DECISION MAKING FRAMEWORK FOR GREEN HOSPITAL BUILDING DEVELOPMENT

SHAZA RINA SAHAMIR

A thesis submitted in fulfilment of the
requirements for the award of the degree of
Doctor of Philosophy in (Civil Engineering)

School of Civil Engineering
Faculty of Engineering
Universiti Teknologi Malaysia

FEBRUARY 2020

DEDICATION

This thesis is dedicated

To my angels (my parents)
Mr. Sahamir & Mrs. Rathiah

To my beloved siblings
Sheila, Shalfa, Shahrir & Shahrul

To my sweethearts (nieces and nephews)
Syifa, Saif, Ariff, Amsyar & Aleesa

To my dearest friends
Raja Rafidah & Noor Akmal Adillah

Thank you so much for your love, support, kindness, care, and wisdom
May Allah SWT grant you the highest level of Jannah

ACKNOWLEDGEMENT

I honour my humble respectful appreciation and gratitude towards my most graceful and love aspiring merciful Almighty Allah S.W.T for making all good things possible.

I pour my heart and soul, my blood and tears and burning the midnight oil in accomplishing this thesis, besides my own effort and encouragement from all other involved people give me strength and direction until the end. This milestone is hectic, full of colors and unpredicted massacre. I do believe this journey has taught me to grow, inside and out.

First and foremost, my deepest appreciation goes to my main supervisor Assoc. Prof. Dr. Rozana Zakaria, for giving me the opportunity to do my research under her supervision. Thank you for the guidance and passion throughout this subsistence. I would like to record my highest gratitude for the constant supervision as well as for providing necessary information regarding the research and also firm support in completing this research. Special thanks also go to Dr. Khairulzan Yahya as my second supervisor for the guidance and support throughout this research.

This is the evidence of journey full of hesitation, up and down and soulful journey; and I still survived. To my mother; Rathiah Shamsudin, I would like to oblige my appreciation for always love and taking care of me. And to my late father; Sahamir Mohd Hassan, this is for you. I am most grateful to have both of you in my life. To all my family members and friends, There are a lot of things I can thank you for: for your support, kindness, care, wisdom and etc. Thank you so much.

Also, I am immensely grateful to all lecturers and support staffs from School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, for all their valuable assistance and guidance in assisting me in completing this thesis.

Last but not least, thanks to all the people that contributed their ideas, without their ideas and advice, this research could not have been completed.
May Allah SWT shower His Countless Blessing to all of you.

ABSTRACT

Phrases such as "going green" and "eco-friendly hospital" conjure images of futuristic building. Apparently, the main green criteria that have developed are hardly visible, yet very impactful. Dealing with many criteria for planning and design associated with green buildings can be daunting. Many research on green building only concentrate on commercial and high rise buildings, but paucity attention is given to hospital building. Significantly, the decision-making process should be an important features in identifying the best criteria for green hospital building development. Thus, this research aims to provide a decision-making framework for green building development of the public hospital. The investigation has been made to the planning and designing stages of Malaysia hospital development. Subsequently, the analysis of green and sustainable elements for the criteria of hospital building development were carried out to propose the decision-making framework of planning and design for green and sustainable hospital building development. The study begun with a critical analysis of the concept and guideline of a green hospital building and later examines the existing green rating systems specifically designed for the hospital building. The data then were analysed using content analysis. A pilot study has taken place based on an implemented literature search. This study utilised a questionnaire survey method for confirming the green elements and criteria. The results from questionnaire was analysed using factor analysis which resulted in 3 sets of components (environmental, social, and economic). 154 respondents of this study were public hospital designers who have experience in dealing with public hospital buildings. Identification of the elements and criteria affecting planning and designing towards hospital green building development has been conducted. The later part of this research provides the decision support framework for green building development of a public hospital. The analysis resulted in 10 main criteria with 337 score points and 16 sets of Green Hospital Building Development (GHBD) matrix rubrics. These results have established several potential aspects that could impact the implementation of green building development for a public hospital. The Technique for Order of Preferences by Similarity to Ideal Solution (TOPSIS) was applied to validate the results from the expert's view. Findings from the research work are including ranking schemes produced for 3 main sustainable dimensions ordered as environmental, social, and economic. The important contribution from this study is to rank the sustainable dimensions in terms of how attractive the decision-maker(s) when all criteria are simultaneously considered in fair evaluation. In conclusion, this study had established a Decision-Making Framework for GHBD.

ABSTRAK

Frasa seperti "menuju hijau" dan "hospital mesra alam" lebih memperlihatkan imej bangunan yang futuristik. Namun begitu, kriteria hijau utama hospital yang telah dibangunkan adalah sukar kelihatan, tetapi sedangkan itu adalah aspek utama yang sangat berimpak. Berurusan dengan pelbagai kriteria perancangan dan reka bentuk berkaitan dengan hospital hijau boleh mengelirukankan. Banyak penyelidikan ke atas bangunan hijau hanya tertumpu pada bangunan komersial dan bangunan tinggi tetapi kurang perhatian diberikan kepada bangunan hospital. Signifikasinya, proses membuat keputusan sepatutnya satu ciri penting dalam mengenal pasti kriteria terbaik untuk pembangunan bangunan hospital hijau. Oleh itu, kajian ini bertujuan untuk menyediakan satu rangka kerja membuat keputusan untuk pembangunan bangunan hijau bagi hospital awam. Kajian telah dibuat kepada peringkat perancangan dan reka bentuk terhadap pembangunan hospital di Malaysia. Seterusnya, analisis terhadap elemen hijau dan kelestarian untuk kriteria pembangunan hospital telah dijalankan bagi cadangan rangka kerja membuat keputusan terhadap perancangan dan reka bentuk untuk pembangunan bangunan hospital hijau dan lestari. Kajian bermula dengan analisa kritikal terhadap konsep dan garis panduan bangunan hospital hijau dan kemudiannya mengkaji sistem penarafan hijau sedia ada yang direkabentuk khusus untuk pembinaan hospital. Data kemudian dianalisis menggunakan analisis kandungan. Satu kajian perintis telah dibuat berdasarkan kajian literatur yang dilaksanakan. Kajian ini menggunakan kaedah satu tinjauan soalan kajiselidik bagi mengesahkan elemen dan kriteria hijau. Keputusan terhadap soalan kajiselidik dianalisis menggunakan analisis faktor yang menghasilkan 3 set komponen (ekonomi, sosial dan persekitaran). 154 responden terhadap kajian ini adalah perekabentuk hospital awam yang mempunyai pengalaman dalam berurusan dengan bangunan hospital awam. Identifikasi elemen dan kriteria yang mempengaruhi perancangan dan reka bentuk ke arah pembangunan bangunan hijau hospital telah dijalankan. Bahagian terakhir kajian ini menyediakan rangka kerja sokongan keputusan untuk pembangunan bangunan hijau terhadap sebuah hospital awam. Analisis ini menghasilkan 10 kriteria utama dengan 337 mata skor dan 16 set. Pembangunan Bangunan Hospital Hijau (GHBD) rubrik matriks keputusan ini telah mewujudkan beberapa aspek berpotensi yang boleh memberi impak implementasi terhadap pelaksanaan pembangunan bangunan hijau untuk sebuah hospital awam. Teknik terhadap perintah keutamaan melalui persamaan kepada solusi ideal (TOPSIS) telah diaplikasikan untuk mengesahkan keputusan dari pandangan pakar. Penemuan dari kerja penyelidikan termasuk skim kedudukan dihasilkan untuk 3 dimensi utama yang dikekalkan sebagai persekitaran, sosial dan ekonomi. Sumbangan penting daripada kajian ini adalah untuk kedudukan dimensi kelestarian dari segi bagaimana ianya menarik perhatian pembuat keputusan apabila semua kriteria dipertimbangkan serentak secara penilaian saksama. Kesimpulannya, kajian ini telah mewujudkan rangka kerja pembuat keputusan untuk GHBD.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

$\sum$	-	Summation
±	-	Plus - minus
=	-	Equals Sign
%	-	Percent
A	-	Attribute
C	-	Criteria
CC_i	-	Closeness Coefficient
S'_i	-	Negative Ideal Solution
S_i*	-	The Positive Ideal Solution
W	-	Weightage
x	-	Times

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Research Background

The construction industry and building construction are essential sectors that contribute greatly to the economic growth of a nation as well as physical development. Despite its positive contribution, the sectors have a significant contribution to many adverse environmental impacts on the environment (Abidin, 2010; Tan et al., 2011). Throughout its lifecycle, Weerasinghe and Ramachandra (2018) stated that conventional buildings consume about 40 percent of global energy, 40 percent of other resources, 25 percent of global water, and let out one-third of Green House Gas emissions. The amount of annual GHGs caused by buildings across the world has been estimated to reach 42.4 billion tonnes by 2035, 43 percent more than the 2007 level (USEIA, 2010). The United States General Services Administration (2011) states that green buildings save 19 percent of the aggregate operational costs, 25 percent of energy, and 36 percent of CO_2 emissions.

The immense consumption of energy and natural resources by the building sector has been known to be an exacerbating factor (Vyas & Jha, 2018). As building construction projects continue to grow and remain on a steady uptrend, the introduction of green initiatives and environment-friendly practices into the planning and design, as well as building and management of facilities is apparently in need. In this regard, the green building movement has gained its momentum (Hoffman & Henn, 2008; Zhang et al., 2019).

As hospitals typically use significantly more resources and produce more waste than comparably sized commercial buildings, effective deployment of environmentally driven strategies to improve resource management is of critical importance in the development of green hospital (Boudhankar et al., 2018). A

significant but perhaps less heralded development in new green hospital initiatives is the growing integration of advanced workflow optimisation into the early stages of building design and construction process. The World Health Organisation (WHO), too, has urged hospitals to proactively address the environmental footprint of the healthcare sector by reducing power consumption and utilising alternative energy generation through the recycling and conservation of resources (Boudhankar et al., 2018).

Hospitals are amongst the most intricate buildings of all modern institutions. It differs from other building types in the complexity of the functional relationship. Unlike other institutions, hospital building has lesser options. Apart from providing the right environment for patients, it should also be sensitive to the other parties. Thus, it is important to examine the emerging issues, analyse the challenges, appreciate the emerging trends, and study the options available for designing, planning, and construction of a hospital. Planning and designing responses must embrace all parts and aspects of the hospital. Strategies must be formulated to cope with the needs, cultures, and climates of a particular country. One of the strategic issues that need to be considered is green hospital building development.

The planning and design process of a new building and major renovations for existing buildings have a prime opportunity to achieve efficiencies in energy, indoor environment, water, lighting, and wastewater. Hence, delving into planning and design elements is colossal to the green building initiative. Many hospitals have begun placing a greater emphasis on becoming healthy buildings that incorporate sustainability into the design, construction materials, utilities, and even the workflow processes. It is a major challenge for the hospital building to get into green initiatives.

