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Organised by:

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faculty of architecture, planning & surveying

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ABSTRACT EXTENDED: PhD SHARING SESSION (2022)

Editors:

HAMIMAH ADNAN

NOOR AKMAL ADILLAH ISMAIL

UNIVERSITI TEKNOLOGI MARA — Fakulti Senibina, Perancangan dan Ukur

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PREFACE

PhD Sharing Session organized by the Faculty of Architecture, Planning and Surveying (FSPU), Universiti Teknologi MARA (UiTM), Shah Alam, was successfully conducted throughout the years of 2020 and 2021. The programme was carried out as an online series due to the impact of COVID-19 pandemic. The presenters were amongst faculty academicians who have finished their PhDs, voluntarily wanted to share their research results and exchange knowledge with others. In conjunction with this sharing session series, 20 extended abstracts that feature various topics of built environment field were compiled into this book after being rigorously reviewed. I would like to take this opportunity to express my sincere gratitude to all presenters and authors who have contributed to this "Abstract Extended: PhD Sharing Session (2022)". I would also like to extend our thanks to the organizing team members for their hard work and a great thank you for the enormous support of the Faculty of Architecture, Planning & Surveying for supporting the programme. May the readers enjoy gaining some valuable knowledge from it, and may the readers find it helpful, exciting, and inspiring.

Chief Editor
Professor Datin Sr Dr. Hamimah Adnan,
Deputy Dean (Research and Industrial Linkages),
Faculty of Architecture, Planning and Surveying,
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A HOLISTIC GEOSPATIAL EPIDEMIC MODELLING FOR IDENTIFYING FUTURE DISEASE HOT SPOTS OF TUBERCULOSIS

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Abstract. Malaysia has only a medium burden of tuberculosis (TB) incidence based on World Health Organization (WHO) indicator, but the national TB technical report in 2015 highlighted that existing detection methods of TB on the site still need to be improved to strengthen the current TB control programme. A geospatial epidemic model (GeoEM) is proposed in this research to identify potential high-risk areas of TB and targeted risk population especially for missing cases and undiagnosed people. Shah Alam in the district of Petaling is selected as a case study since it has recorded constant TB cases and it also has a diversity of environment related TB risk factors (2014-2018). GeoEM is innovatively developed using spatial epidemiology (SE) approach, geographical information system (GIS), GIS-Multicriteria Decision Making (MCDM) method, logistic regression and geostatistical method. The overall spatial pattern of TB in Shah Alam is a slight medium random that exists in certain clustered areas, in particular at section U17, U18, U19, U20, S7, S17, S18, S20, S27 and S28. Seven influential risk factors with the local TB are selected and sequently ranked from human mobility, high risk group, SES, population, type of house, distance of factory and urbanisation. GeoEM has estimated 102 high risk localities in the risk sections. The unique part of the model is that it is an integrated technique for a holistic risk map of potential high risk TB areas (HRTBAs).

RESEARCH BACKGROUND

Malaysia has a medium burden of TB incidence based on WHO indicator, but the trend of TB cases is still generally increasing from 16 665 in 2006 to 25 739 in 2016 (MOH, 2017). Selangor is among the top-three highest TB cases in the country with more than 4000 cases reported from 2013 to 2016 [9]. Therefore, the Ministry of Health (MOH), Malaysia has set up several guidelines to control the disease systematically. Although the guidelines seem to be focusing on human or biomedical approach (TB screening and x-ray methods) to control the disease as stated by WHO (2016), the main aim of the guidelines or agendas is still the same which is to emphasise on strengthening control, prevention and elimination of the disease as suggested by the TB and Leprosy Sector, MOH Malaysia (2015).

WHO stated that the current method still fails to address inequitable distribution of disease and does not diagnose many TB patients especially among poor and vulnerable communities, and marginalized people. Missing cases and undiagnosed patients of TB cannot be identified if real or actual cases are not reported in the official system. This situation is caused by several factors, especially the inefficiency of the existing method or system to comprehensively detect the TB cases. TB cases are not only influenced by human-based factors (such as high-risk group and socio-economic status), but also are driven by environmental risk factors such as land use, human movement and housing conditions. Consequently, this method needs to be combined with other techniques (Burgos & Pym, 2022; Mathema et al., 2006; Narayanan, 2004) in order to improve management of cases and analytical power.

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A medical expert, Narayanan (2004) has also suggested that the combination between molecular techniques and geographical techniques can enhance the TB transmission analysis for identifying different geographical areas in high-burden disease areas and subsequently enhancing targeted screening efforts. As such, this research proposes a geospatial model as an alternative method to limit the spread of TB and to detect potential risk areas. This proposed model can identify potential high-risk geographical areas of clustered TB and characterise the areas with TB potential risk areas. Technical aspects in SE, GIS and TB epidemiology are combined to develop a geospatial model for identifying potential high-risk TB hot spots in the research area. A geospatial model can perform a better spatial decision making system for public health management Fuller et al. (2014) to estimate potential high-TB risk areas (Daley & Gani, 2005; Lin et al. 2012; Middelkoop et al, 2009; Moonan et al., 2006; Musenge et al., 2013; Wei et al., 2016).

RESEARCH METHODOLOGY

The overall research steps of the model are shown in Figure 1. It comprises integrated risk factors of local (input), an integrated geospatial approach (process), and significant outcome of the research (Output). A conceptual framework of spatial epidemiological data analysis (Pfeiffer et al., 2008), GIS- MCDM method [2][6] and epidemic modelling [3][14] are mainly adapted in this proposed geospatial model for the description of spatial patterns, identification of disease cluster or risk factors, and explanation or prediction of disease risk.
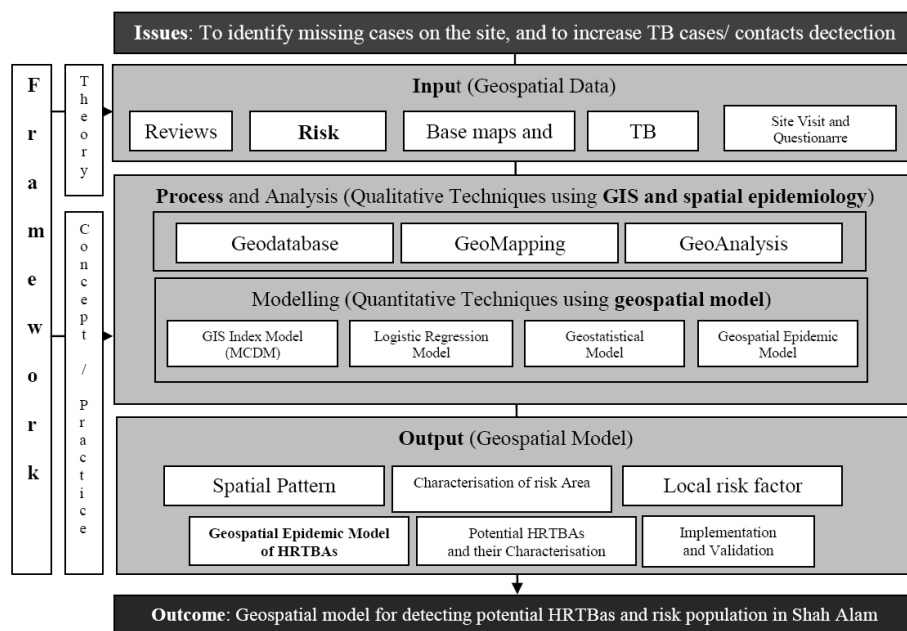
Figure 1: Main Framework of Geospatial Epidemic Modelling (GeoEM) for Potential High Risk TB Areas (HRTBAs) in Shah Alam

RESEARCH FINDINGS

Spatial Characterisation of the High Risk Areas of TB

Spatial pattern and risk clustering analysis were conducted to investigate existing TB distribution, and then to qualitatively determine the possible risk factors according to the local environments. In Shah Alam, the overall spatial pattern of TB in the research area is slightly similar in distribution with a medium cluster or random pattern which exists in certain areas. TB is concentrated in the northern zone, central zone and a few in the southern zone. There are 10 main sections from

47 sections which have significant clustering or high risk and endemic spots, including Section U17, U18, U19, and U20 in the northern zone. Meanwhile, Sections S7, S17, S18, S20, S27 and S28 are located at the central and southern zone, respectively. Most areas are located in urban areas and crowded environment. These findings are important to develop a general view of spatial data dimension, spatial pattern and possible risk factors contributing to HRTBAs.

Influential Risk Factors of Local TB Cases

The presence of spatial heterogeneousness of TB incidence may lead to the complexities of risk factors identification because each area has its own unique risk factors and dynamics as shown in spatial TB pattern in Malaysia. In Shah Alam, it is found that seven risk factors are significant factors in the local incidence, including urbanisation, distance to factory, SES, high risk group, human mobility, house type, distance to healthcare centres, and number of population in a house. Each relative risk rate that affects TB occurrences and their combination will give more impact on the overall occurrences. Human-based indicators, especially human mobility, have a significant contribution to prediction compared to biophysical indicators. The selection of the factors is the basis for the formation of the proposed model for risk assessment and mapping of potential areas using GeoEM.

