mokhtar's (2013) study which opined that setting precise energy efficient action plan and target provides occupants guidance for continuous improvement in energy performance of green office building.

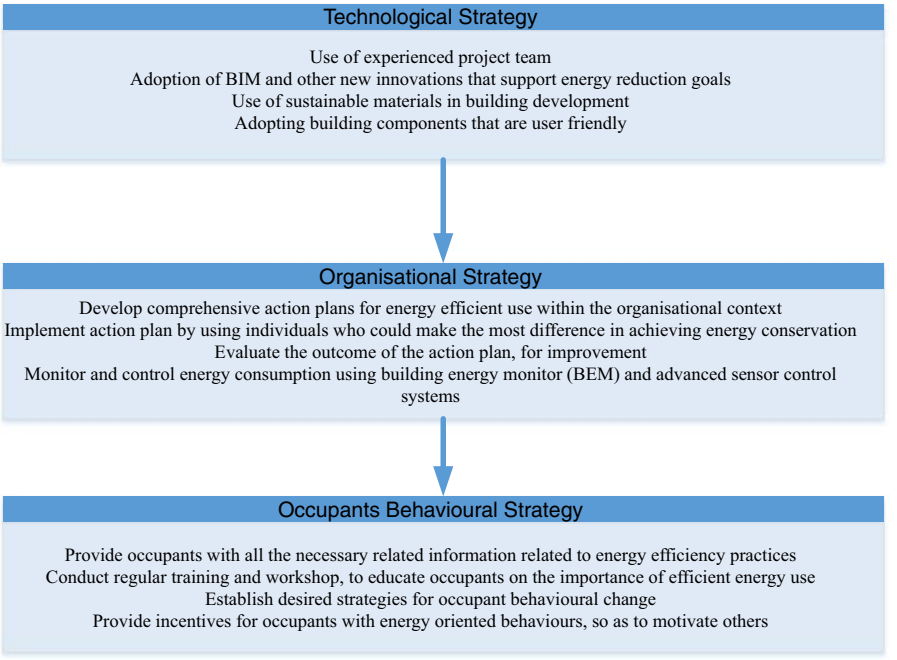

Figure 3.
Energy efficiency framework practices for Malaysia's green office building occupants

Furthermore, the used building energy monitor and advanced sensor control systems have a potential energy savings of 8.8 kWh/m^2/year.

The third Main variable focusses on improving occupants' behaviour towards energy use, by providing occupants with all the necessary information related to EE practices, conducting efficient energy training and workshops for occupants regularly, establishing desired strategies for occupant behavioural change, and giving incentives to occupants with energy-oriented behaviours. Also, providing information in various formats is usually necessary for occupants' awareness on environmental problems. This strategy encourages occupants to switch off all electronic, lighting, and HVAC systems before leaving the office. As reported by Judd *et al.* (2013) adjusting temperature set points, turning off light, computer appliances, and plugins, save up to 10 per cent of energy in green commercial buildings. Wolfe *et al.* (2014) believe that employing various methods and strategies that are aligned with specific occupants' behavioural change is a major key to influence occupants' orientation on EE.

In other words, the established EE concept suggests the integration of technology, organisation policy, and occupants' behavioural strategy for reduction of energy use in Malaysia's green office buildings. There should be a connection between the adopted technology, organisations energy-saving policies, and occupants behaviours towards the actualisation of these policies (Judd *et al.*, 2013). Furthermore, a holistic approach that provides a cradle to grave EE practices for green office building occupants should be developed in Malaysia. To achieve aggressive energy conservation goals, it is increasingly important to develop integrated strategies that link mission, organisational policies, and behavioural change tactics to motivate and support new ways of interacting with the building environment (Moezzi and Janda, 2013). Adhering strictly to EE practices can save up to 30 per cent of the energy used in commercial buildings (Energy-Star, 2018).

Thus, the EE practices developed in this study will be beneficial to Malaysian construction industry in the following ways:

(1) reduction of energy consumption of green office buildings in Malaysia;

(2) improving social and environmental sustainability of Malaysia; and

(3) training and educating green building users on the collective need for the actualisation of sustainable development goals in Malaysia.

7. Conclusion

Literature studies reiterated that green office buildings in Malaysia consume a substantial amount of energy due to poor design decision, organisational culture, and behavioural discrepancies among the occupants (Hassan *et al.*, 2015). Therefore, this study investigated how occupants interact with their green building features, and strategies for improving occupant behavioural discrepancies in green office buildings in Malaysia. However, mixed method research was conducted to survey the respondents. SPSS software and thematic content analysis were used to analyse the questionnaire and interview data, respectively.

The result was discussed via constant comparative method, which enabled us to highlight strategies for reducing the energy consumption of green office buildings in Malaysia. As a result of this, EE practices have been developed. The research output will guide occupants to reduce energy use in Malaysian green office buildings by integrating technology, organisation policy, and occupant behavioural strategies. Specifically, the EE practices developed in this study highlighted that adopting technological strategies such as BIM energy simulation and analysis tool; organisational policies such as setting EE goals and action plan; and occupants behaviour strategy that will effect occupant behavioural change is paramount for enhancing energy performance of green office buildings in Malaysia. Also, it will help in

reducing the performance gap that exists between predicted energy and actual energy use of green office buildings in Malaysia.

However, this study is limited to GBI-rated green office buildings because the majority of the office buildings in Malaysia are certified or assessed using GBI as of the time of this study. Besides the study focussed on green buildings located in the capital city of Malaysia which is Kuala Lumpur. Therefore, more research is needed on green office buildings that are rated with other Malaysian's green building rating tools such as MyCREST. Also, the study should be extended to other states in Malaysia, in order to establish a more comprehensive guide for green office buildings occupants in Malaysia.

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