1.2 Statement of the Research Problem

Climate change is a reality, and the modern healthcare sector not just contributes towards this grave phenomenon but is itself being affected by it (Dhillon & Kaur, 2015). Hospitals are major contributors to environmental pollution contributing to pathological, pharmaceutical, chemical, radioactive, health risk and other wastes (World Health Organization, 2014). Dhillon and Kaur (2015) specified that hospitals, being the resource of intensive establishments, consume vast amounts of electricity, water, food and construction materials to provide high-quality care.

Concern about the environment and the future of the earth has become the focal point of global intention, the healthcare industry is encouraged to incorporate the greening movement in its practice. In recent years, there has been an emerging subset of green design that has been revolutionizing hospital design by employing sustainable technologies, energy-saving systems, and recyclable or renewable resources and materials (Gudiene et al., 2013). Green hospital design aspires to provide users with energy savings and a comfortable environment through innovative designs and green techniques (Wood et al., 2016).

Although hospital buildings represent one of the largest sectors of the economy in the West, hospitals have been very slow in addressing the sustainability issue (Prasad, 2008). One industry report produced by the American Society for Healthcare Engineering (ASHE, 2004), found that many hospitals have even less interest in green building certification than companies in other industries. The same discussion was stated by Kras (2011), that the healthcare sector is a sector that is strongly changing, with trends rapidly following one another. However, sustainability is not really a part of these trends in hospital buildings yet. Hospitals have traditionally lagged behind other industries in green building initiatives that employ environmentally friendly materials and construction methods. According to Castro et al. (2015), sustainable practices are not widespread mainly due to the fact that the hospital buildings are exceptional. Additionally, the implementation of sustainable practices, normally related to the concept of reduction, is not always very well perceived by society and can generate some resistance (Castro et al., 2015). Recognizing the importance of

sustainable building practices, “going green” and “environment sustainability” has been introduced for many years (Lorenzen, 2012; Wong & Zhou, 2015) but construction industry remains a major energy consumer based on official statistics (Wong & Zhou, 2015). This could be due to the passive attitude of construction practitioners towards adopting sustainable solutions (Wong & Kuan, 2014).

With many arising green hospital buildings around the world, the development of green hospital buildings in Malaysia has been under-researched. In the Malaysian context, Sahamir and Zakaria (2014) stated that paucity has been given to the importance of ensuring the sustainability of public hospital buildings in Malaysia.

It was also found that certain healthcare institutions, by employing simple, smart and sustainable measures can greatly reduce the environmental footprint (Dhillon & Kaur, 2015). The construction of green hospitals can be a challenge considering the local conditions and growing customer expectations (Dhillon & Kaur, 2015).

Hospital building normally includes more than one building. It stands like a campus or a small city. Thus, the whole operation requires sustainability efforts in terms of planning and design. As hospitals are quite complex buildings consisting of several dozens of different departments, it is necessary to appoint the corresponding criteria where needed.

As things stand, little research has been done in the field of sustainability for public hospitals in Malaysia, since sustainability is not on the priority list of the hospital boards. Therefore, it is pertinent to explore the green assessment criteria when it comes to sustainability for hospital buildings development (Sahamir & Zakaria, 2014). This is supported by a study done by Kersch et al. (2011), that it is pertinent to explore what constitutes good practice when it comes to sustainability in the hospital industry.

The present-day construction clients demand assurance on the long-term economic performance and costs of the buildings (Weerasinghe & Ramachandra, 2018). Parties involved which consist of the developers, suppliers, manufacturers, design teams, and construction teams are under immense pressure to minimise the total project cost and focus on cost over its life cycle (Oberg, 2005). As mentioned by Woodward (1997) in Weerasinghe and Ramachandra's (2018) studies, the concept of green building as applied to the construction of buildings is intended to promote the utmost efficiency and to reduce financial costs.

The target outcome of this research is to provide hospital stakeholders (client, owner, and board leaders) with information that will be useful in reaching a final decision regarding the implementation of a green strategy. Therefore, this research attempts to develop a decision-making framework that enables the proper guideline of hospital building towards sustainable practices.

Hence, a green hospital is imperative to study as sustainability must be taken into account when planning and designing new buildings and facilities. Indeed, sustainable building is about doing it right the first time, by keeping an eye to the short- and long-term consequences.

1.2.1 Research Questions

a) What is the current status of the green practice of public hospital building development?
b) What are the factors influencing the planning and designing of green public hospital building development?
c) What are the criteria that steer green developments for public hospital buildings?
d) How do those criteria influence the decision and drive sustainability outcomes in hospital buildings?

1.3 Research Gap

According to Papajohn et al. (2016), there are many green building assessment tools including the sets of criteria to assess the building's sustainability. However, there is no framework or established key criteria have been developed to provide a basis for the evaluation of green buildings (Papajohn et al., 2016). Further, some scholars focused on evaluating the differences between different standards of structural systems, such as object, content, mechanism, process, index categories, method, and weight settings that pointed out the differences among different standards (Zhang et al., 2017). For example, certain studies evaluated existing green building rating tools to develop new rating criteria for certain countries (Vyas & Jha, 2016). Sallam and Abdelaal (2016) evaluated water efficiency criteria of widely used green buildings rating tools compared to a proposed baseline. Similarly, there are many studies analysing energy use and assessment comparing widely used green building rating tools (Chen & Lee, 2013; Lee, 2012; Lee & Burnett, 2008; Schwartz & Raslan, 2013). Also, there are many kinds of research comparing different green building rating tools focusing on a specific criterion such as energy and water. In Malaysia context, until 2018, there is no public hospital building certified as green building. This could be due to the passive attitude of construction practitioners towards adopting sustainable solutions (Wong & Kuan, 2014). Thus, the study could assist hospital building in implementing the green practice. Furthermore, it can be seen that there are significant inadequacies in the existing literature in integrating key criteria and sustainable dimension of green buildings with the decision-making for green building assessment specifically for hospital buildings (Figure 1.1). Feasibly, identified research gap implies the integration of green assessment criteria and sustainable dimension. Where the decision-making framework needs to be developed after the process of integration for green initiative tools for hospital building. It thus provides the body of knowledge for this study with significant novelty.

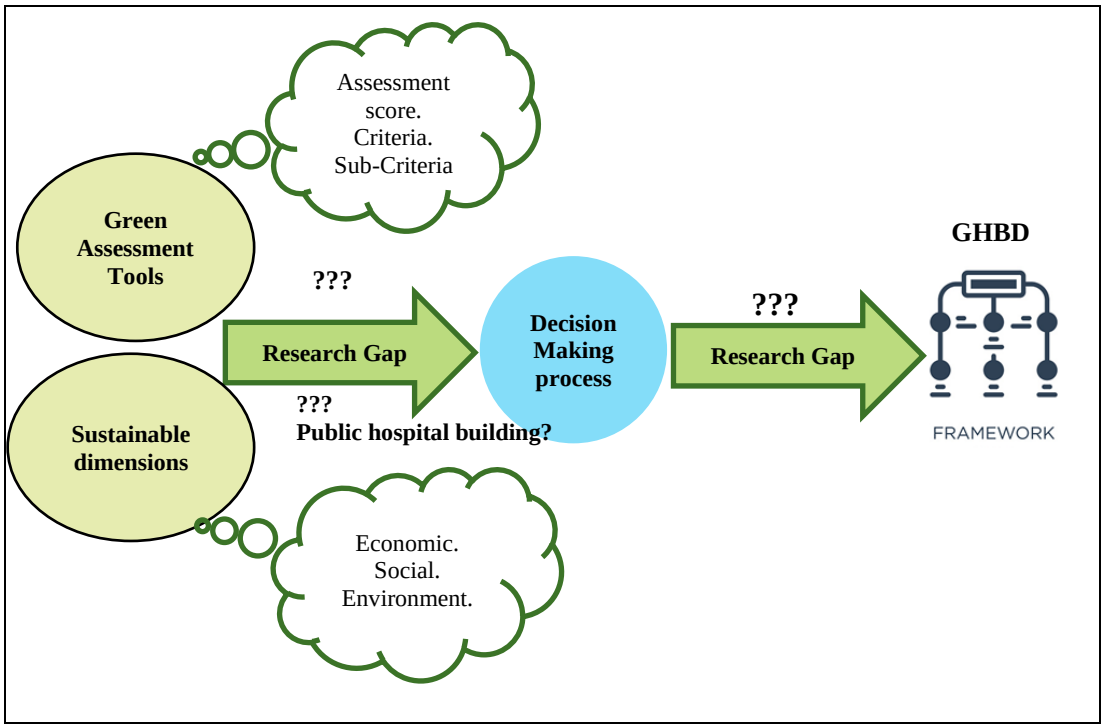

Figure 1.1 Research gap

1.4 Research Aim

The aim of the research is to provide a decision-making framework for Green Hospital Building Development (GHBD). The research elucidates the understanding of green hospital buildings towards the new development and improvement of the hospital buildings in Malaysia.

1.4.1 Research Objectives

To attain the research aim, the following objectives are formulated:

a) To investigate the green practice of hospital building development in Malaysia.
b) To determine the factors and criteria affecting the planning and designing of green hospital building development.
c) To analyse green and sustainable factors and criteria of hospital building development.
d) To propose the decision-making framework of planning and designing for green and sustainable hospital building development.

1.5 Research Scope

The research aims to propose the decision-making framework that hospital buildings will utilise green building design and practices into the development and its operation in Malaysia. Thus, the scope of this research confines the green building development concerning its criteria and sub-criteria in the decision-making process during planning and design stage.

Malaysian public hospital buildings are targeted in conducting the research as it contributes more to the development of green dimensions (economic, social, and environment). Besides, it is utilized by major populations in the region. The current

green assessment tools and related green policies applied in Malaysia have been used to highlight the practice of the sustainable concept.

The research focuses on the planning and designing practice in incorporating the green public hospital building for the development process. It discloses more on the design team's roles and responsibilities based on their job scope as professional planners and designers. The respondents of this research are those who were involved in the public hospital building project who held decisive roles during the project's planning and designing stage and had some knowledge pertaining to sustainable development and green construction. The results apply to Malaysia specifically, although they could be generalised to be applied to other developing countries with some modification regarding the cultural and political measures.

All criteria of buildings, respondents, and others are corresponding to the Malaysian context. At the 2015 United Nations Climate Change Conference, also known as 2015 Paris Climate Conference and Conference of Parties (COP) 21, held in Paris, France, Malaysia made a commitment to reduce by 2030 its CO_2 emissions per unit of GDP by 45% from the level in 2005. Thus, this study in the context of Malaysian hospital building development is essential. It is focused on the issue of public hospital building sustainability, which has generally tended to receive limited attention in Malaysia. Malaysia's green assessment tools and several global assessment tools for hospital buildings have been reviewed in ascertaining the objectives of the research.

1.6 Significance of Research

This study is expected to provide the Ministry of Health (MoH), Public Works Department (PWD), Hospital Directors (BOD), developers, and others with more sustainable responsive hospital building through green building practices. The following expected findings are essential for this research:

a) Understanding of the existence of a current condition of hospital buildings as compared to green practices that should be implemented to hospital buildings in Malaysia. Thus, the outcome will benefit the Ministry of Health in terms of fulfilling the government's provision.

b) Expected findings on the factors and criteria affecting the planning and designing of green hospital buildings that should highly give attention to the development process. Additionally, the analysis results in factors elements and criteria that should be incorporated into hospital buildings.

c) The list of sustainable and green building elements (e.g. energy, materials, waste disposal, etc) to the hospital building is a contribution towards the hospital stakeholders, i.e. directors (BOD), developers, Ministry of Health (MoH), etc. in aiding the decision-making process.

d) Analysis of research leads to an appropriate Decision-Making Framework for the hospital stakeholders to improve hospital green building planning, design, and operation.