GeoEM for Identifying Potential HRTBs

This research is also essential in producing a risk map of potential high risk TB areas (HRTBAs) using geospatial epidemic model (GeoEM). With a fairly relevant model validation, this integrated model can provide a holistic platform in identifying local risk factors and targeted areas for TB risk concentration. In Shah Alam, the model has successfully identified 102 high-risk localities for TB screening and control programmes on the site as shown in Figure 2. The unique part of the model is that it is an incorporated technique among knowledge-data-driven techniques (GIS multi-criteria decision analysis method, MCDM), data-driven technique (logistic regression model) and method-driven technique (geostatistical method). This innovative combination is required to produce a new generation or precise epidemic model as suggested by scholars and researchers: with a proper understanding on local TB biological transmission process and using a multidisciplinary modelling approach towards implementation in the National Tuberculosis Control and Prevention Programme (NTCPP).
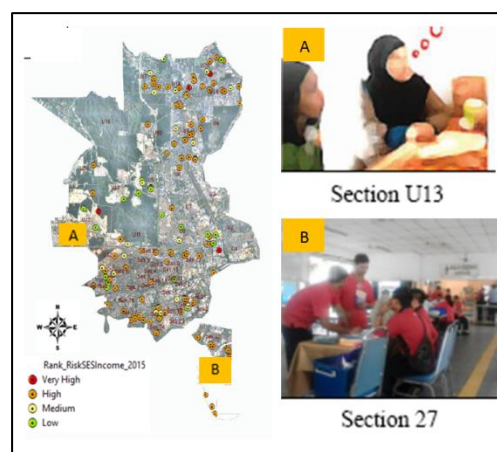

Figure 2: Potential Map of HRTBAs and its Application in the
Local TB Screening and Control Programme of Shah Alam

CONCLUSION

In Malaysia, the current limitation of detecting tools for local TB missing cases and contacts on the field are the central issues as highlighted in this research. The proposed model of GeoEM is developed using holistic risk assessment to identify the local high risk TB areas (HRTBAs). This research has two significant contributions towards local knowledge and society implications of spatial TB epidemiology as recommended in the National Tuberculosis Control and Prevention Programme (2016 to 2020). Firstly, the study has created a spatial theoretical framework or hypothetical model of TB risk factor and risk map for distinctly enhancing the understanding of local TB patterns and their risk variations. Secondly, the spatial technical framework and conceptual research model developed in this study are vital in appropriately targeting the potential HRTBAs in the study area. In addition, GeoEM has practical capabilities for estimating potential TB cases and contacts on the field as suggested by global experts.

REFERENCES

[1]   Burgos, M. V., & Pym, A. S. (2002). Molecular epidemiology of tuberculosis. European Respiratory Journal, 20(Supplement 36), 54S–65s. doi:10.1183/09031936.02.00400702.

[2]   Chang, K. (2011). Introduction to Geographic Information Systems, New York, USA.McGraw Hill, 389-399.

[3]   Daley, D. J. & Gani, J. (2005). Epidemic Modeling: An Introduction. NY: Cambridge University Press.

[4]   Fuller, D. O., Troyo, A., Alimi, T. O., & Beier, J. C. (2014). Participatory Risk Mapping of Malaria Vector Exposure in Northern South America using Environmental and Population Data. Applied Geography (Sevenoaks, England), 48, 1–7. doi:10.1016/j.apgeog.2014.01.002.

[5]   Lin, H., Shin, S. S., Contreras, C., Asencios, L., Paciorek, C. J., & Cohen, T. (2012). Use of Spatial Information to Predict Multidrug Resistance in. Emerging Infectious Diseases, 18(5), 5–7. doi:DOI: http://dx.doi.org/10.3201/eid1805.111467.

[6]   Malczewski, J. (2000). On the use of weighted linear combination method in GIS:Common and best practice approcahes.Transanctions in GIS 4:50-22.

[7]   Mathema, B., Kurepina, N. E., Bifani, P. J., & Kreiswirth, B. N. (2006). Molecular epidemiology of tuberculosis: current insights. Clinical Microbiology Reviews, 19(4), 658–85. doi:10.1128/CMR.00061-05.

[8]   Middelkoop, K., Bekker, L., Morrow, C., Zwane, E., & Wood, R. (2009). Childhood tuberculosis infection and disease : A spatial and temporal transmission analysis in a South African township. SAMJ, 99(10).

[9]   Ministry of Health Malaysia [MOH]. (2015). The National TB strategic plan (2010- 2015) and NTLP. TB/Leprosy Sector. Putrajaya.

[10]   Moonan, P. K., Oppong, J., Sahbazian, B., Singh, K. P., Sandhu, R., Drewyer, G., … Weis, S. E. (2006). What Is the Outcome of Targeted Tuberculosis Screening Based on Universal Genotyping and Location ? Am J Respir Crit Care Med, 174, 599–604. doi:10.1164/rccm.200512-1977OC.

[11]   Musenge, E., Vounatsou, P., Collinson, M., Tollman, S., & Kahn, K. (2013). The contribution of spatial analysis to understanding HIV/TB mortality in children: a structural equation modelling approach. Glob Health Action 2013, 19266(1)

[12]   Narayanan, S. (2004). Molecular epidemiology of tuberculosis. Indian J Med Res, (October), 233–247.

[13]   Pfeiffer, D. U., Robinson, T. P., Stevenson, M., Stevens, K. B., & Rogers, D. J. (Techniques). (2008). *Spatial Analysis in Epidemiology United Kingdom*. Oxford University Press, USA.

[14]   Touray, K., Adetifa, I. M., Jallow, a, Rigby, J., Jeffries, D., Cheung, Y. B., … Hill, P. C. (2010). Spatial analysis of tuberculosis in an urban west African setting: is there evidence of clustering? Tropical Medicine & International Health : TM & IH, 15(6), 664–72. doi:10.1111/j.1365-3156.2010.02533

[15]   Wei, W., Wei-sheng, Z., Ahan, A., Ci, Y., Wei-wen, Z., & Ming-qin, C. (2016). The Characteristics of TB Epidemic and TB / HIV Co-Infection Epidemic : A 2007 Retrospective Study in Urumqi , Xinjiang Province, China. PloS One, 11(10), 1–12. doi:10.1371/journal.pone.0164947

POTENTIALS AND PROCESS OF BIM FOR INTERIOR DESIGN INDUSTRY IN MALAYSIA

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Abstract. Building Information Modelling (BIM) is a tool integrated with the data and process to enhance the quality, knowledge and skill for the construction industry. This work aims to assess the effectiveness of BIM implementation for the interior design industry by looking at the potential and process involved. Thus far, the implementation of BIM in the interior design industry remains behind, as compared to other building professions. Preliminary studies demonstrate that lack of knowledge about BIM is among the reasons as to why interior design firms do not implement BIM technology. Hence, there is a vital need to identify this further through the methodology conducted which involves applying descriptive survey methods such as structured questionnaires and interviews for selected interior design firms. The study was conducted at among 63 interior design firms located around the Klang Valley in Malaysia, which were selected by using three groups, namely, small, medium and large. Two methods of data were collected, specifically quantitative data (questionnaire) and qualitative data (interview). Data from the questionnaire was then used to determine potential factors and processes for the BIM implementation, while the interview data describes in detail the questionnaire data. This study is crucial, as research on the implementation of BIM in the interior design industry is still lacking, and needs to be improved by reducing the identified barrier factors.

INTRODUCTION

Today, the construction industry is moving forward by using updated technology and efficient time management to develop, manage and construct buildings from the beginning until the handover phase. By using a new and innovative technology in the new era of building, the implementation of Building Information Technology (BIM) is shown to be more effective in augmenting processes in the construction industry. The implementation of BIM is a different approach based on the difficulty of the construction phases (Chena and Qu, 2011).

In Malaysia, the implementation of BIM was introduced by the Public Works Department (PWD), (2013), while the construction industry faced problems on several factors such as cost overrun, delays, low quality production and using old technology (CIDB, 2009). The importance of BIM usage in the construction industry influenced the design stage (55%), design and tender stage (52%), construction phase (35%), feasibility phase (27%) and maintenance phase (9%) (Eadie *et.al,* 2013). According to CIDB (2016), the developments of BIM process is still in stages, where the processes of collaborated information will be available after each stage.

Currently, the study on BIM and the interior design industry are limited, and sources for literature reviews are few. Most of the available studies focus on the AEC industry, facilities management and management (Santos et. al, 2017). Many of the research were published using semi-

structured interviews to measure the perception of BIM in the construction industry (Latiffi *et al.,* 2016 & 2017; Mamter *et al.,* 2017 and Yusuf *et al.,* 2017).

Consequently, this research is conducted to identify the issues and problems BIM had with interior design firms. These were obtained via interviews and questionnaire surveys. Random sampling method was used to determine the sample size for this study as it was appropriate to be applied for a preliminary study in which a complete list of the population was available (Kumar, 2014). Generally, there is still a lack of research in topics such as Information and Communication Technology (ICT), software and hardware, BIM knowledge and awareness, and readiness on BIM usage. Thus, there is a possibility to implement BIM in the interior design industry.

THE SIGNIFICANCE OF BIM IN THE DESIGN PROCESS AND ITS POTENTIALS

The potential for the interior design industry to implement BIM technology is highly recommended. The analysis shown in Table 1 describes the potential for the interior design industry to use BIM. Table 1 shows that the acceptable data for small firms is that the current BIM usage for interior design is still new, with a mean score of 3.89. BIM technology can help in the design process and suggestions for the government to implement BIM was at a mean score of 3.85. For medium firms, their mean score was higher at 3.81 because they agreed that the implementation of BIM could lead to better pay and BIM can help interior designers to solve the problems in the design process.

Table 1 Mean score of the current situation of BIM in the interior design firms according to the size of interior design firms.

No.	The Factors of the BIM	Small firms *(mean)*	Medium firms *(mean)*	Big firms *(mean)*	Overall (mean)
1.	The implementation of BIM in Malaysia is extensive.	3.07	3.05	3.07	**3.06**
2.	BIM technology can help in the design process.	3.85	3.38	3.47	**3.57**
3.	Software used in BIM is easy and fast.	3.15	3.05	3.27	**3.16**
4.	The use of BIM in Interior Design is still new.	3.89	3.29	3.60	**3.59**
5.	Rapidly development requires Interior Designers directly using BIM.	3.41	3.62	3.47	**3.50**
6.	The government has suggested using BIM in the construction industry, including the Interior Design profession.	3.85	3.67	3.87	**3.80**
7.	Implementation of BIM in the interior design field leads to better pay.	3.78	3.81	3.40	**3.66**
8.	Implementation of BIM workflow will lead to better designer works.	3.70	3.76	4.07	**3.84**
9.	Implementation of BIM leads to greater efficiency	3.74	3.67	4.13	**3.85**
10.	BIM can help interior designers to solve the problems in the design process.	3.81	3.81	3.80	**3.81**
	Overall	**3.63**	**3.51**	**3.62**	

BIM technology has always been a vital factor to improve the design methods in the interior design industry. The statistics shows that the implementation of BIM is important in the design process and could provide a good impact on the interior designer (Table 2). All the interior design firms are agreed with 100% that BIM can help in design process system to improve the quality and the documentations in the interior design projects and very significance in term of BIM implemented in projects.