1.7 Contribution to the Body of Knowledge

In order to overcome the increasing concern of today's resource depletion and to address environmental considerations, a decision-making framework is applied in order to improve sustainability in the construction industry as well as to the green hospital building development.

The development of the framework, as described in this research, is a good starting point for having a green public hospital building, especially in Malaysia's scenario. It can be used as a guideline for hospitals to become more sustainable.

The contribution of a decision-making process in obtaining green hospital building in Malaysia will assist the hospital stakeholders, for examples, the Ministry of Health Malaysia (MoH) and the Ministry of Works (Malaysia), or the Public Works Department (PWD) who are responsible as clients to have an immediate reference in their decision making.

The adoption of this innovative idea benefits the construction industry. The planning and designing stages are the key factor in the life cycle towards integrating sustainability into green hospital buildings. Therefore, practical methods and tools are needed to facilitate sustainability in the development of green hospital buildings. The acceptance of green practice should be integrated into the planning, designing, and subsequent building development of all buildings as well as hospital premises.

1.8 Thesis Outline

The following briefly describes six chapters provided in this thesis.

Chapter 1 introduces the research by presenting the research background; hence, the research problems are identified. The research gap, research questions, research aim, and objectives are depicted as a research direction. The chapter further briefly discusses the methodology conducted for the research. In parallel with that, it outlines the scope and limitations of the research and highlights the research significance.

Chapter 2 reflects the detailed literature review for the research. It includes two main topics, which are sustainable development and green hospital building development. Apart from the general overview of sustainable development, the topic explains the current implementation of the development in general. This section grasps the issues in green buildings practice for hospital buildings. Since the research identifies the current status of green hospital development in Malaysia, some green rating systems are discussed along with the current development of green buildings in the Malaysian construction industry.

Chapter 3 describes the literature relevant to the decision-making framework. As the research proposes a decision-making framework, the need to present the purpose and application of such techniques need to be detailed out. It grasps the issues of the decision-making process in terms of impacting sustainability practice.

Chapter 4 describes the research methodology applied to conduct the research. It portrays the philosophy on which the research is based upon. The research primarily uses the quantitative approach as the main data collection. Apart from the literature review and a preliminary study conducted for data gathering, this chapter explains the primary methods selected for the research, which are the questionnaires. The technique is justified appropriately to investigate the research questions, hence achieving the research aim and objectives. Furthermore, this section also describes the main data analysis approach to analyse results, namely factor analysis and TOPSIS.

Chapter 5 presents the results of data collection specifically pertaining to the current practice in the planning and designing of green hospital building development. The critical analysis and content analysis were used in response to several objectives of the research. The results from the pilot interview of the theoretical study help in portraying the current situation of green hospital building development in Malaysia. Factor analysis and TOPSIS presents the result of each variable pertaining to the preference of GHBD decision-making framework.

Chapter 6 concludes the findings concerning the research aim, research questions, and research objectives. Some research contributions that are divided into theoretical and practical are highlighted in this chapter. This section also outlines the research limitations as well as the recommendations for future research.

REFERENCES

Abdul Rahman, I., Memon, A. H., Karim, A., & Tarmizi, A. (2013). Significant factors causing cost overruns in large construction projects in Malaysia. J. Appl. Sci., (13), 286–293.

Abidin, N. Z. (2010). Investigating the awareness and application of sustainable construction concept by Malaysian developers. Habitat Int., 34(4), 421–426. Retrieved from http://dx.doi.org/10.1016/j.habitatint.2009.11.011.

Abrahams, G. (2015). Smart and Sustainable Built Environment Article information: Constructing Definitions of Sustainable Developmen.

Adams, W.M. (2006). The Future of Sustainability Re-thinking Environment and Development in the Twenty-first Century. Report of the IUCN Renowned Thinkers Meeting, International Union for Conservation of Nature (IUCN), University of Cambridge, UK, (Accessed 5 April 2014), ⟨http://cmsdata.iucn.org/ downloads/iucn_future_of_sustanability.pdf⟩.

Affendy, M., Yao, L., & Kamarudin, D. (2018). In-House Green Knowledge Practice For, 62–72.

Ahmed, T., Rajagopalan, P., & Fuller, R. (2015). A classification of healthcare facilities: toward the development of energy performance benchmarks for day surgery centers in Australia. Health Environ Res Des J, 8(4), 139–57. http://doi.org/http://dx.doi. org/10.1177/1937586715575910.

Ahn, Y., & Pearce, A. (2007). Green construction: contractor experiences, expectations, and perceptions. Journal of Green Building 2:106-22.

Alabool, H., Kamil, A., Arshad, N., Alarabiat, D. (2018). Cloud service evaluation methodbased multi-criteria decision-making: a systematic literature review, J. Syst. Softw. 139 161–188 https://doi.org/10.1016/j.jss.2018.01.038.

Alahmer, A., & Alsaqoor, S. (2019). Energy efficient of Using Chilled Water System for Sustainable Health Care Facility Operating by Solar Photovoltaic Technology. Energy Procedia, 156(September 2018), 65–71. http://doi.org/10.1016/j.egypro.2018.11.092

Ali, H.H., Al Nsairat, S.F. (2009). Developing a green building assessment tool for developing countries - case of Jordan, Build. Environ. 44 1053–1064.

Alia, A., Bohari, M., Skitmore, M., Xia, B., Teo, M., Zhang, X., & Naim, K. (2015). The path towards greening the Malaysian construction industry. 52(2015), 1742–1748. https://doi.org/10.1016/j.rser.2015.07.148

Ali-Toudert, F., & Ji, L. (2017). Modeling and measuring urban sustainability in multicriteria- based systems - a challenging issue. Ecological Indicators, 73, 597–611.

Alwan, Z., Jones, P., & Holgate, P. (2017). Strategic sustainable development in the UK construction industry, through the framework for strategic sustainable development, using Building Information Modelling. J. Clean. Prod. 140 (Part 1), 349–358.

Ametepey, O., Aigbavboa, C., & Ansah, K. (2015). Barriers to Successful Implementation of Sustainable Construction in the Ghanaian Construction Industry. Procedia Manufacturing, 3(Ahfe), 1682–1689. http://doi.org/10.1016/j.promfg.2015.07.988

Ando S, Arima T, Bogaki K, Hasegawa H, Hoyano A, Ikaga T, et al (2005). Architecture for a sustainable future. Tokyo: Architectural Institute of Japan.

Annual Report 2010, Ministry of Health, Putrajaya, Malaysia. http://www.moh.gov.my/v/duk (Online, accessed on 10. 1. 2013).

Annual Report 2011, Ministry of Health, Putrajaya, Malaysia. http://www.moh.gov.my/v/duk (Online, accessed on 10. 1. 2013).

Annual Report 2017, Ministry of Health, Putrajaya, Malaysia. http://www.moh.gov.my/v/duk (Online, accessed on 10. 9. 2018).

Arrindell, W. A., & Van der Ende, J. (1985). An Empirical-Test of the Utility of the Observationsto-Variables Ratio in Factor and Components Analysis. Applied Psychological Measurement, 9(2), 165–178.

Asdrubali, F., Baldinelli, G., Bianchi, F., Sambuco, S. (2015). A comparison between environmental sustainability rating systems LEED and ITACA for residential buildings. Build. Environ. 86, 98-108. https://doi.org/10.1016/j.buildenv.2015.01.001.

ASHE. (2004). Green Healthcare Construction Guidance Statement Practices: Integrating Green Principles into the Design Process.

ASHE. (2007). Lexington Medical center builds South Carolina's first "green certified" medical complex, 2007.

Atici, K. B., & Ulucan, A. (2009). Multi criteria decision analysis approaches in energy projects evaluation process and Turkey applications. Hacattepe Univ Fac Econ Adam Sci J, 27(1), 161–86.

Awadh, O. (2017). Sustainability and green building rating systems: LEED, BREEAM, GSAS and Estidama critical analysis. J. Build. Eng. 11, 25-29. https://doi.org/10. 1016/j.jobe.2017.03.010.

Ayçam, İ., & Yazici, A. (2017). Evaluation of Operating Room Units within the Context of Green Design Criteria, 30(1), 1–15.

Aye, L., Hes D. (2012). Green building rating system scores for building reuse, J Green Build. 7 (2) 105–112.

Azar, F. E., Farzianpour, F., & Foroushani, A. R. (2015). Evaluation of Green Hospital Dimensions in Teaching and Private Hospitals Covered by Tehran University of Medical Sciences, (April), 259–266.

Azhar, S., Carlton, W. A., Olsen, D., & Ahmad, I. (2011). Building Information Modeling for sustainable design and LEED® rating analysis. Automation Constr., (20), 217–224.

Azmal, M., Kalhor, R., Dehcheshmeh, N. F., Goharinezhad, S., Heidari, Z. A., & Farzianpour, F. (2014). Going toward Green Hospital by Sustainable Healthcare Waste Management: Segregation, Treatment and Safe Disposal. Health, 06(19), 2632–2640. http://doi.org/10.4236/health.2014.619302

Baek, C., Park, S. H., Suzuki, M., & Lee, S. H. (2013). Life cycle carbon dioxide assessment tool for buildings in the schematic design phase. Energy Build., (61), 275–287.

Bakhtiar B. and Ibrahim R., (2010). "Developing Smart Growth Model for Building Affordable Quality Housing," School of Graduate Studies, vol. PhD. University Putra Malaysia, Serdang, p. 240,.

Bansal, S., & Singh, S. (2014). A sustainable approach towards the construction and demolition waste. Int. J. Innovative Res. Sci. Eng. Technol., (3), 1262–1269.

Bartlett, M. S. (1954). A note on the multiplying factors for various chi square approximations. Journal of the Royal Statistical Society, 16, 296–8.

Becker, H. S. (2012). How many qualitative interviews is enough? Expert voices and early career reflections on sampling and cases in qualitative research. National

Centre for Research Methods, University of Southampton. Retrieved from http://eprints. ncrm.ac. uk/2273/(accessed 16 August 2012).

Bentler, P. M., & Kano, Y. (1990). On the Equivalence of Factors and Components. Multivariate Behavioral Research, 25(1), 67–74.

Berardi, U. (2013). Clarifying the new interpretations of the concept of sustainable building. Sustain. Cities Soc., 8, 72–78.

Berardi, U., GhaffarianHoseini, A., GhaffarianHoseini, A. (2014). State-of-the-art analysis of the environmental benefits of green roofs. Appl. Energy 115, 411-428. https://doi.org/10.1016/j.apenergy.2013.10.047.