Table 2 Frequency of the significance of BIM in the design process

Characteristics	Size of Interior Design Firm						Statistics (%)	
	Small firms *(f)*		Medium firms *(f)*		Big firms *(f)*			
	Yes	No	Yes	No	Yes	No	Yes	No
Design Process	4 (33%)	0	5 (42%)	0	3 (25%)	0	12 (100%)	0
Significant of BIM for Interior Design	4 (33%)	0	5 (42%)	0	3 (25%)	0	12 (100%)	0

CONCLUSION

The main aim of this research is to identify methods to improve the implementation and usage of BIM in the interior design industry within the Malaysian context by developing an improvised skill and knowledge for interior design firms. From the results of descriptive statistics, it showed the driving key factors that affected the interior design firms from using BIM, which is reliant on the size of firms.

REFERENCES

[1] Chen, L. and Qu, H. (2011) 'Evaluation for "Economics and Legislative Factors Influence the Design Team and Contractor throughout a Building Project from Inception to Completion', *Journal of System and Management Sciences* Vol. 1(1).

[2] Construction Industry Development Board (CIDB), (2009) 'Construction Industry Master Plan Malaysia 2006-2015 (CIMP)', Malaysia: Construction Industry Development.

[3] Construction Industry Development Board (CIDB) (2016) 'BIM Guide 2016: Awareness', 1st Edition, pp. 5.

[4] Eadie, R., Browne, M., Odeyinka, H., McKeown, C. and McNiff, S. (2013) 'BIM Implementation Throughout the UK Construction Project Lifecycle: An Analysis, *Autom. Constr. 36* (2013), pp. 145–151.

[5] Kumar, R. (2014) ' Research Methodology: A Step-by step Guide for Beginners'. London: SAGE Publications Ltd . 4th Ed.

[6] Latiffi, A. A., Brahim, J. and Fathi, M. S. (2016) 'Transformation of Malaysian Construction Industry with Building Information Modelling (BIM)' *MATEC Web of Conferences* 66, pp. 1-8

[7] Latiffi, A. A., Brahim, J. and Fathi, M. S. (2017). Building information modelling (BIM) after ten years: Malaysian construction players' perception of BIM *IOP Conference Series: Earth and Environmental Science* 81 012147

[8] Mamter, S., Mat Salleh, N. and Mamat, M. E. (2014) 'Building Information Modelling (BIM) Awareness Among Higher Education Institution Students', Proceedings of the 2nd International Conference on Green Technology & Ecosystem for Global Sustainable Development Putrajaya, Malaysia – November 2014.

[9] Public Works Department (PWD), (2011) 'Year in Review 2011', Retrieved December 20, 2013 from https://www.jkr.gov.my/var/files/File/dokumen/laporan_ tahunan_jkr_2011.pdf.

[10] Santos, R., Costa, A. A. and Grilo, A. (2017) 'Bibliometric analysis and review of Building Information Modelling', Literature Published Between 2005 And 2015', Automat. Constr. ,80, pp. 118-36.

[11] Yusuf, B. Y., Embi, M. R. and Ali, K. N. (2017) 'Academic readiness for building information modelling (BIM) integration to Higher Education Institutions (HEIs) in Malaysia', *Proc. of the 2017 International Conference on Research and Innovation in Information Systems (Langkawi)* pp. 1-6.

THE EFFECT OF LANDSCAPING ON THE THERMAL PERFORMANCE OF SINGLE-FAMILY HOUSING IN THE TROPICAL ENVIRONMENT

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Abstract. The urban heat island effect is well-documented as an urban phenomenon that exerts influence on most major cities worldwide. This urban phenomenon occurs when air temperatures in densely built urban areas are higher than the temperatures of the surrounding rural countryside. The exterior environment is hot in tropical cities due to the high temperature, especially during dry seasons. The planning and development of exterior spaces can reduce the energy consumption of buildings by lessening the adverse impact of some climate factors. This study investigated the effect of landscaping on the thermal performance of housing in a hot and humid tropical climate. The climatic parameters and physical characteristics of building construction, as well as landscape design were measured and surveyed on three private single-family houses in Shah Alam, Selangor, Malaysia. The study focused on the potential impact of shade trees and different types of foliage on the thermal performance of houses of different ages. The result showed that the well-landscaped houses' outdoor air temperatures were usually lower than the minimum-landscaped houses'. The main findings revealed that well-designed landscaping around single-family houses could potentially slow down heat build-up by shading, evapotranspiration, and wind channelling.

INTRODUCTION

The external environment in tropical cities is hot due to the high temperature, especially during dry seasons. The planning and development of exterior spaces can reduce the energy consumption of buildings by lessening the adverse impact of some climate factors. If the micro climatic condition around the buildings is very similar to the desired interior condition, little extra energy is required. Conversely, if the microclimate is significantly different from the desired interior conditions, large amounts of energy may be required for heating or cooling. Solar heat passing through windows and being absorbed through the walls and roofs is the primary source of heat flow into buildings. Landscaping is one of the most straightforward strategies that can particularly influence microclimate and associated building thermal performance. Strategically placed vegetation around a building has long been recognized as a means of cooling. It reduces the amount of radiation that falls on the building by shading, moderating temperatures, evapotranspiration processes, and controlling wind direction to keep the building cool. The appropriate amount, type, and vegetation placement can slow down heat build-up on a hot summer day. However, the effect of the immediately surrounding vegetation on the thermal performance of single dwellings in a tropical environment has not been widely recognized and quantified.

LITERATURE REVIEW

The urban heat island effect is well-documented as an urban phenomenon that influences cities worldwide. This urban phenomenon will occur when air temperatures in densely built urban areas are higher than the temperatures of the surrounding rural countryside. Buildings and paved surfaces in

urban areas cause the absorption of solar energy into building structures, roads, and other hard surfaces. The absorbed heat is subsequently re-radiated, increasing the surface temperature of urban structures up to 5.5–10°C (Akbari et al., 1992). As the urban surfaces become hotter, the overall ambient air temperature can increase by 2–8°C. The larger the city, the more intense the summer heat island effect (Oke, 1973), including the magnitude of discomfort and associated air conditioning load (Akbari et al., 1986). Taha et al. (1988) stated that residential buildings are susceptible to high heat levels as they are envelope-dominated structures. This urban phenomenon significantly contributes to the urban dwellers' discomfort on hot summer days. Appropriate planning and design of residential buildings to take account of these concerns is becoming more critical. Thus, numerous studies on the effect of vegetation on urban temperatures worldwide and in tropical climates have been carried out and they provide beneficial findings.

The tropical and subtropical zones contain the most incredible variety of plants globally, with an estimated minimum of 200,000 species (Sparrow & Hanly, 2002). According to Casper (2007), besides having several canopies, the favorable conditions of the tropics encourage diverse plant life, which includes trees, palms, shrubs, climbers, grasses, ground covers, and lawns. In tropical regions, trees are the essential plant structures in a garden, and they often grow particularly fast. They can also be the most satisfying plants in the garden. However, while large trees with spreading branches help keep houses cool, there should not be so many of them to exclude breezes. The lengths and patterns of shade provided by trees vary with the seasons. Foliage-canopy structures and vertical woody species distribution are also important factors as they can influence shading, evapotranspiration, and wind channeling. Herbs and spices are synonymous with tropical gardens. Not only that they contribute their exquisite flavors and aromas to a wide variety of dishes, they provide fragrant garden areas.

The "cool effect" is defined as a change in the micro climatological conditions in a vegetated (green) area (Saaroni, Bitan, Dor, & Feller, 2004). The change is manifested at lower temperatures and higher relative humidity (Oke, 1988). Oke claimed that green areas are more humid and, therefore, cooler than their surroundings due to evapotranspiration processes. Shade from vegetation also prevents direct radiation from reaching the ground surface and warming it, thereby resulting in lower air temperatures above these surfaces. The air near the ground in green areas is more remarkable due to the evapotranspiration process. According to Santamouris (2001), as well as Misni and Allan (2010), evapotranspiration creates lower temperature spaces in the urban environment. This is known as "the cool phenomenon." In this process, the plant draws moisture from the ground, uses what it needs for growth, and moderates its temperature as it transpires the excess water. This then cools the surrounding air. Evaporation of water from the leaves exposed to the sun consumes most of the absorbed solar radiation. The evaporation cools the leaves and the air in contact with them and, at the same time, increases the humidity of the air (Givoni, 1991). Givoni also stressed that the importance of this effect depends on the local humidity and temperature conditions.

Numerous studies simulating the effect of additional vegetation on urban temperatures have been performed by various researchers and provided beneficial information. The computer simulation by Huang et al. (1987) predicted that increasing tree covers by 25% in Sacramento and Phoenix, USA, would decrease air temperature at 2.00 p.m. in July by 3.3 to 5.6°C. Taha (1997) reported that the factors that affect temperature reduction are evaporative cooling and shading of the ground. In contrast, temperature increase during the night results from the reduced sky factor within the canopy. He concluded that the results of the simulations he carried out revealed that vegetation cover of 30% could produce a noontime excellent of up to 6°C cooler in favorable conditions and nighttime heat island of 2°C. Evapotranspiration and shading play a role in creating the cooling effect (Saaroni et al., 2004). Oke mentioned that the wind can modify it. According to Bernatzky (1982) and Misni (2013), they reduce the local temperature by 2–4°C. In hot-humid tropical climates, landscape design plays a

vital role in determining the extent of the cool effects on a neighborhood scale. The most important implications are the need for more shaded areas and to minimize the sun-exposed grass areas.