Besir, A.B., Cuce, E. (2018). Green roofs and facades: a comprehensive review. Renew. Sustain. Energy Rev. 82, 915-939. https://doi.org/10.1016/j.rser.2017.09.106.

Bianchini, F., Hewage, K. (2012). Probabilistic social cost-benefit analysis for green roofs: a lifecycle approach. Build. Environ. 58, 152-162. https://doi.org/10.1016/j.buildenv.2012.07.005.

Biswas, T., Tsung-Hsien, W., & Krishnamurti, R. (2008). Integrating Sustainable Building Rating Systems with Building Information Models.

Bizzarri, G., & Morini, G. L. (2006). New technologies for an effective energy retrofit of hospitals. Applied Thermal Engineering, Vol.26, 161-169.

Blankendaal, T., Schuur, P., & Voordijk, H. (2014). Reducing the environmental impact of concrete and asphalt: a scenario approach. J. Clean. Prod., (66), 27–36.

Bluyssen, P. M. (2009). Towards new methods and ways to create healthy and comfortable buildings. Building and Environment, 1–11.

Boston University. (2018). What is LEED?

Bottani, E., & Rizzi, A. (2006). A fuzzy TOPSIS methodology to support outsourcing of logistics services. Supply Chain Management: An International Journal, 11(4), 294–308. http://doi.org/10.1108/13598540610671743

Boudhankar, R., Singh, V. K., & Lillrank, P. (2018). Planning and Designing Helathcare Facilities. New York: Productivity Press.

Bouma, G., & Atkinson, G. (1995). A Handbook of Social Science Research: A Comprehensive and Practical Guide for Students. Oxford University Press.

Bourdeau, L. (1999). Agenda 21 on Sustainable Construction. CIB report publication, p. 237.

Boyce, C., & Neale, P. (2006). Conducting in-depth Interviews: A Guide for Designing and Conducting In-Depth Interviews. Pathfinder International Tool Series.

BREEAM, UK. http://www.breeam.org/page.jsp?id=105 (Online, accessed on 10. 4. 2011).

Brudermann, T., Sangkakool, T. (2017). Green roofs in temperate climate cities in Europe e an analysis of key decision factors. Urban For. Urban Green. 21, 224-234. https://doi.org/10.1016/j.ufug.2016.12.008.

Brundtland, G. H. (1987). Report of World Commission on Environment and Development (WCED): Our Common Future, A Report Prepared for the General Assembly of the United Nations, United Nations, (Accessed 4 April 2014), ⟨http://www.undocuments.net/our-common-future.pdf⟩.

Building and Construction Authority. (2016). BCA Green Mark Assessment Criteria and Online Application.

Calabrese, A., Costa, R., Levialdi, N., & Menichini, T. (2018). Integrating sustainability into strategic decision-making: A fuzzy AHP method for the selection of relevant sustainability issues. Technological Forecasting and Social Change, (March), 1–14. http://doi.org/10.1016/j.techfore.2018.11.005

Camgöz-akdağ, H., Konyalıoğlu, A. K., & Beldek, T. (2019). The Comparison and Similarity Study Between Green Buildings and Green Hospitals: Springer International Publishing. http://doi.org/10.1007/978-3-319-92267-6

Campos-Guzman, V., Garcia-Cascales, M.S., Espinosa, N., Urbina, A. (2019). Life cycle analysis with multi-criteria decision making: a review of approaches for the sustainability evaluation of renewable energy technologies, Renew. Sustain. Energy Rev. 104 343–366 https://doi.org/10.1016/j.rser.2019.01.031.

Carli, R., Dotoli, M., & Pellegrino, R. (2018). Multi-criteria decision-making for sustainable metropolitan cities assessment. Journal of Environmental Management, 226(July), 46–61. http://doi.org/10.1016/j.jenvman.2018.07.075

Carpenter D., (2008). Greening up – Hospitals getting savvier on sustainability. HFM Magazine; 2008. p. 15-21.

Casanovas-rubio, M., & Ramos, G. (2017). Resources, Conservation & Recycling Decision-making tool for the assessment and selection of construction processes based on environmental criteria : Application to precast and cast- in-situ alternatives. Resources, Conservation & Recycling, 126(July), 107–117. http://doi.org/10.1016/j.resconrec.2017.07.035

Castro, M. D. F., Mateus, R., & Bragança, L. (2014). A critical analysis of building sustainability assessment methods for healthcare buildings. Environ Dev Sustain, 17(6), 1381–412.

Castro, M. D. F., Mateus, R., & Bragança, L. (2017). Healthcare Building Sustainability Assessment tool - Sustainable Effective Design criteria in the Portuguese context. Environmental Impact Assessment Review, 67(September), 49–60. http://doi.org/10.1016/j.eiar.2017.08.005

Catell, R. B. (1966). The scree test for number of factors. Multivariate Behavioral Research, 1, 245–76.

Chan, A.L.S., Chow, T.T. (2013). Evaluation of Overall Thermal Transfer Value (OTTV) for commercial buildings constructed with green roof. Appl. Energy 107, 10-24. https://doi.org/10.1016/J.APENERGY.2013.02.010.

Charmaz, K. (2012). Expert voices. In How many qualitative interviews is enough? Expert voices and early career reflections on sampling and cases in qualitative research (pp.21-22). National Centre for Research Methods, University of Southampton.

Chen, P., & Kan, M. (2014). Integrating Energy Simulation in Energy Saving Analysis of Taiwan's Green Hospital Buildings, (Isarc).

Chen, X., Yang, H., Lu, L. (2015). A comprehensive review on passive design approaches in green building rating tools. Renew. Sustain. Energy Rev. 50, 1425-1436. https://doi.org/10.1016/j.rser.2015.06.003.

Chitu Okoli, & Pawlowski, S. D. (2004). The Delphi method as a research tool: an example, design considerations and applications. Information & Management, 42, 15-29.

Chowdhury, M., Upadhyay, A., Briggs, A., & Belal, M. (2016). An Empirical Analysis of Green Supply Chain Management Practices in Bangladesh Construction Industry.

Chua SC, Oh TH (2010). Review on Malaysia's national energy developments: key policies, agencies, programmes and international involvements. Renewable and Sustainable EnergyReviews2010;14(9):2916–25.

Chua, S. C., & Oh, T. H. (2011). Green progress and prospect in Malaysia. Renewable and Sustainable Energy Reviews, 15(6), 2850–2861. https://doi.org/10.1016/j.rser.2011.03.008

CIDB. (2018). Built It Green: An Overview of Sustainability Green Building Rating Tools in Malaysia. Kuala Lumpur.

Cole R. (2003). Building environmental assessment methods: a measure of success. Special issue article in: The Future of Sustainable Construction.

Cole, R.J. (2005). Building environmental assessment methods: redefining intentions and roles. Build. Res. Inf. 33 (5), 455-467. http://dx.doi.org/10.1080/09613210500219063.

Comrey, A., & Lee, H. (1992). A first course in factor analysis. Hillsdale, NJ: Erlbaum.

Coolican, H. (1993). Research Methods and Statistics in Psychology. Hodder & Stoughton.

Coote A. (2002). Claiming the health dividend. London:: King's Fund.

Costello, A. B., & Osborne, J. W. (2005). Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most from Your Analysis. Practical Assessment & Evaluation, 10(7), 1–9.

Creswell, J. W. (2009). Research Design: Qualitative, Quantitative and Mixed methods Approaches (3rd Editio). Los Angeles: Sage.

Crochet, A.-L. (2016). Sustainable Hospitals ~ Consider Going Green? Medical Tourism Magazine. Retrieved from https://www.medicaltourismmag.com/sustainable-hospitals-consider-going-green/

Dhillon, V. S., & Kaur, D. (2015). Green Hospital and Climate Change: Their Interrelationship and the Way Forward, 1–5. http://doi.org/10.7860/JCDR/2015/13693.6942

Ding, Z., Fan, Z., Tam, V.W.Y., Bian, Y., Li, S., Illankoon, I.M.C.S., Moon, S. (2018). Green building evaluation system implementation. Build. Environ. 133, 32-40. https://doi.org/https://doi.org/10.1016/j.buildenv.2018.02.012.

Dixit, M. K., Culp, C. H., & Fern_andez-Solís, J. L. (2013). System boundary for embodied energy in buildings: a conceptual model for definition. Renew. Sustain. Energy Rev., (21), 153–164.

Dixit, M. K., Fern_andez-Solís, J. L., Lavy, S., & C.H. Culp. (2012). Need for an embodied energy measurement protocol for buildings: a review paper, Renew. Sustain. Energy Rev., (16), 3730–3743.

Dixon, J. (2009). Is Climate Change on Malaysia's Agenda? Posted on July 8, 2009. Filed under: Climate Change,

⟨http://envdevmalaysia.wordpress.com/2009/07/08/isclimate-change-on-malaysias-agenda/⟩; [Accessed 01.12.13].

Doan, D. T., Ghaffarianhoseini, A., Naismith, N., Zhang, T., Ghaffarianhoseini, A., & Tookey, J. (2017). A critical comparison of green building rating systems. Building and Environment, 123, 243–260. https://doi.org/10.1016/j.buildenv.2017.07.007

EIA, Energy Information Administration. Annual energy outlook. US Department of Energy http://www.eia.doe.gov/oiaf/aeo/index.html; 2008 [accessed 1.10.10].

Elomda, B. M., Hefny, H. A., & Hassan, H. A. (2013). An extension of fuzzy decision maps for multi-criteria decision-making. Egyptian Informatics Journal, 14, 147–155.

Erdogan, S. A., Šaparauskas, J., & Turskis, Z. (2017). Decision Making in Construction Management: AHP and Expert Choice Approach. Procedia Engineering, 172, 270–276. http://doi.org/10.1016/j.proeng.2017.02.111

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. Psychological Methods, 4(3), 272–299.

Figueira, J., Greco, S., & Ehrgott, M. (2004). Multiple Criteria Decision Analysis: State of the Art Surveys. New York: Springer.

Florez, L., Castro, D., & Irizarry, J. (2013). Measuring sustainability perceptions of construction materials. Constr Innov: Inf Process Manag, 13(2), 217–34.

Floyd, F. J., & Widaman, K. F. (1995). Factor analysis in the development and refinement of clinical assessment instruments. Psychological Assessment, 7(3), 286–299.

Ford, J. K., MacCallum, R. C., & Tait, M. (1986). Application of Exploratory Factor-Analysis in Applied- Psychology - a Critical Review and Analysis. Personnel Psychology, 39(2), 291–314.

Fowler K. M., Rauch E. M. (2006). Sustainable Building Rating Systems Summary. Pacific Northwest National Laboratory - U.S. Department of Energy; 2006.

Fowler, F. J. (2008). Survey Research Methods (4th Editio). Los Angeles: Sage Pub.

Franco, A., Shaker, M., Kalubi, D., & Hostettler, S. (2017). A review of sustainable energy access and technologies for healthcare facilities in the Global South. Sustainable Energy Technologies and Assessments, 22, 92–105. http://doi.org/10.1016/j.seta.2017.02.022

GBI. (2011). Assessment Criteria for Non-Residential Exisiting Building (NREB), 1st ed. January 2011, version 1.1 http://www.greenbuildingindex.org/ (Online, accessed on 10. 8. 2011).

GBI. (2013). Green Building Index. http://www.greenbuildingindex.org/organisation-certified-buildings-NRNC.html (Online, accessed on 10. 7. 2013).

GBI. (2016). What is Green Building Index? https://www.greenbuildingindex.org/

General Services Administration, U.S. (2011). The benefits and challenges of green roofs on public and commercial buildings. Rep. United States Gen. Serv. Adm.

Getter, K.L.K., Rowe, D.B. (2006). The role of extensive green roofs in sustainable development. Hortscience 41, 1276-1285.

Gharzeldeen, M., & Beheiry, S. (2014). Investigating the use of green design parameters in UAE construction projects. Int J Sustain Eng, 1–9.

Gidney, G. (2008). Infection control: A tool for sustainable hospital design. University of Cambridge.

Goepel, K.D. (2018). Implementation of an online software tool for the analytic hierarchy process (AHP-OS), Int. J. Anal. Hierar. Proc. 10 (3) 469–487 https://doi. org/10.13033/ijahp.v10i3.590.

Gong, M., Simpson, A., Koh, L., & Tan, K. (2016). Inside out: the interrelationships of sustainable performance metrics and its effect on business decision-making: theory and practice. Resour. Conserv. Recycl. (in Press).

Gorsuch, R. L. (1990). Factor-Analysis Versus Component Analysis - Some Well- and Little-Known Facts. Multivariate Behavioral Research, 25(1), 33–39.

Gou, Z., & Xie, X. (2017). Evolving green building: triple bottom line or regenerative design? J. Clean. Prod., 153, 600–607. Retrieved from https://doi.org/10.1016/j.jclepro.2016.02.%0A077.

Gou, Z.H., Lau S. (2014). Contextualizing green building rating systems: case study of HK, Habitat Int. 44 282–289.

Government of Malaysia (GoM), “Eight Malaysia Plan (2001-2005),” Economic Planning Unit, Prime Minister’s Department, Kuala Lumpur, 2001.

Government of Malaysia (GoM), “Eleventh Malaysia Plan (2016-2020),” Government Press, Kuala Lumpur.

Government of Malaysia (GoM), “Fifth Malaysia Plan (1986-1990),” Government Press, Kuala Lumpur, 1986.

Government of Malaysia (GoM), “Ninth Malaysian Plan (2006 – 2010),” Economic Planning Unit, Prime Minister’s Department, Putrajaya, 2006.

Government of Malaysia (GoM), “Ten Malaysia Plan (2014-2015),” Government Press, Kuala Lumpur, 1976.

Government of Malaysia (GoM), “Third Malaysia Plan (1976-1980),” Government Press, Kuala Lumpur, 1976.

Govindan, K. (2018). Sustainable consumption and production in the food supply chain: A conceptual framework. International Journal of Production Economics, 195(March 2017), 419–431. http://doi.org/10.1016/j.ijpe.2017.03.003

Govindan, K., Shankar, K. M., & Kannan, D. (2016). Sustainable material selection for construction industry – A hybrid multi criteria decision making approach. Renewable and Sustainable Energy Reviews, 55, 1274–1288. http://doi.org/10.1016/j.rser.2015.07.100

Green Building Council Australia. (2011). Green Star assesses the sustainable design, construction and operation of buildings.

Green star healthcare v1. Green Building Council Australia (GBCA). http://www.gbca.org.au/green-star/rating-tools/green-star-healthcare-v1/1936.htm (Online, accessed on 10. 6. 2011).

Green star. (2011). Green Building Council Australia (GBCA). http://www.gbca.org.au/green-star/ (Online, accessed on 10. 6. 2011).

Griffiths, J. (2006). Environmental sustainability in the national health service in England. Public Health 120, 609–612.

Griffiths, J. (2006). Environmental sustainability in the national health service in England. Public Health 120, 609–612.

Guadagnoli, E., & Velicer, W. F. (1988). Relation of Sample-Size to the Stability of Component Patterns. Psychological Bulletin, 103(2), 265–275.

Gudiene, N., Banaitis, A., & Banaitiene, N. (2013). Evaluation of critical success factors for construction projects: an empirical study in Lithuania. Int. J. Strateg. Prop. Manag., 17(1), 21–31.

Haapio, A. (2012). Towards sustainable urban communities. Environmental Impact Assessment Review, 32(1), 165–169.

Häkkinen, T. (2007). Assessment of indicators for sustainable urban construction. Civ Eng Environ Syst, 24(4): 247–59.

Halimaton S. H. and Benson D. J., (1994). “Integrating Strategic Environmental Assessment inot Malaysian Landuse Planning,” Department of Town and Country Planning Faculty of Social and Environmental Science , vol. PhD. University Of Newcastle Upon Tyne, Newcastle, p. 429, 1994.

Hamid, Z. A., & Kamarul Anuar Mohamad Kamar. (2012). Aspects of off-site manufacturing application towards sustainable construction in Malaysia. Construction Innovation, Vol. 12(Issue: 1), pp.4-10.

He, Y., Kvan, T., Liu, M., Li, B. (2018). How green building rating systems affect designing green. Build. Environ. 133, 19-31. https://doi.org/10.1016/j.buildenv. 2018.02.007.

Heravi, G., Fathi, M., & Faeghi, S. (2017). Multi-criteria group decision-making method for optimal selection of sustainable industrial building options focused on petrochemical projects. Journal of Cleaner Production, 142, 2999–3013. http://doi.org/10.1016/j.jclepro.2016.10.168

Hezri, A. A., & Hasan, M. N. (2006). Towards sustainable development? The evolution of environmental policy in Malaysia. Natural Resources Forum 30, 37–50.

Holton, I., Glass, J., & Price, A. D. F. (2010). Managing for sustainability: findings from four company case studies in the UK precast concrete industry. Journal of Cleaner Production 18, 152-160.

Holton, I., Glass, J., & Price, A. D. F. (2010). Managing for sustainability: findings from four company case studies in the UK precast concrete industry. Journal of Cleaner Production 18, 152-160.

Huo, X., Yu, A.T.W., Wu, Z. (2017). A comparative analysis of site planning and design among green building rating tools. J. Clean. Prod. 147, 352-359. https://doi.org/10.1016/j.jclepro.2017.01.099.

Hwang, C. L., & Yoon, K. P. (1981). Multiple Attribute Decision Making: Methods and Applications, A State-of-the-Art Survey. Berlin: SpringerVerlang.

Illankoon, I.M.C.S., Tam, V.W.Y., Le, K.N., Shen, L. (2017). Key credit criteria among international green building rating tools. J. Clean. Prod. 164, 209-220. https://doi.org/10.1016/j.jclepro.2017.06.206.

Invidiata, A., & Ghisi, E. (2016). Life-cycle energy and cost analyses of window shading used to improve the thermal performance of houses. J. Clean. Prod., (133), 1371–1383.

IPCC. (2007). from available at: www.ipcc.ch (accessed June 2008), Intergovernmental Panel on Climate Change.

Ismaeel, W.S.E. (2018). Midpoint and endpoint impact categories in Green building rating systems. J. Clean. Prod. 182, 783-793. https://doi.org/10.1016/j.jclepro.2018.01.217.

Jalaei, F., & A. Jrade. (2015). Integrating Building Information Modeling (BIM) and LEED system at the conceptual design stage of sustainable buildings. Sustain. Cities Soc., (18), 95–107.

Jato-Espino, D., Castillo-Lopez, E., Rodriguez-Hernandez, J., & Canteras-Jordana, J. C. (2014). A review of application of multi-criteria decision-making methods in construction. Automation in Construction, 45, 151–162. http://doi.org/10.1016/j.autcon.2014.05.013

Kaiser, H. (1970). A second-generation Little Jiffy. Psychometrika, (35), 401–15.

Kaiser, H. (1974). An index of factorial simplicity. Psychometrika, (39), 31–6.

Kaplan, S., Sadler, B., Little, K., Franz, C., & Orris, P. (2012). Can Sustainable Hospitals Help Bend the Health Care Cost Curve? The Commonwealth Fund, 29.

Karliner, J., & Guenther, R. (2011). Global Green and Healthy Hospitals: Agenda for Hospitals and Health Systems Around the World. Retrieved from www.noharm.org

Karteris, M., Mallinis, G., Tsiros, E. (2016). Towards a green sustainable strategy for Mediterranean cities: assessing the bene fits of large-scale green roofs implementation in Thessaloniki, Northern Greece, using environmental modelling, GIS and very high spatial resolution remote sensing data, 58, 510-525. https://doi.org/10.1016/j.rser.2015.11.098.

Kates, R. W. (2012). From the Unity of Nature to Sustainability Science: Ideas and Practice. In M. P. Weinstein, & R. E. Turner (Eds.). Sustainability science: The emerging paradigm and the urban environment (pp. 3-19).New York, NY: Springer New York. https://doi.org/10.1007/978-1-4614-3188-6_1.

Kates, R. W., Clark, W. C., Corell, R., Hall, J. M., Jaeger, C. C., Lowe, I. (2001). Sustainability Science. Science, 292(5517), 641–642.

Kats, G., Alevantis, L., Berman, A., Mills, E., Perlman, J. (2003). The Costs and Financial Benefits of Green Buildings. A Report to California's Sustainable

Building Task Force, U.S Green Building Council, (Accessed 4 April 2014), ⟨http://www. usgbc.org/Docs/News/News477.pdf⟩.

Kersch, R., Laanen, E., Wabnegg, M., & Julaniya, A. (2011). A study on the relation between sustainability initiatives and organisational design elements in hospitals.: Rotterdam School of Management, Erasmus University

Kersch, R., Laanen, E., Wabnegg, M., & Julaniya, A. (2011). Sustainability in Health Care, (May).

KeTTHA. 2013. https://www.mestecc.gov.my/web/

Keysar E, & AR., P. (2007). Decision support tool for green building: facilitating selection among new adopters on public sector projects. Green Building, 2(3), 153–171.

Khasreen, M.M., Banfill, P.F.G., Menzies, G.F. (2009). Life-cycle assessment and the environmental impact of buildings: a review, Sustainability 1 674–701.

Khishtandar, S., Zandieh, M., & Dorri, B. (2017). A multi criteria decision making framework for sustainability assessment of bioenergy production technologies with hesitant fuzzy linguistic term sets: The case of Iran. Renewable and Sustainable Energy Reviews, 77(November 2016), 1130–1145. http://doi.org/10.1016/j.rser.2016.11.212

Kibwami, N., & Tutesigensi, A. (2016). Enhancing sustainable construction in the building sector in Uganda. Habitat International, 57, 64–73. http://doi.org/10.1016/j.habitatint.2016.06.011

Kiker, G. A., Bridges, T. S., Varghese, A., Seager, P. T., & Linkov, I. (2005). Application of multicriteria decision analysis in environmental decision making. Integr. Environ. Assess. Manag., (1), 95–108.

Kim, S., & Osmond, P. (2014). Analyzing green building rating tools for healthcare buildings from the building user' s perspective, 23(5), 757–766. http://doi.org/10.1177/1420326X13480223

Kras, I. (2011). Sustainable hospital building Faculty of Architecture, Urbanism and Building Science,Technical University of Delft.