METHODOLOGY AND ANALYSIS

Research Methodology

Data collection was carried out on 50 single-family houses in Putrajaya and Shah Alam, Selangor, Malaysia. The house study involved the construction and surrounding landscaping of single-family houses aged 5–30 years old. While their construction was similar, the design and size of each house varied because they were built in different eras of construction methods and styles of architecture and landscaping. The design and construction of single-family houses in Shah Alam were up to each homeowner to decide on, while in Putrajaya they were set by the developer and owner. The different ages of construction were chosen because they provided different vegetation and landscaping styles, as well as sizes, which would have different effects on the thermal performance of the houses by providing shading, evapotranspiration, and channelling wind.

The study of all landscape elements was conducted through observation and interviews with each house owner. Landscape elements and house plans were drawn in detail and to scale. Landscape elements included soft landscape and hard landscape. The location of every type of vegetation was recorded at five-meter intervals extending out from the building for each of four azimuths. Tree azimuth classes were defined regarding building wall orientation. According to Simpson (2002), a wall is cardinally oriented if the expected distance to the wall is within ±45°E of a cardinal direction (North, East, South, or West); otherwise, it is inter-cardinal (NE, SE, SW, or NW). A detailed landscape plan was recorded for every type of vegetation because shading, evapotranspiration, and wind flow are all affected by different types of landscaping.

Once all the data were collected, master spreadsheets were developed using Origin 8.0. All vegetation data gathered from each house's four azimuths were recorded numerically in this spreadsheet as percentages or figures. These data were analyzed based on a few variables, including vegetation structure and typology or biomass, which were representative of the natural conditions of vegetation on the site. The actual amount and biomass of every vegetation type could appear as an average or mean to represent the surrounding landscape and design for every sample house.

The effect of landscaping on the thermal performance of single-family housing

In a tropical climate, vegetation has a significant influence on the microclimate. Vegetation cover has direct and indirect effects, which can influence urban microclimate directly by shading surfaces and altering wind speeds, as well as indirectly by evapotranspiration of water. Trees, grasses, and shrubs will reduce air temperatures near the house and provide evaporative cooling. Tree shading is the cover or shelter provided by their interception of trees and solar radiation. Using shade effectively depends on the species and density of the tree and the size, foliage, shape, and location of the moving shadow that it casts. According to Akhbari et al. (1992), tree shade reduces cooling energy use inside a building in three ways.

First, window shading helps prevent direct solar radiation from entering the house's interior. Second, shading the walls, windows, and roofs keeps them from getting hot, thereby reducing the heat reaching the interior. Third, the shade keeps the soil around the building cool. Evapotranspiration is the combined loss of water from vegetation to the atmosphere by evaporation and transpiration. This is a primary mechanism through which trees contribute to decreasing urban temperatures (Santamouris, 2001). Transpiration puts moisture into the air and moderates air temperature changes. Olgyay (1963) suggested that wind is significant for comfort when temperatures are above 29°C and

relative humidity above 50%. In these cases, cooling needs are high, and landscaping around the buildings should be directed towards channeling cooling breezes and minimizing humidity close to the home.

This study focused on the impacts of the thermal characteristic's potential of shade trees and different types of foliage on the thermal performance of housing in hot tropical climates. Comparison of the results and analysis of air temperature, relative humidity, and wind speeds in outdoor and indoor spaces revealed an exciting aspect of the passive cooling potential of the surrounding landscaping:

i. Comparing the three different ages of construction in the three single-family houses revealed that construction ten years ago was an ideal age of landscaping in providing ideal physical conditions to protect from a hot and humid tropical climate. However, all plant types should be physically fertile and in lush conditions. The size of plants, a sufficient height, and the number of leaves, including the total number of plants would become significant criteria in providing a good quality of shade and a large quantity of evapotranspiration to channel the prevailing wind properly.

ii. The height of the shade trees should be matched to the height of the houses. The primary concern was to provide shade to the roof surfaces, where trees should be located within a 3–5m distance from the buildings. However, shade trees could also shade the walls, especially at the house's upper story in the morning and late afternoon. 1.5m trunk height was a minimum height to channel and allow wind through the gardens and building surfaces.

iii. The height of the shrubs should be matched to the size of the fixed windows' shading devices. The windows' shading devices could provide shades for windows at around 11.00–15.00 hours. The rest of the time, during late morning and late afternoon, shades for windows should be taken over by shrubs. Thus, the efficient height of the shrubs was approximately 1–1.5m in an east-west direction to fulfil the sufficient size of shades.

iv. Having the best orientation was very important in the house configuration and design, as well as the surrounding landscaping. The best design is a north-south orientation and openings to the east and west minimized as far as possible to reduce the effect of direct solar radiation. However, in this study, shades provided by plants in all directions were essential, and the priority should be given to the east-west in observing calm and comfortable ambient air.

v. Environmental conditions in nearby neighborhoods also influenced the direction and the quality of the wind speed, including the evapotranspiration rate of the garden and the house. It was expected that the mature landscape and the new landscape house would reach higher exterior and interior temperatures throughout the day than the ordinary landscape house due to inefficient landscape design around the house. However, the results showed that the air temperature, humidity, and wind speed were about the same because two of the houses were adjacent to the mature green open spaces.

CONCLUSION

This study presented quantitative findings regarding the effectiveness of the surrounding landscaping in three single-family houses with three different landscaping strategies in a low-density residential neighborhood in a hot and humid tropical region. The focus was on the vegetation in the urban environment at the physical scale of a medium-sized single-family house and its private garden. This study demonstrated that the better way to create a favorable microclimate for a tropical residential landscape is by selecting the amount, size, and arrangement. Moreover, the environmental consequences of these designs can extend beyond the residential or development scale to the macroclimate or regional scale.

REFERENCES

[1]   Akbari, H., Davis, S., Dorsano, S., Huang, J., & Winnet, S. (1992). *Cooling our Communities, A Guidebook on Tree Planting and Light-Colored Surfacing.* Washington: Lawrence Berkeley Laboratory.

[2]   Akbari, H., Taha, H., Huang, J., & Rosenfeld, A. (1986). *Undoing uncomfortable summer heat islands can save gigawatts of peak power.* In proceeding of the The Panel on Small Building Technologies, Washington, DC.

[3]   Baker, N. V. (1987). *Passive and Low Energy Building Design for Tropical Island Climates.* London: The Commonwealth Secretariat.

[4]   Bernatzky, A. (1982). The contribution of tress and green spaces to a town climate. *Energy and Buildings*, 5(1), 1-10. doi:10.1016/0378-7788(82)90022-6.

[5]   Casper, J. K. (2007). *Plants: Life from the Earth*. New York: Infobase Publishing.

[6]   Givoni, B. (1991). Impact of planted areas on urban environmental quality: A review. *Atmospheric Environment - Part B Urban Atmosphere, 25*(3), 289-299. doi:10.1016/0957-1272(91)90001-U.

[7]   Givoni, B. (1994). *Passive and low energy cooling of buildings*. New York: Van Nostrand Reinhold.

[8]   Huang, Y. J., Akbari, H., Taha, H., & Rosenfeld, A. H. (1987). The potential of vegetation in reducing summer cooling loads in residential building. *Climate and Applied Meteorology, 26*, 1103-1116. doi:10.1175/1520-0450(1987)026<1103:TPOVIR>2.0.CO;2.

[9]   Misni, A. (2013). Modifying the outdoor temperature around single-family residences: The influence of landscaping. *Procedia-Social and Behavioral Sciences*, 105, 664-673. Doi:10.1016/j.sbspro.2013.11.069.

[10]   Misni, A., & Allan, P. (2010). *Sustainable Residential Building Issues in Urban Heat Islands - The Potential of Albedo and Vegetation* In proceeding of the Sustainable Building Conference (SB10) New Zealand.

[11]   Oke, T. R. (1988). *Boundary Layer Climates*. London: Routledge Taylor & Francis Group.

[12]   Oke, T. R. (1973). City size and the urban heat island. *Atmospheric Environment*, 7(8), 769-779. Doi:10.1016/0004-6981(73)90140-6.

[13]   Olgyay, V. (1963). *Design with Climate Bioclimatic Approach to Architectural Regionalism.* New Jersey: Princeton University Press.

[14]   Parker, J. H. (1981). Uses of Landscaping for Energy Conservation. Florida: Florida State University System.

[15]   Saaroni, H., Bitan, A., Dor, E. B., & Feller, N. (2004). The mixed results concerning the `oasis effect' in a rural settlement in the Negev Desert, Israel. *Journal of Arid Environments, 58*(2), 235-248. doi:10.1016/j.jaridenv.2003.08.010.

[16]   Santamouris, M. (2001). *The role of green spaces, in Energy and Climate in the Urban Built Environment*. London: James & James (Science Publishers) Ltd.

[17]   Sparrow, J., & Hanly, G. (2002). *Subtropical Plants for New Zealand Gardens*. Auckland: Random House New Zealand.

[18]   Taha, H. (1997). Urban climates and heat islands: albedo, evapotranspiration and anthropogenic heat. *Energy and Building, 25*, 99-103. doi: 10.1016/S0378-7788(96)00999-1.

[19]   Taha, H., Akbari, H., Rosenfeld, A., & Huang, J. (1988). Residential Cooling Loads and the Urban Heat Island - the effects of Albedo, *Building and Environment*, 23, 271-283. doihttps://doi/:10.1016/0360-1323(88)90033-9.

FRAMEWORK FOR INTERIOR DESIGN WORK DEVELOPMENT PLAN (IDWDP), MALAYSIAN CONTEXT

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Abstract. An interior designer's work and work procedures have been compared to those of an architect. When it comes to designing an ideal environment, both the interior designer and architect are involved. It has been suggested that interior designers' scope and process of project delivery lacks a standard of scope of work, which has led to disputes among team members over work coordination, procedure, and flow. Originally, in seeking to find a solution to this problem, this research was performed to see if the ideas could be proven correct and to construct a management framework for interior designers. The discussion focused on how comprehensive a standard work development plan has to be, and what the definite needs are for scope of work for interior design project delivery. The interior design project team members, including the interior designers themselves, have been subjected to a preliminary qualitative research study. Verbatim data collection established a data base by means of rigorous document analyses. Interviews with 12 key respondents for 20 current and completed projects to document work flow, processes, and scope. The interior design framework was used to identify gaps in the work flow and process of delivering interior design projects. In the findings, major gaps in present interior design project delivery procedures were discovered, which relates to the issue stated, the lack of sufficient written standard documents on project delivery practices. This investigation discovered significant knowledge relevant to interior design project delivery. Using this framework, interior project delivery can be improved.