Kucukvar, M., & Tatari, O. (2013). Towards a triple bottom-line sustainability assessment of the US construction industry. Int. J. Life Cycle Assess., (18), 958–972.

Lahdelma, R., Salminen, P., & Hokkanen, J. (2000). Using multicriteria methods in environmental planning and management. Environ. Manag., (26), 595–605.

Lam, P. T. I., Chan, E. H. W., Chau, C. K., & Poon, C. S. (2011). A sustainable framework of "green" specification for construction in Hong Kong. Journal of Facilities Management, 9(1), 16–33. http://doi.org/10.1108/14725961111105718

Latiff A., (2004) Towards a Framework for Indicators of Biodiversity Conservation. Indicators of Sustainable Development, Assessing Changes in Environmental Condition 2004;45.

Laustsen, G. (2007). Reduce-recycle-reuse: guidelines for promoting perioperative waste management. AORN J(85(4)), 717-728.

Laustsen, J. (2008). Energy Efficiency Requirements in Building Codes, Energy Efficiency Policies for New Buildings, International Energy Agency (IEA), Paris, ⟨http:// www.iea.org/publications/freepublications/publication/Building_Codes.pdf⟩ (Accessed 7 April 2014)

LEED, US (2010). http://www.usgbc.org/leed/rating-systems/healthcare (Online, accessed on 12. 12. 2010).

LEED, US (2012). http://www.usgbc.org/leed (Online, accessed on 14. 8. 2012).

Li, P., & Froese, T. M. (2017). A green home decision-making tool: Sustainability assessment for homeowners. Energy and Buildings, 150, 421–431. http://doi.org/10.1016/j.enbuild.2017.06.017

Loehlin, J. C. (25AD). Component Analysis Versus Common Factor-Analysis - a Case of Disputed Authorship. Multivariate Behavioral Research, 1(29–31).

Løken, E. (2007). Use of multicriteria decision analysis methods for energy planning problems. Renew. Sust. Energ., (Rev. 11), 1584–1595.

Lorenzen, J. A. (2012). Going Green: the process of lifestyle change 1, in: Sociological Forum. Wiley Online Library, 94–116.

Lu, Y., Geng, Y., Liu, Z., Cote, R., Yu, X. (2017). Measuring sustainability at the community level: an overview of China's indicator system on National Demonstration Sustainable Communities. J. Clean. Prod. 143, 326-335. http://dx.doi.org/10.1016/j.jclepro.2016.12.105.

Luc Bourdeau, (1999), CIB Report Publication 237 on Agenda 21 on Sustainable Construction, July 1999.

MacCallum, R. C., & Tucker, L. R. (1991). Representing Sources of Error in the Common Factor Model - Implications for Theory and Practice. Psychological Bulletin, 109(3), 502–511.

MacCallum, R. C., Widaman, K. F., Zhang, S. B., & Hong, S. H. (1999). Sample size in factor analysis. Psychological Methods, 4(1), 84–99.

Madew, R. (2006). The Dollars and Sense of Green Buildings. A Report for the Green Building Council of Australia, Green Building Council of Australia, (Accessed 25 March 2014), ⟨http://www.gbca.org.au/resources/dollars-and-sense-of-greenbuildings-2006-building-the-business-case-for-green-c/1002.htm⟩.

Mahdiyar, A., Tabatabaee, S., Abdullah, A., Marto, A. (2018). Identifying and assessing the critical criteria affecting decision-making for green roof type selection. Sustain. Cities Soc. 39, 772-783. https://doi.org/10.1016/j.scs.2018.03.007.

Mahdiyar, A., Tabatabaee, S., Durdyev, S., Ismail, S., Abdullah, A., Wan Mohd Rani, W.N.M. (2019). A prototype decision support system for green roof type selection: a cybernetic fuzzy ANP method. Sustain. Cities Soc. 101532. https://doi.org/10.1016/j.scs.2019.101532.

Manokaran, E., Subhashini, S., Senthilvel, S., Muruganandham, R., & Ravichandran, K. (2011). application of Multi Criteria Decision Making Tools and validation with optimisation technique-case study using TOPSIS, ANN and SAW. International Journal of Management and Business Studies, 1(3), 112–115.

Manso, M., Castro-Gomes, J. (2015). Green wall systems: a review of their characteristics. Renew. Sustain. Energy Rev. 41, 863-871. https://doi.org/10.1016/j.rser.2014.07.203.

Marimuthu, M., & Paulose, H. (2016). Emergence of Sustainability Based Approaches in Healthcare: Expanding Research and Practice. Procedia - Social and Behavioral Sciences, 224(August 2015), 554–561. http://doi.org/10.1016/j.sbspro.2016.05.437

Mas, U. (2004). ECOT Miljo¨ information. Nr. 2. Sweden.

Mateus, R., Bragança, L., & F, M. De. (2017). Development of a healthcare building sustainability assessment method e Proposed structure and system of weights for the Portuguese context, 148. http://doi.org/10.1016/j.jclepro.2017.02.005

Mattoni, B., Guattari, C., Evangelisti, L., Bisegna, F., Gori, P., Asdrubali, F. (2018). Critical review and methodological approach to evaluate the differences among

international green building rating tools. Renew. Sustain. Energy Rev. 82, 950-960. https://doi.org/10.1016/j.rser.2017.09.105.

McDonald, R.C. (2005) The Economics of Green Building in Canada: Highlighting Seven Keys to Cost Effective Green Building. Doctoral Dissertation, Royal Roads University, Colwood.

Mederly, P., Novacek, P., & Topercer, J. (2003). Sustainable development assessment: quality and sustainability of life indicators at global, national and regional level. Foresight, 5(5), 42–49. http://doi.org/10.1108/14636680310507307

Miller, D., Doh, J.-H., Panuwatwanich, K., & Oers, N. V. (2015). The contribution of structural design to green building rating systems: an industry perspective and comparison of life cycle energy considerations. Sustain. Cities Soc., (16), 39–48.

Mitleton-Kelly, E. (2011). A complexity theory approach to sustainability: A longitudinal study in two London NHS hospitals. The Learning Organisation, Vol.18 No.1, 45-53.

Moghimi, S., Azizpour, F., Mat, S., Lim, C. H., Salleh, E., & Sopian, K. (2013). Building energy index and end-use energy analysis in large-scale hospitals—Case study in Malaysia. Energy Effic., (7), 243–256.

Moghtadernejad, S., Chouinard, L. E., & Mirza, M. S. (2018). Multi-criteria decision-making methods for preliminary design of sustainable facades. Journal of Building Engineering, 19(May), 181–190. http://doi.org/10.1016/j.jobe.2018.05.006

Monokaran, E., Subhashini, S., Senthivel, S., Muruganandham, R., & Ravichandran, K. (2011). Application of Multi Criteria Decision Making Tools and Validation with Optimization Technique-Case Study using. International Journal of Management Business Studies, 9, 112–115.

Mousa, A. (2015). A Business approach for transformation to sustainable construction: An implementation on a developing country. Resources, Conservation and Recycling, 101, 9–19. http://doi.org/10.1016/j.resconrec.2015.05.007

Mulaik, S. A. (1990). Blurring the Distinctions between Component Analysis and Common Factor-Analysis. Multivariate Behavioral Research, 25(1), 53–59.

Naoum, S. G. (2007). Dissertation research and writing for construction student (2nd ed.). Amsterdam: Butterworth-Heinemann.

National Health Service Sustainable Development Unit. (2011). Route Map for Sustainable Health. Cambridge.

Nations, U. (1992). Report of the United Nations conference on environment and development. In: Paper presented at the Rio de Janeiro (3-14 June 1992) A/CONF.

Nations, U. (2016). The Sustainable Development Agenda.

Nawawi, N., Sapian, A. R., Abdul Majid, N. H., & Aripin, S. (2013). Hospital Designs in Tropical Malaysia - Towards a Green Agenda. The Uia/Phg 2013 Annual Healthcare Forum + Gupha Meeting At Iidex Canada, Toronto, Canada, 24-28Th September 2013, (September), 24–28.

Nguyen BK., (2011). TPSI – Tall-building Projects Sustainability Indicator. PhD thesis. The University of Sheffield; 2011 (In Press).

Nguyen, B., & Altan, H. (2011). Tpsi–tall-building projects sustainability indicator. Procedia Engineering, 21, 387–94.

Nieto-morote, A., & Ruz-vila, F. (2012). Automation in Construction A fuzzy multi-criteria decision-making model for construction contractor prequali fi cation. Automation in Construction, 25, 8–19. http://doi.org/10.1016/j.autcon.2012.04.004

Nilashi, M., Zakaria, R., Ibrahim, O., Zaimi, M., Majid, A., Mohamad, R., … Aminu, D. (2015). Knowledge-Based Systems A knowledge-based expert system for assessing the performance level of green buildings. Knowledge-Based Systems, 86, 194–209. http://doi.org/10.1016/j.knosys.2015.06.009

Nimlyat, P. S. (2018). Indoor environmental quality performance and occupants' satisfaction [IEQ POS] as assessment criteria for green healthcare building rating. Building and Environment, 144(April), 598–610. http://doi.org/10.1016/j.buildenv.2018.09.003

Nunnally, J. O. (1978). Psychometric theory. New York: McGraw-Hill.

Oberg, M. (2005). Integrated Life Cycle Design – Applied to Concrete Multidwelling Buildings. Lund University.

Ogunbiyi, O., Oladapo, A., & Goulding, J. (2013). An empirical study of the impact of lean construction techniques on sustainable construction in the UK. Constr Innov: Inf Process Manag, 14(1), 88–107.

Omidreza S. Lim CH, Sohif M. Kamaruzaman S., (2012). Perspective of Sustainable Development in Malaysia. International journal of energy and environment 2012;6(2).

Ooshaksaraei, P., Ali, B., Mat, S., Yahya, M., Ibrahim, K., Zaharim, A., et al. (2010). Large Scale Solar Hot Water Heating Systems for Green Hospital. Recent Advances In Applied Mathematics.

Ooshaksaraei, P., Ali, B., Mat, S., Yahya, M., Ibrahim, K., Zaharim, A., et al. (2010). Large Scale Solar Hot Water Heating Systems for Green Hospital. Recent Advances In Applied Mathematics.

Ortiz, O., Castells, F., Sonnemann, G. (2009). Sustainability in the construction industry: a review of recent developments based on LCA, Constr. Build. Mater. 23 28–39, http://dx.doi.org/10.1016/j.conbuildmat.2007.11.012.

Osei, V. (2013). The construction industry and its linkages to the Ghanaian economypolices to improve the sector's performance. Int. J. Dev. Econ. Sustain., (1), 56–72.

Pallant, J. (2010). SPSS survival manual (4th ed.). London: McGraw-Hill.

Pallant, J. (2013). SPSS survival manual: a step by step guide to data analysis using SPSS. Berkshire: McGraw-Hill Education.

Pan, W., Dainty, A.R., Gibb, A.G. (2012). Establishing and weighting decision criteria for building system selection in housing construction. J. Constr. Eng. Manag. 138 (11), 1239-1250.

Pantzartzis, E., Edum-fotwe, F. T., & Price, A. D. F. (2017). Sustainable healthcare facilities: Reconciling bed capacity and local needs. International Journal of Sustainable Built Environment, 6(1), 54–68. http://doi.org/10.1016/j.ijsbe.2017.01.003

Papajohn, D., Brinker, C., El Asmar, M. (2016). Uncovering Key Criteria to Assess Sustainability Rating Systems for the Built Environment. Paper presented at the Construction research congress, San Juan, Puerto rico.

Peck, Steven, W., Callagha, Chris. (1999). Greenbacks from Green Roofs: Forging a New Industry in Canada. Citeseer.

Perini, K., Rosasco, P. (2013). Costebenefit analysis for green façades and living wall systems. Build. Environ. 70, 110-121. https://doi.org/10.1016/j.buildenv.2013.08.012.

Pitt, M., Tucker, M., Riley, M., & Longden, J. (2009). Towards sustainable construction: promotion and best practices. Construction Innovation, 9(2), 201–224. http://doi.org/10.1108/14714170910950830

Prasad, S. (2008). Changing Hospital Architecture. London, United Kingdom: RIBA Publications.

Pulselli RM, Simoncini E, Pulselli FM, & S., B. (2007). Emergy analysis of building manufacturing, maintenance and use: Em-building indices to evaluate housing sustainability. Energy and Buildings, Vol. 39 No.5, 620–628.

Ramachanderan, S. S., Venkiteswaran, V. K., & Tze, Y. (2017). Carbon (CO2) Footprint Reduction Analysis for Buildings through Green Rating Tools in Malaysia. Energy Procedia, 105, 3648–3655. https://doi.org/10.1016/j.egypro.2017.03.841

Raslan, R. (2010). Performance based regulations: The viability of the modelling approach as a methodology for building energy compliance demonstration. PhD. London: University College.

Refocus (2004). Firing on target, US building designer aim for green. Retrieved April 7, 2011 from www.re-focus.net.

Ries, R., Bilec, M.M., Needy, K.L., Gokhan, N.M. (2006). The economic benefits of green buildings: a comprehensive case study, Eng. Econ. 51 259–295, http://dx. doi.org/10.1080/00137910600865469.

Rode, P., Burdett, R., & Soares Gonçalves, J. C. (2011). Buildings: Investing in Energy and Resource Efficiency.

Romney, A. K., Weller, S. C., & Batchelder, W. H. (1986). Culture as Consensus: A Theory of Culture and Informant Accuracy. American Anthropologist, 88(2), 313–338.

Roulet, C.-A., Flourentzou, F., Foradini, F., Bluyssen, P., Cox, C., Aizlewood, C. (2006). Multicriteria analysis of health, comfort and energy efficiency in buildings. Build. Res. Inf. 34 (5), 475-482.

Rouse, M. (2018). BREEAM (BRE Environmental Assessment Method).

Runde, T., & Thoyre, S. (2010). Integrating sustainability and green building into the appraisal process. J. Sustain. Real Estate, 2, 221–248.

Ryan-fogarty, Y., Regan, B. O., & Moles, R. (2016). Greening healthcare: systematic implementation of environmental programmes in a university teaching

hospital. Journal of Cleaner Production, 126, 248–259. http://doi.org/10.1016/j.jclepro.2016.03.079

Saaty, T. L. (1990). The Analytic Hierarchy Process (2nd ed.). Pittsburgh, PA: RWS Pub.

Saaty, T. L., & Ozdemir, M. S. (2003). Why the magic number seven plus or minus two? Mathematical and Computer Modelling, 38, 233–244.

Saaty, T.L. (2008). Relative measurement and its generalization in decision making: why pairwise comparisons are central in mathematics for the measurement of intangible factors. The analytic hierarchy/network process, Rev Royal Acad Exact, Phys. Nat. Sci. Ser. A: Math. 102 (2) 251–318.

Sahamir, S. R., & Zakaria, R. (2014). Green Assessment Criteria for Public Hospital Building Development in Malaysia. Procedia Environmental Sciences, 20, 106–115. http://doi.org/10.1016/j.proenv.2014.03.015

Sahamir, S. R., Zakaria, R., Alqaifi, G., & Izieadiana, N. (2017). Investigation of Green Assessment Criteria and Sub-criteria for Public Hospital Building Development in Malaysia, 56, 307–312. http://doi.org/10.3303/CET1756052

Saidur R., (2009). Energy consumption, energy savings, and emission analysis in Malaysian office buildings. Energy Policy 2009;37(10):4104e13.

Saidur R., (2010). A review on electrical motors energy use and energy savings. Renewable and Sustainable Energy Reviews 2010;14(3):877e98.

Saidur, R., Hasanuzzaman, M., Yogeswaran, S., Mohammed, H. A., & Hossain, M. S. (2010). An end-use energy analysis in a Malaysian public hospital. Energy, Vol.35, 4780-4785.

Sallam, I., Abdelaal, M.R.M. (2016). Relative weight of water efficiency credits: as an indicator to enhance buildings' environmental assessment tools performance. Architect. Sci. Rev. 59, 423-431. https://doi.org/10.1080/00038628.2015.1107526.

San-José, J., Garrucho, I., Losada, R., & Cuadrado, J. (2007). A proposal for environmental indicators towards industrial building sustainable assessment. Int J Sustain Dev World Ecol, (14(2)), 160–73.

Šaparauskas, J., & Turskis, Z. (2006). Evaluation of construction sustainability by multiple criteria methods. Technol Econ Dev Econ, 12(4), 321–6.

Sattler, B., & Hall, K. (2007). Healthy choices: transforming our hospitals into environmentally healthy and safe places. Online J Issues Nurs [serial online](12(2)).

Schonemann, P. H. (1990). Facts, Fictions, and Common-Sense About Factors and Components. Multivariate Behavioral Research, 25(1), 47–51.

Sekaran, U., & Bougie, R. (2013). Research methods for business. 6th ed. United Kingdom: Wiley

Setyowati, E., Rochma, A., & Nurul, Y. (2013). Green Building Design Concepts of Healthcare Facilities on the Orthopedic Hospital in the Tropics. Procedia - Social and Behavioral Sciences, 101, 189–199. http://doi.org/10.1016/j.sbspro.2013.07.192

Sha, K., Deng, X., & Cui, C. (2000). Sustainable construction in China: status quo and trends. Build Res Inf, 28(1), 59–66.

Shad, R., Khorrami, M., Ghaemi, M. (2017). Developing an Iranian green building assessment tool using decision making methods and geographical information system: case study in Mashhad city. Renew. Sustain. Energy Rev. 67, 324-340. https://doi.org/10.1016/j.rser.2016.09.004.

Shafique, M., Kim, R., Rafiq, M. (2018). Green roof benefits, opportunities and challenges-a review. Renew. Sustain. Energy Rev. 90, 757-773. https://doi.org/10.1016/j.rser.2018.04.006.

Shan, M., & Hwang, B. (2018). Green building rating systems: global reviews of practices and research efforts. Sustain. Cities Soc., 39, 172–180. Retrieved from https://doi.org/10.1016/j.scs.2018.02.034

Shaner-McRae, H., McRae, G., & Jas, V. (2007). Environmentally safe health care agencies: nursing's responsibility, Nightingale's legacy. . Online J Issues Nurs [serial online].

Shojaei, S., & Tehrani, H. (2004). Textbook of Preventive Andocial Medicine. Samt Public: Persian.

Slowinski, R. (1986). A multicriteria fuzzy linear programming method for water supply system development planning. Fuzzy Sets Syst., (19), 217–237.

Snook, S. C., & Gorsuch, R. L. (1989). Component Analysis Versus Common Factor-Analysis - a Monte- Carlo Study. Psychological Bulletin, 106(1), 148–154.

Spangenberg, J. H. (2011). Sustainability science: a review, an analysis and some empirical lessons. Environmental Conservation, 38(3), 275–287. https://doi.org/10.1017/S0376892911000270.

Srinivasan, R. S., Ingwersen, W., Trucco, C., Ries, R., & Campbell, D. (2014). Comparison of energy-based indicators used in life cycle assessment tools for buildings. Build. Environ., (79), 138–151.

Stadel, A., Eboli, J., Ryberg, A., Mitchell, J., & Spatari, S. (2011). Intelligent sustainable design: integration of carbon accounting and Building Information Modeling. J. Prof. Issues Eng. Educ. Pract., (137), 51–54.

Steiger, J. H. (1990). Some Additional Thoughts on Components, Factors, and Factor-Indeterminacy. Multivariate Behavioral Research, 25(1), 41–45.

Stephan, A., Crawford, R. H., & De Myttenaere, K. (2011). Towards a more holistic approach to reducing the energy demand of dwellings. Procedia Eng., (21), 1033–1041.

Stevanovic, M., Allacker, K., & Vermeulen, S. (2017). Hospital building sustainability: the experience in using qualitative tools and steps towards the life cycle approach. Procedia Environmental Sciences, 38, 445–451. http://doi.org/10.1016/j.proenv.2017.03.135

Stevens, J. (1996). Applied multivariate statistics for the social sciences (3rd ed.). Mahwah, NJ: Lawrence Erlbaum.

Sudhagar, S., Sakthivel, M., Mathew, P. J., & Daniel, S. A. A. (2017). A multi criteria decision making approach for process improvement in friction stir welding of aluminium alloy. Measurement, 108, 1–8. http://doi.org/10.1016/j.measurement.2017.05.023

Tabachnick, B. G., & Fidell, L. S. (2001). UsingMultivariate Statistics. Boston: Allyn and Bacon.

Tabachnick, B. G., & Fidell, L. S. (2007). Using multivariate statistics (5th ed.). Boston: Pearson Education.

Tam, C., Tam, V. W., & W., T. (2004). Green construction assessment for environmental management in the construction industry of Hong Kong. Int. J. Proj. Manag., (22), 563–571.

Tan, Y., Shen, L., & Yao, H. (2011). Sustainable construction practice and contractors' competitiveness: a preliminary study. Habitat Int., 35(2), 225–230.

Tatari, O., & Kucukvar, M. (2011). Cost premium prediction of certified green buildings: A neural network approach. Building and Environment(46), 1081-1088.

Taylor, B. M. (2013). Sustainability and performance measurement: corporate real estate perspectives. Perform. Improv., (52), 36–45.

Thormark C. (2006). The effect of material choice on the total energy need and recycling potential of a building. Building and Environment, 41(8), 1019–1026.

Thurstone, L. L. (1947). Multiple factor analysis. Chicago: University of Chicago Press.

Tonietto, J., & Carbonneau, A. (2004). A multicriteria climatic classification system for grapegrowing regions worldwide. Agric. For. Meteorol., (124), 81–97.

Torcellini, P., Pless, S., Deru, M., Griffith, B., Long, N., Judkoff, R. (2006). Lessons Learned from Case Studies of Six High-Performance Buildings (Technical Report NREL/TP550-37542), National Renewable Energy Laboratory (NREL), http://dx.doi. org/10.2172/884978

Triantaphyllou, E. (2000). Multi-Criteria Decision Making Methods: A Comparative Study. London: Kluwer Academic.