INTRODUCTION AND BACKGROUND OF RESEARCH

Interior design is a sub-sector of the construction business. The sector has become one of the most prominent professions worldwide. Despite its perceived minor role in the architectural scope of work, the interior design business is a significant contributor to the country's economic growth. The works provide a good introduction to all of the skills required in building, including design, programming, contracting, and construction or installation. Work processes by their very nature are multi-segmented. Although many regard interior design as a tiny actor (Guerin and Martin, 2004; 2010) in building works, it has a prominent and notable function to play. Clearly, the interior design business is awakening from its slumber, owing to the growth of the construction industry and the maturity of technology.

Interior design requires good coordination and teamwork, as well as project management skills and understanding. Interior design generally entails integrating and coordinating the activities of project consultants and clients. Each stakeholder involved in the coordination must be proficient in each area and possess a thorough understanding of their particular scope of work (SOW).

Interior designers say lack of clear SOW is a serious problem when dealing with interior design projects. The biggest problems faced by interior designers when managing projects were their lacking of SOWs and process disputes. Interior designers indicated that poor project management abilities are

the reason behind the constant clashes between work and process, while poor coordination understanding increases the conflicts between work. More than 65% of respondents reported having constant disagreements with interior designers, and these disagreements happened while interior design work was being performed. The absence of a standard written form of interior design project scope in Malaysia was cited as a major problem. Project management skills are not highly valued among interior designers. This demonstrates that interior designers have difficulty delivering on interior design projects.

The goal of the study is to provide a management framework for projects in the field of interior design. Where, (Guerin and Martin, 2004) to investigate the current work development process (WDP) in interior design project delivery; (Guerin and Martin, 2010) to identify the elements of the work process in interior design project scope of work (SOW); (Noorhani, 2017) to analyze the flow of the interior design work process in interior design project delivery; and (RIBA, 2013a) to determine the scope of work (SOW) management framework in interior design project delivery. This research was using a qualitative methodology, which including literature review analysis, document analysis, interview, framework method and validation of the framework models.

The Development of IDWDP-SOW for Interior Project Delivery

Not only were the order, process flow, and workflow of all of the interior design project delivery difficult to define, but they were virtually impossible to pin down. Without sufficient guidance or a workable framework/model, designers in Malaysia run projects from start to finish utilizing their own ideas and experiences. Tiresome but well-executed interviews and data and content analysis that focused on data and content allowed the information to be organized in a written form. Results of the data were distinct, contrasted, and lengthy during the analytical procedure.

The findings from secondary data were consistent with the second outcome (data from interviews). The findings were recorded and synthesized into a structure for interior design project delivery WDP and SOW (Outcome 3). Analysis, comparison, synchronization, and organization were employed to present the different elements, processes, phases, and stages of work. Research objective 2 and 3 were fulfilled by a series of complementary analyses that followed a flow and sequence of work that aligned with construction process norms. The second step of the analysis process proceeded by testing project outcome 3 via framework method analysis (Baker, 2016); [, yet this instance the Noorhani's project management process framework (Noorhani, 2017) employed as a null framework was a particular interior design project management process framework. The results (research outcome 4) presented in Diagram 1, to highlight the process and flow, as well as confirming objectives 2 and 3 were the outcome of the research.

Interior design project development process and scopes are typically already in place in most practices. This means that how designers handle their projects is dictated by their experiences and common project's process. Despite that, effective work standards are required in order to produce standardized steps, and this must be made clear for practitioners, who should know that they may be applied uniformly to interior projects. The data obtained were then fortified by referencing RIBA POW 2013 (RIBA, 2013a) (and the updated 2020 edition (RIBA 2020)) and comparing the two. As a consequence, the current interior design WDP and SOW have been originated (research outcome 5 in Diagram 2). Work stages for interior design projects typically begin with project *kick-off*, continue through pre-contract and construction phases, then conclude with post-construction phase and project completion.
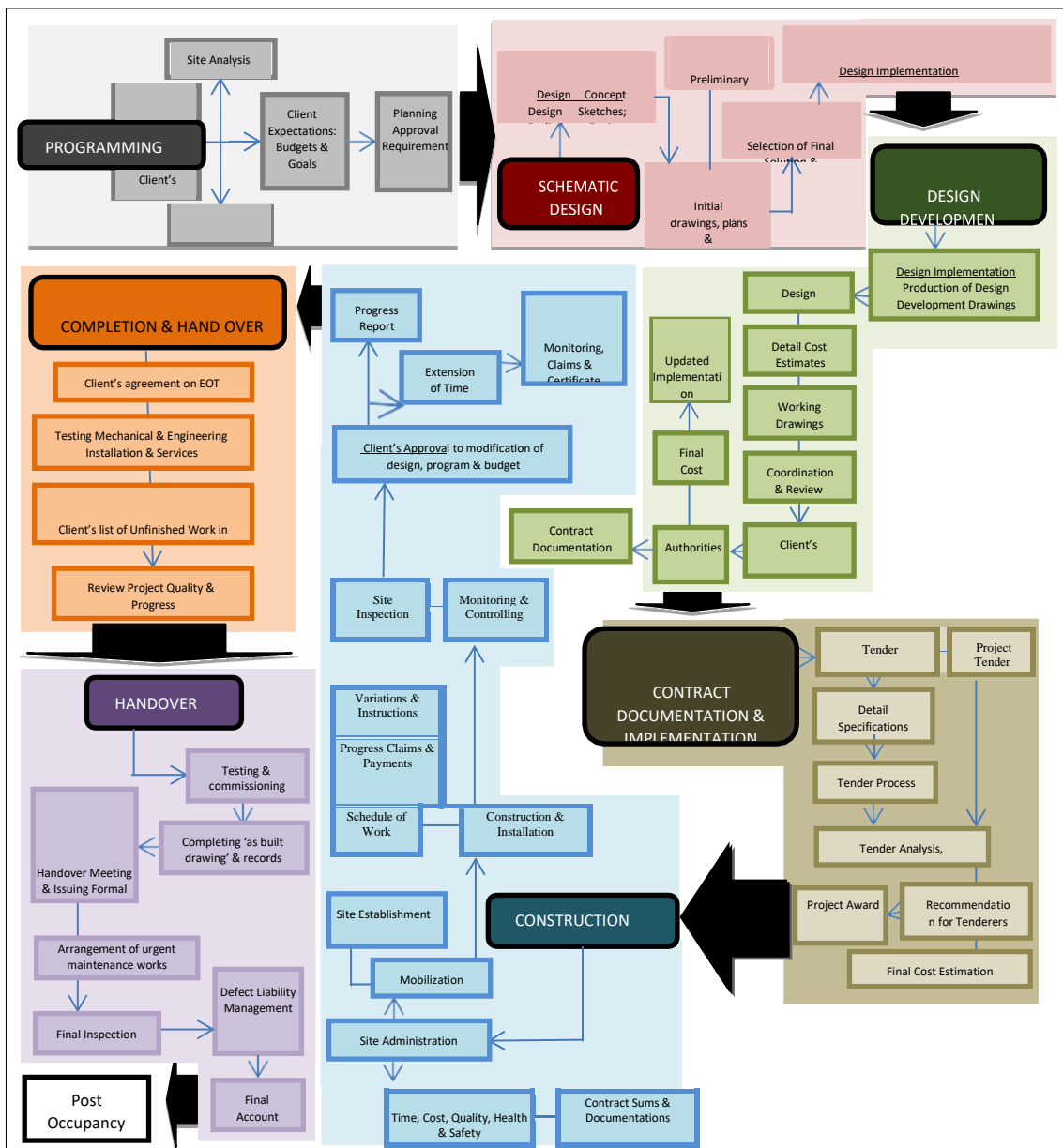
Diagram 1: Interior Project Delivery Work Process (Research Outcome 4)

The IDSOW Management Framework was intended to best suit the needs of a wide range of businesses and organizations. The framework is configurable and versatile, and it is capable of being easily adopted by different types of interior design firms and projects of all sizes and development methods.
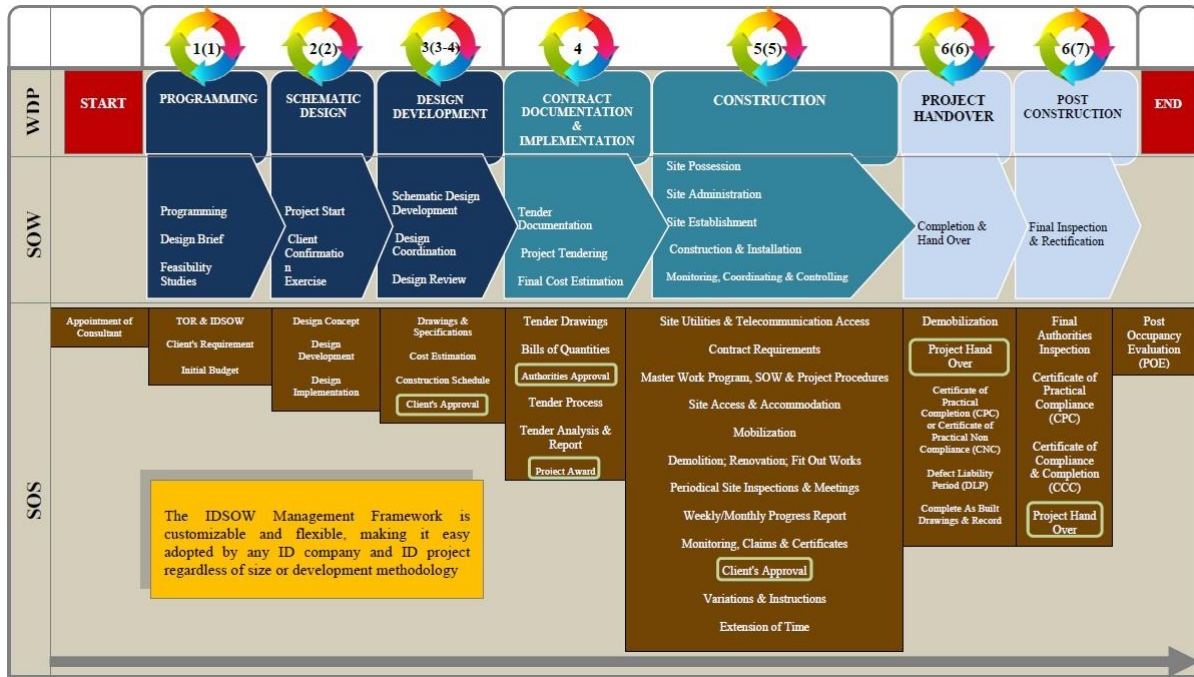
Diagram with rows: WDP, SOW, SOS