Tsai, C., & Chang, A. (2012). Framework for developing construction sustainability items: the example of highway design. J Clean Prod, 20(1), 127–36.

Tudor, T. L. (2007). Towards the development of a standardised measurement unit for healthcare waste generation. Resources, Conservation and Recycling Vol.50, 319-333.

Turner, B. L., (2010). Vulnerability and resilience: Coalescing or paralleling approaches for sustainability science. Global Environmental Change, 20(4), 570–576. https://doi. org/10.1016/j.gloenvcha.2010.07.003.

TwisukPunpeng (Senior Adviser Ministry of Health Thailand). (2011). GREEN and CLEAN Hospital. In Asia Regional Conference for Mercury Free Health Care. Manila, Philippines.

Tzeng, G. H., & Huang, J. J. (2011). Multiple Attribute Decision Making: Methods and Applications.

U.S. Environmental Protection Agency. (October 28, 2009). Green Building Basic Information. Retrieved December 10, 2009, from http://www.epa.gov/greenbuilding/pubs/about.htm

Udawatta, N., Zuo, J., Chiveralls, K., & Zillante, G. (2015). Attitudinal and behavioural approaches to improving waste management on construction projects in Australia: benefits and limitations. Int. J. Constr. Manag., (15), 137–147.

Ugwu, O., & Haupt, T. (2007). Key performance indicators and assessment methods for infrastructure sustainability – a South African construction industry perspective. Build Environ, 42(2), 665–80.

UNEP. (2011). Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication, United Nations Environment Programme (UNEP), (Accessed 7 April 2014), ⟨http://www.unep.org/greeneconomy/Portals/88/documents/ger/9.0_Buildings.pdf⟩.

UNEP. (2012). Greening the Economy Through Life Cycle Thinking, United Nations Environment Programme, (Accessed 25 May 2014), ⟨http://www.unep.org/greeneconomy/Portals/88/documents/partnerships/UNEPBCGE A4.pdf⟩.

United States Agency for International Development. (2016). Powering health: Electrification options for rural health centers.

USEIA. (2010). International Energy Outlook 2010. Washington, DC 20585.

Vanegas, J.A., DuBose, J.R., Pearce, A.R. (1995). Sustainable technologies for the building construction industry. In: Paper Presented at the Symposium on Design for the Global Environment, Atlanta, GA. November.

Velasquez, M., Hester, P.T. (2013). An analysis of multi-criteria decision making methods, Int. J. Oper. Res. 10 (2) 56–66.

Velicer, W. F., & Fava, J. L. (1998). Effects of variable and subject sampling on factor pattern recovery. Psychological Methods, 3(2), 231–251.

Venkatarama Reddy BV, & KS., J. (2003). Embodied energy of common and alternative building materials and technologies. Energy and Buildings, 35(2), 129–137.

Verderber, S., 2010. Innovation in Hospital Architecture, 2010 ed. Routledge, New York.

Versini, P., Jouve, P., Ramier, D., Berthier, E., Gouvello, B. De, Jouve, P., Ramier, D., Berthier, E. (2016). Use of green roofs to solve storm water issues at the basin scale e study in the Hauts-de-Seine County (France). Urban Water J. 13, 372-381. https://doi.org/10.1080/1573062X.2014.993993.

Vyas, G. S., & Jha, K. N. (2016). Identification of green building attributes for the development of an assessment tool: a case study in India. http://dx.doi.org/10.1080/10286608.2016.1247832. Civ. Eng. Environ. Syst., 33(4), 313–334.

Wang W, Zmeureanua R, & H, R. (2005). Applying multi-objective genetic algorithms in green building design optimization. Building and Environment, 40(11), 1512–1525.

Wang, N. (2014). The role of the construction industry in China's sustainable urban development. Habitat Int., (44), 442–450.

WBCSD. (2007). Energy Efficiency in Buildings. Business Realities and Opportunities. The World Business Council for Sustainable Development.

Weerasinghe, A. S., & Ramachandra, T. (2018). Economic sustainability of green buildings: a comparative analysis of green vs non-green. Built Environment Project and Asset Management, 8(5), 528–543. http://doi.org/10.1108/BEPAM-10-2017-0105

Widaman, K. F. (1990). Bias in Pattern Loadings Represented by Common Factor-Analysis and Component Analysis. Multivariate Behavioral Research, 25(1), 89–95.

Widaman, K. F. (1993). Common Factor-Analysis Versus Principal Component Analysis - Differential Bias in Representing Model Parameters. Multivariate Behavioral Research, 28(3), 263–311.

Wilburn, S. (2007). Overview and summary: environmental health: important choices for a greener world. Online J Issues Nurs [serial online].(12(2)).

Wong, J. K. W., & Kuan, K. L. (2014). Implementing 'BEAM Plus' for BIM-based sustainability analysis. Automation Constr., (44), 163–175.

Wong, J. K. W., & Zhou, J. (2015). Enhancing environmental sustainability over building life cycles through green BIM: a review. Automation Constr., 57, 156–165.

Wong, J. K., Li, H., Wang, H., Huang, T., Luo, E., & Li, V. (2013). Toward low-carbon construction processes: the visualisation of predicted emission via virtual prototyping technology. Automation Constr., (33), 72–78.

Wong, K. Y., Saman, M. Z. M., Azadnia, A. H., Ghadimi, P., & Heavey, C. (2013). An integrated approach for sustainable supplier selection using Fuzzy Logic and Fuzzy AHP. Applied Mechanics and Materials, 315, 206–210.

Wood, L. C., Wang, C., Abdul-rahman, H., Syakirin, N., & Abdul-nasir, J. (2016). Green hospital design : integrating quality function deployment and end-user demands. Journal of Cleaner Production, 112, 903–913. http://doi.org/10.1016/j.jclepro.2015.08.101

Woodward, D. G. (1997). Life cycle costing – theory, information acquisition and application. International Journal of Project Management, 15(6), 335–344.

Worden, E., Guidry, D., Ng, A.A., Schore, A. (2004). Green Roofs in Urban Landscapes. University of Florida, IFAS Extension.

World Energy Outlook. (2009). Executive summary. International Energy Agency.

World Green Building Council. (2015). About World GBC. Retrieved from: http://www.worldgbc.org/.

World Health Organization. (2014). Safe Management of Wastes from Health-care Activities. Switzerland, Geneva.

Wu, Z. (2011). Evaluation of a sustainable hospital design based on its social and environmental outcomes. Cornell University.

Wu, Z., Shen, L., Yu, A.T.W., Zhang, X. (2016). A comparative analysis of waste management requirements between five green building rating systems for new residential buildings. J. Clean. Prod. 112, 895-902. https://doi.org/10.1016/j.jclepro.2015.05.073.

Yale University. (2005). Environmental sustainability index study–national benchmark environmental management. New Haven, CT: Yale University.

Yale. (2018). Environmental Performance Index. Retrieved from https://epi.envirocenter.yale.edu/epi-topline

Yanarella, E. J., Levine, R. S., & Lancaster, R. W. (2009). Research and solutions:" Green" vs. Sustainability: from semantics to enlightenment. Sustain. J. Rec., 2, 296–302.

Yang, C., Peijun, L., Lupi, C., Yangzhao, S., Diandou, X., Qian, F., et al. (2009). Sustainable management measures for healthcare waste in China. Waste Management, Vol.29, 1996-2004.

Yeheyis, M., Hewage, K., Alam, M. S., Eskicioglu, C., & Sadiq, R. (2013). An overview of construction and demolition waste management in Canada: a lifecycle analysis approach to sustainability. Clean Technol. Environ. Policy, (15), 81–91.

Yilmaz, M., & Bakıs¸, A. (2015). Sustainability in construction sector. Procedia-Social Behav. Sci., (195), 2253–2262.

Yoon, K. P., & Hwang, C. L. (1995). Multiple Attribute Decision Making: An Introduction. Thousand Oaks (CA): Sage University Paper.

Yoon, K., & Kim, W. K. (2017). The behavioral TOPSIS. Expert Systems with Applications, 89, 266–272. http://doi.org/10.1016/j.eswa.2017.07.045

Yu, W., Li, B., Yang, X., Wang, Q. (2015). A development of a rating method and weighting system for green store buildings in China. Renew. Energy 73, 123-129. https://doi.org/10.1016/j.renene.2014.06.013.

Yudelson, J. (2008). The Green Building Revolution, Island Press, Washington, D.C.

Zabalza Bribian, I., Aranda Uson, A., Scarpellini, S. (2009). Life cycle assessment in buildings: state-of-the-art and simplified LCA methodology as a complement for building certification, Build. Environ. 44 2510–2520.

Zadeh, S. R., Xuan, X., & Shepley, M. M. (2016). Sustainable healthcare design: Existing challenges and future directions for an environmental, economic, and social approach to sustainability. Facilities, 34(5/6), 264–288. http://doi.org/10.1108/F-09-2013-0067

Zahir, M.H.M., Raman, S.N., Mohamed, M.F., Jamiland, M., Nopiah, Z.M. (2014). The perception of Malaysian architects towards the implementation of green roofs: a review of practices, methodologies and future research. E3S Web Conf. 3, 01022. https://doi.org/10.1051/e3sconf/20140301022.

Zavadskas, E., & Turskis, Z. (2011). Multiple criteria decision making (MCDM) methods in economics: an overview. Technological and Economic Development of Economy, 17(2), 397–427.

Zhang, S., Li, J., & Wang, X. (2012). Application of Green Construction Techniques in Public Buildings : A Case of the Medicine Building in Nanjing Pukou Central Hospital, 178–182. http://doi.org/10.4028/www.scientific.net/AMR.374-377.178

Zhang, X., Zhan, C., Li, G., & Liu, Z. (2018). Comparison of the quantitative evaluation system between ESGB and EEWH. International Conference on Zero Energy Mass Customised Housing (ZEMCH 2018), 567–579. Melbourne.

Zhang, Xiang, Zhan, C., Wang, X., & Li, G. (2019). Asian green building rating tools : A comparative study on scoring methods of quantitative evaluation systems.

Journal of Cleaner Production, 218, 880–895. https://doi.org/10.1016/j.jclepro.2019.01.192

Zhang, Y., Wang, J., Hu, F., Wang, Y. (2017). Comparison of evaluation standards for green building in China, Britain, United States. Renew. Sustain. Energy Rev. 68, 262-271. https://doi.org/10.1016/j.rser.2016.09.139.

Zikmund, W. (1997). Business Research Methods. Dryden Press.

Zuckermann A., (2000). Creating a vision for the twenty-first century healthcare organization. Journal of Healthcare Management 2000;45(5):294-396.

Zutshi, A., & Creed, A. (2014). An international review of environmental initiatives in the construction sector. J Clean Prod.

Zyoud, S. H., & Fuchs-Hanusch, D. (2017). A bibliometric-based survey on AHP and TOPSIS techniques. Expert Systems with Applications, 78, 158–181. http://doi.org/10.1016/j.eswa.2017.02.016