WDP row:
1(1) PROGRAMMING | 2(2) SCHEMATIC DESIGN | 3(3-4) DESIGN DEVELOPMENT | 4 CONTRACT DOCUMENTATION & IMPLEMENTATION | 5(5) CONSTRUCTION | 6(6) PROJECT HANDOVER | 6(7) POST CONSTRUCTION

START | ... | END

SOW row:
- Programming; Design Brief; Feasibility Studies
- Project Start; Client Confirmation Exercise
- Schematic Design Development; Design Coordination; Design Review
- Tender Documentation; Project Tendering; Final Cost Estimation
- Site Possession; Site Administration; Site Establishment; Construction & Installation; Monitoring, Coordinating & Controlling
- Completion & Hand Over
- Final Inspection & Rectification

SOS row:
- Appointment of Consultant
- TOR & IDSOW; Client's Requirement; Initial Budget
- Design Concept; Design Development; Design Implementation
- Drawings & Specifications; Cost Estimation; Construction Schedule; Client's Approval
- Tender Drawings; Bills of Quantities; Authorities Approval; Tender Process; Tender Analysis & Report; Project Award
- Site Utilities & Telecommunication Access; Contract Requirements; Master Work Program, SOW & Project Procedures; Site Access & Accommodation; Mobilization; Demolition; Renovation; Fit Out Works; Periodical Site Inspections & Meetings; Weekly/Monthly Progress Report; Monitoring, Claims & Certificates; Client's Approval; Variations & Instructions; Extension of Time
- Demobilization; Project Hand Over; Certificate of Practical Completion (CPC) or Certificate of Practical Non Compliance (CNC); Defect Liability Period (DLP); Complete As Built Drawings & Record
- Final Authorities Inspection; Certificate of Practical Compliance (CPC); Certificate of Compliance & Completion (CCC); Project Hand Over
- Post Occupancy Evaluation (POE)

> The IDSOW Management Framework is customizable and flexible, making it easy adopted by any ID company and ID project regardless of size or development methodology

Diagram 2: IDWDP Management Framework for Interior Design Project Delivery

CONCLUSION

Interior design professionals who do both design management and project management should strike a balance between the two. Creating a quality interior environment requires more than just design. Making the design work is crucial. Also critical to project success is the project delivery process. As a result, interior design professional practice should conduct and manage the project wisely within the parameters to be followed. The purpose of this measure is to increase the quality of work and to lower tensions and disagreements that may arise while delivering a project. Significant effort is required to plan and set the scope of work for the delivery of interior projects.

REFERENCES

[1]   Guerin, D. A. & Martin, C. S. (2004). The career cycle approach to defining the interior design profession's body of knowledge. Journal of Interior Design, 30(1), 1-22. doi:10.1111/j.1939-1668.2004.tb00396.x

[2]   Guerin, D.A. and Martin, C.S. (2010). The Interior Design Profession's Body of Knowledge and its Relationship to People. College of Design, University of Minnesota.

[3]   A. Noorhani, N.M. (2017). A Developed Project Management Competency for Interior Design Professional Practice. PhD Thesis of University Teknologi MARA (UiTM), Malaysia.

[4]   RIBA Plan of Work, (2013a). at https://www.ribaplanofwork.com/

[5]   RIBA Plan of Work (2020). Overview. At https://www.architecture.com//media/GatherContent/Test-resources-page/AdditionalDocuments/2020RIBAPlanofWorktemplatepdf.pdf

[6]   Baker, A. (2016). The Framework Method for Qualitative Data Presentation and Analysis. Retrieved https://abbarker.wordpress.com/2016/08/10/the-framework-method-of-qualitative- data-presentation-and-analysis/

[7]   Ritche, J. And Lewis, J. (2003). Chapters in Book, Qualitative Research Practice; A guide for Social Science Students and Researchers. SAGE publications, London. ISBN 0 7619 71092

THE EFFECTIVENESS OF LAND USE PLANNING IN URBAN HOUSING DEVELOPMENTS IN SELANGOR

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Abstract. Land use planning are considered to be some of the contributing factors in achieving better housing development. However, the effectiveness of land use planning for housing development is still questionable leading, to issues related to shortages, location, choices and its quality. The research sets out to examine the effectiveness of development plans and planning control in terms of its implementation in urban housing developments in Selangor. Four objectives outlines which highlights the current housing planning activities in preparing development plans including formulation of policy; determination of land location, land size; guidelines; and its implementation through planning control during housing applications and approvals, were analysed based on the perception of respondents. The research is measured through quantitative analysis based on a structured questionnaire survey conducted among government planners and planning consultants. Expert interviews were also conducted with expert town planners. The strength and weaknesses of housing planning aspects were analysed using an IPA Matrix which focuses on important items that require high attention for improvement based on its effectiveness. Finding reveals several issues inherent in the process of housing application approvals which were; difficulties caused by the time consumed for the adoption of development plans due to gazetting period, poor content of development policies on housing control, consequently leading to low level of compliance with low cost housing policies, land use zoning and housing category. The findings of the research indicate a vital need for change in the approach and practice of housing planning in development plans and implementation through planning control.

RESEARCH BACKGROUND

Issues such as low housing vacancy, surplus committed housing and low sales performance were widely believed to be exacerbated by the ineffectiveness of land use planning activities and process. There were three (3) research problems; 1) the effectiveness of policies being implemented and translated into other plans weaken its function in guiding housing planning (Thuraiya, 2011; Ibrahim et al, 2011; Dunse et al, 2013), 2) the weak preparation of development strategies employed during feasibility study in terms of land location, land size and guidelines related to housing (Gurran and Whitehead, 2011; Hamizah et al, 2012) , and 3) the weak of planning control during the process of housing applications and approvals (Alias and Ratnawati, 2011; Hamizah et al, 2013; Foo and Wong, 2014). The research aimed to examine the implementation of planning and control activities and process in housing delivery system in urban areas in Selangor. In order to achieve the aim, there were four (4) objectives, 1) to analyse the extent to which planning policies are effective in ensuring and improving the housing delivery system, 2) to evaluate the level of effectiveness of housing development strategies in ensuring and improving the housing delivery system, 3) to investigate the current process of housing planning applications and approvals in relation to the provision of development plans (policies and strategies) in ensuring and improving the housing delivery system, and 4) to analyse the planning aspects influencing housing development in ensuring and improving the effectiveness of the housing delivery system. Figure 1 show theoretical framework of the research.
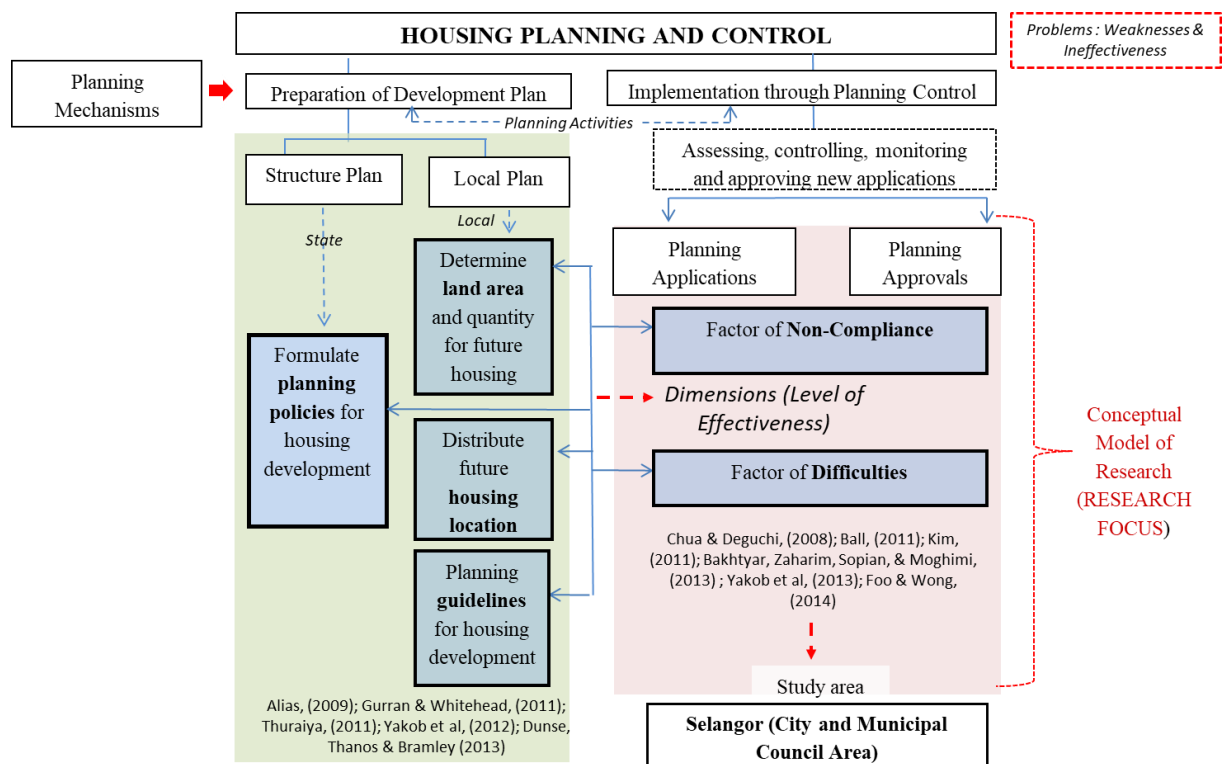
Figure 1: Theoritical Framework of the Research

METHODOLOGY AND ANALYSIS

The questionnaire survey involved (*n* = 67) respondents including 29 respondents from government planning departments and 38 respondents from private planning consultant agencies. From the 29 government town planners, 2 of them were attached to *Bahagian Projek Zon Tengah* of the Federal Department of Town and Country Planning (PLANMalaysia), 12 with the Selangor State Town and Country Planning Department who were in charge of the One Stop Centre (OSC) department and also plannners from *Rancangan Pembangunan* Department. Meanwhile, another 15 served local planning authorities including 2 City Councils and 6 Municipal Councils within the study area. They were the heads of two different departments; *Jabatan Rancangan Kawalan Perancangan* and *Jabatan Rancangan Pembangunan*. On the other hand, the private town planners were attached to planning consultancy firms, and were mainly employees of the firms. The respondents were selected from grade J41 and above or heads of departments. Only 67 out of 113 identified respondents were selected as samples as the survey used a single cross-sectional method.

An in-depth interview was conducted to validate and seek insight on the specific or significant issues and loopholes encountered in housing planning and control within the study area as revealed in the questionnaire survey. In order to select appropriate respondents, the purposive sampling technique was applied by choosing the selected respondents based on their years of experience of more than ten (10) years and also their involvement in the preparation of development plan, housing layout plan, submission and approval of housing planning applications. A total of fifteen respondents (n = 15) were selected and interviewed which includes nine (9) respondents who were planning consultants and seven (7) respondents from government planning departments.

Table 1: Summary of Importance- Performance Analysis (IPA) Index

Dimension (Dependent Variable)	No of Items (Independent Variables)	Type of analysis	Result of findings
1) Policy related to housing objectives	10	Quadrant Analysis or Importance- Performance Analysis (IPA)	**Quadrant I**: 4 items (high importance and high level of effectiveness or performance) **Quadrant II**: 6 items (*price*,*quality*, *needs*, policy coordination, *development of LCH* and *ownership* was rated low in effectiveness or performance but considered as high importance for improvement)
2) Land Location for housing development	15	**Quadrant I**: Strengths, high performance, optimal resource utilisation	**Quadrant I**: 13 items **Quadrant II**:1 item **Quadrant III**: 1 item (*Determination by certain planning phases* considered unimportant weakness and low priority for improvement)
3) Land Size for housing development	11	**Quadrant II**: Weaknesses and high priority for improvement	**Quadrant I**: 11 items (high importance and high level of effectiveness or performance)
4) Planning guidelines for housing	8		**Quadrant I**: 8 items (high importance and high level of effectiveness or performance)
5) Level of Compliance	17	**Quadrant III**: Unimportant weaknesses (low performance) and low priority for improvement	**Quadrant I**: 14 items **Quadrant II**: 3 items (compliance with low density, high density and according to development phases seemed weak in terms of its compliance or performance)
6) Level of Difficulty	14	**Quadrant IV**: Low priority but high performance, hence over-utilisation of resources	**Quadrant II**: 14 items (very important but low in terms of performance)
7) Strategy implementation of NHP thrust	5		**Quadrant I** : 4 items **Quadrant II** : 1 item (Strategy on BTS concept was rated low in effectiveness or performance but considered as high importance for improvement)

Table 1 show the result of the IPA Matrix (Quadrant Analysis) shows that there are scopes for improvement in each variable of the study. This analysis is important in searching for planning aspects or activities that require high attention for improvement in terms of the effectiveness of its implementation. To summarise, items that are classified in Quadrant II for policy (6 items), location (1 item), compliance (2 items) and difficulty (14 items) require high attention by the policy makers in decision making and consultants in implementing these planning activities during the planning and control process, as it is significant in ensuring effectiveness. Therefore, town planners should be more cautious in their decisions, recommendations and technical analysis in preparing development plans and controlling housing applications and approvals. There were two (2) significant outputs which contribute to the research; 1) Framework in order to improve housing planning and control activities process and, 2) the Importance-Performance Analysis (IPA) Index in searching for planning aspects or elements or activities that need high attention for improvement. The framework could broadening research in the area of housing planning and control process. In terms of practical contribution, it can be also serve as reminder and used as guide in order to properly plan, control and approve housing supply.

CONCLUSION

Among direction of future research were; firstly, it cover new scopes that have a connection with the process and outcomes of housing planning such as household demands and market demands by types and choices. Secondly, it was suggested to involve perception of developers, property analysts which focused on level of acceptance, the effects and implications of the proposals on the housing market. It was also suggested to identifying and ranking the significant factors, explaining the relationship between issues. Finally, the future research can expand evaluation of the effectiveness of planning and controlling housing supply through; 1) concentrate on one planning mechanisms, 2) selection of other case study area or two or more, and 3) adoption of other method such as planning document analysis (e.g housing application files).

REFERENCES

[1] Alias Rameli & Ratnawati Aman. (2011). Ineffectiveness of Planning Control and Its Implication to Housing Oversupply : A Case Study of. *Civil Engineering and Architecture*, 1–15.

[2] Dunse, N., Thanos, S., & Bramley, G. (2013). Planning policy, housing density and consumer preferences. Journal of Property Research, 30(3), 221–238.

[3] Foo, L. H. R., & Wong, C. (2014). Planning for Housing Development in Malaysia: Developers' Response to the Regulatory Policy Framework. *International Planning Studies*, *19*(2), 192–209.

[4] Gurran, N., & Whitehead, C. M. E. (2011). Planning and affordable housing in Australia and the UK: a comparative perspective. *Housing Studies*, *26*(7–8), 1193–1214.

[5] Hamizah Yakob., Fatimah Yusof., & Hazlina Hamdan. (2012). Land Use Regulations towards a Sustainable Urban Housing : Klang Valley Conurbation *Procedia - Social and Behavioral Sciences*, *68*, 578–589.

[6] Hamizah Yakob., Fatimah Yusof., & Hazlina Hamdan. (2013). Sustainable Urban Housing Development through Planning Mechanism: Issue and Challenges. Asia Pacific Network for Housing Research (APNHR) Proceedings

[7] Ibrahim Mohd., Faizah Ahmad., & Ezrin Arbi,. (2011). One Stop Centre as a Boon to Property Development Approval Process. A Case Study: City Hall of Kuala Lumpur. *Journal of Design and Built Environment*, *8*, 1–15.

[8] Thuraiya Mohd,. (2011). The Role of Housing Planning Practices in Contributing towards Housing Oversupply, 767–775.

BEST PRACTICES IN STAKEHOLDER ENGAGEMENT THROUGH A COLLABORATIVE PROCUREMENT SYSTEM FOR INFRASTRUCTURE PROJECTS

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Abstract. Infrastructure construction projects engage multiple stakeholders directly and indirectly during the pre-construction stages. In large projects, stakeholders have varying information needs and interests, and projects that actively engage with their stakeholders are more likely to succeed. One of the reasons for engaging stakeholders is to promote equity and fairness to both external and internal stakeholders. The collaborative procurement approach has been acknowledged as an approach that can provide a way to manage stakeholder complexity. This research aims to investigate the influence of stakeholders during the engagement process and stakeholders' effects on project outcomes. This research applies a fully qualitative research methodology based on interviews, case studies and observations from two case studies in New Zealand and two case studies in Malaysia. The research also draws information from stakeholder engagement reports, project documentation, public engagement reports, and transportation agency reports. The comparative findings show the values of stakeholder engagement obtained during the pre-construction process for large infrastructure projects. Comparison of these case studies enables lessons to be learnt that could improve stakeholder engagement. The findings provide the best practices into how the features of a project (project governance and a commercial model) formulate an effective approach (building a culture of care, communicating beyond compliance and responsiveness) to managing multiple stakeholders during the planning and consenting phase. The research provides a reference for construction organisations to help them develop best practices for successfully managing stakeholder complexity in future construction infrastructure projects.

INTRODUCTION

The purpose of this research is to investigate stakeholder engagement processes and their implementation in project collaboration, specifically in infrastructure projects. The research aims to provide evidence on how future stakeholders could be successfully managed. The case studies selected from New Zealand and Malaysia showed the process of stakeholder engagement and compared approaches in a developed and developing country. The research examined two different stakeholder management cultures, where different approaches were used, but where the intent was to effectively engage with stakeholders. The research examines the concept of stakeholder engagement, the process and method of engaging stakeholders, the need for stakeholder engagement during the early stage of projects (such as inception, planning and pre-construction), the key implications of early stakeholder engagement and the application of stakeholder engagement in infrastructure projects. The research also provides valuable knowledge and useful guidelines for project owners, stakeholder managers and project personnel regarding the importance of engaging stakeholders early. The research presents a theoretical and general model of the process of analysing stakeholders' satisfaction

LITERATURE REVIEW

Stakeholder engagement embraces the willingness of project clients and managers to listen and discuss issues of interest to stakeholders. Critically, organisations must be prepared to consider changing what it aims to achieve and how it operates as a result of stakeholder engagement (Jeffery, 2009). Stakeholder engagement identified by Rodriguez-Melo and Mansouri (2011) as the defining factor increasing managers' awareness, helping legislation be effectively implemented and making sustainability highly appealing to clients. Greenwood (2007) defined stakeholder engagement as practices that the organisation undertakes to involve stakeholders in a positive manner in organisational activities. Stakeholder engagement in construction projects is important for project teams, as the nature of construction projects is uncertain and complex and requires multiple views and inputs (Yang et al., 2011). Stakeholder engagement is increasingly becoming part of construction project practice to deliver better project outcomes. There are various stakeholders involved in construction project, with diverse occupational and professional backgrounds (Mok, Shen, & Yang, 2015), and engaged at different levels and with different interests (Yang et al., 2011). Large infrastructure projects that involve complex relationships between varieties of stakeholders are a managerial challenge (Flyvbjerg, 2014; Mok et al., 2015). Bal et al., (2013) showed that in order to deliver and achieve excellent project outcomes, stakeholder engagement is an important part of successful construction practice. Heravitorbati, et al., (2011) stressed that effective stakeholder involvement is regarded a key success factors in construction projects. Stakeholders have their own interests and priorities that may cause conflicts and increase the complexity and risk of the project practice (Bal et al., 2013; Manowong & Ogunlana, 2010; Mok et al., 2015). Chinyio and Akintoye (2008) stated that, to achieve project objectives, it is essential to formulate a process for stakeholder management and to identify effective approaches for stakeholder analysis and engagement. Effective engagement requires communicating with stakeholders and involving and developing relationships with them (Greenwood, 2007; Chinyio & Akintoye, 2008; Bal et al., 2013; Mok et al., 2015). C observed that enhanced stakeholder involvement can help manage stakeholder needs, decrease unanticipated risk and reduce unconstructive actions or reactions that may affect project success.

Project delivery systems have an effect on stakeholder engagement. Different project delivery systems involve project collaboration with different players and key stakeholders. From an innovation perspective, Walker and Hampson (2003) stated that the most important aspect of a procurement system is the presence of a well-integrated team, which they considered vital for driving innovation. Communication, learning and innovation are believed to be improved across the supply chain through management by a single entity (Walker & Hampson, 2003). However, if the stakeholders' goals include contractor collaboration in the design process and higher client involvement, the traditional procurement method is weak in dealing with these issues (Rwelamila, 2010). Collaborative procurement has been seen to reduce costs, reduce project times, improve quality and improve client satisfaction. Collaborative procurement can also mean that all stakeholders across the project supply chain can be more easily identified as the project team works more closely together. Rwelamila (2010) stated that, during the preparation of project documentation, irrespective of procurement type, the project manager should identify project stakeholders.

Mega infrastructure projects encompass construction projects that demand a large amount of financing and staffing, and are often part of politically charged processes. Gellert and Lynch (2003) defined mega infrastructure projects as technologically complex, detailed in planning and highly sensitive to political influences. Mega projects usually cause visible change to the living environment. In most countries, mega infrastructure projects take a special position in public policy (Giezen, 2012). In any infrastructure project, dealing with various stakeholders, wider communities and the public can be a

challenging task for project developers. As a result of the complexity, Flyvbjerg, Bruzelius, and Rothengatter (2003) and Altshuler and Luberoff (2003) showed that mega projects have a bad track record of keeping to budget and time schedules. Mega projects for infrastructure often involve various stakeholders of diverse occupational and professional backgrounds, who have different levels and types of interest in the project. The complex and volatile nature of mega projects requires systematic approaches and appropriate skills by project managers to accommodate multiple stakeholder interests and achieve the best value project outcomes (Mok et al., 2015). Successful stakeholder engagement can be achieved by ensuring a close relationship between the project team and the stakeholders involved, including the public. However, projects, especially mega projects, find it difficult to coordinate, communicate and manage stakeholders effectively, and this can reflect poorly on project outcomes. Discovering methods of managing mega project stakeholders is at the heart of this research, with a view to producing best practices for industry to use when managing stakeholders.

METHODOLOGY & ANALYSIS

Research Methodology

This research consists of four main phases of research. At the beginning of the study, a comprehensive literature review was conducted to gain a thorough understanding of the fundamental concepts and theoretical framework of the study, also to identify the research gap of the research. The literature reviews cover international journals, research articles, stakeholder and stakeholder engagement manuals, project reports, other countries and companies' reports, books, scholarly journal articles and other documentation, websites and scholarly theses. The literature review focused on themes of stakeholder management, stakeholder engagement, project collaboration, project delivery systems, innovation in project delivery systems, stakeholder approach and identification, public participation spectrum, effective engagement and large infrastructure projects.

Next phase, semi-structured interviews with practitioners were used as the data collection method. An in-depth, face-to-face interview techniques and semi-structured questions were adopted for the interviews. The reason of conducting a face-to-face interview was to identify how stakeholder engagement processes in a large infrastructure project are conducted during the planning phase of the development. Moreover, a comparative case studies between the case studies were undertaken with key personnel, internal and external stakeholders of the projects. Two case studies in New Zealand and two case studies in Malaysia was selected. The case studies selected for the current research were limited to infrastructure projects, such as expressway and railway projects. The case study selection was not restricted to a preferable project size. These case studies were identified where they involved a special stakeholder engagement team in the projects. Finally comparative analysis was conducted for this research through a cross-case analysis method. Conducting the comparative analysis as mentioned by Stake (2006), by means of examining how the program or phenomenon performs in different environments. The logic of using the multiple case studies requires each case be carefully selected and investigate in order to foresee the result either similar or contradict (Yin, 2003). The findings derived, coupled with the results from the semi-structured interviews, were synthesised to develop best practices for the stakeholder engagement process when undertaking collaborative procurement in New Zealand and Malaysia, with specific recommendations regarding the themes obtained.

Best Practices for Stakeholder Engagement Process as a Guideline for Infrastructure Projects.

Having completed four case studies examining stakeholder engagement, and compared, brings the research together to provide practical guidelines for stakeholder engagement on infrastructure projects. This research focusses on the key research questions on "What are the

best practices that could be derived from the stakeholder engagement processes?" and uses the best practices derived from the case studies in New Zealand and Malaysia to provide answers. Although these countries are different in geography and politics, the implementation of stakeholder engagement in the cases show complementary processes and management of stakeholder needs. The best practices highlighted help establish a guideline for stakeholder engagement for future infrastructure projects. Only limited guidelines exist to indicate the optimal approach to engaging and managing stakeholder in complex infrastructure projects. This research helps close this gap by proposing five recommendations for key stakeholders, project owners, project developers and public agencies regarding how to improve the stakeholder engagement process, especially when using the collaborative procurement delivery system. This research captured the management and stakeholder best practice for the engagement process in the early stages of infrastructure projects. In contrast to other sectors, the best practice process in infrastructure megaprojects is moulded according to the needs and nature of the stakeholders involved. The findings from the building professionals and stakeholders in New Zealand and Malaysia demonstrated the opinions and views regarding the project implementation. Best practice guidelines can be amended according to the needs and nature of the project. In the case studies, these guidelines would help management to strategies effective ways to engage and create an innovative approach. The best practice guidelines were broken down into six themes, based on the key implications: (i) process of stakeholder engagement, (ii) internal early preparation and planning, (iii) business case scenario, (iv) project governance, (v) delivering values in engagement and (vi) policy and social effects.

The best practices exercises developed efficient practices to provide better quality service to stakeholders. The guidelines developed from this research can be used as complementary guidance material to project developers of infrastructure projects who manage stakeholders and are involved with the engagement practice. Each theme was broken into key points to enable reference.

REFERENCES

[1]   Bal, M., Bryde, D., Fearon, D., & Ochieng, E. (2013). Stakeholder engagement: Achieving sustainability in the construction sector. *Sustainability, 5*(2), 695–710.

[2]   Chinyio, E. A., & Akintoye, A. (2008). Practical approaches for engaging stakeholders: Findings from the UK. Construction Management and Economics, 26(6), 591–599.

[3]   Flyvbjerg, B. (2014). What you should know about megaprojects and why: An overview. *Project Management Journal, 45*(2), 6–19.

[4]   Flyvbjerg, B., Bruzelius, N., & Rothengatter, W. (2003). *Megaprojects and risk: An anatomy of ambition.* New York, NY: Cambridge University Press.

[5]   Gellert, P. K., & Lynch, B. D. (2003). Mega-projects as displacements. *International Social Science Journal, 55*(175), 15–25.

[6]   Giezen, M. (2012). Keeping it simple? A case study into the advantages and disadvantages of reducing complexity in mega project planning. *International Journal of Project Management, 30*(7), 781–790.

[7]   Greenwood, M., (2007). Stakeholder engagement: Beyond the myth of corporate responsibility. *Journal of Business Ethics, 74*, 315–327. doi:10.1007/s10551-007-9509-y

[8]   Heravitorbati, A., Coffey, V., Trigunarsyah, B., & Saghatforoush, E. (2011). Evaluating the influences of stakeholder management on construction project quality. In Proceedings of 1st International Construction Business & Management Symposium. Kuala Lumpur: University Teknologi

Malaysia. Retrieved from http://eprints.qut.edu.au/41585/

[9]   Jeffery, N. (2009). Stakeholder engagement: A road map to meaningful engagement #2 in the Doughty Centre 'How to do Corporate Responsibility' series. School of Management, Cranfield University. Retrieved from https://dspace.lib.cranfield.ac.uk

[10]   Manowong, E., & Ogunlana, S. (2010). Strategies and tactics for managing construction stakeholders. In Ezekiel Chinyo and Paul Olomolaiye (Eds.), Construction Stakeholder Management (pp.121–137),Sussex, England: Wiley-Blackwell Publishing Ltd.

[11]   Mok, K. Y., Shen, G. Q., & Yang, J. (2015). Stakeholder management studies in mega construction projects: A review and future directions. International Journal of Project Management, 33(2), 446–457.

[12]   Rodriguez-Melo, A. & Mansouri, S. A. (2011). Stakeholder engagement: Defining strategic advantage for sustainable construction. Business Strategy and the Environment, 20, 539–552. doi:10.1002/bse.715

[13]   Rwelamila, P. D. (2010). Impact of procurement on stakeholder management. In Ezekiel Chinyo and Paul Olomolaiye (Eds.), , Construction stakeholder management (pp. 193–215). Sussex, England: Wiley-Blackwell Publishing Ltd

[14]   Yang, J., Shen, G. Q., Bourne, L., Ho, C. M. F., & Xue, X. (2011). (2011). A typology of operational approaches for stakeholder analysis and engagement. Construction Management and Economics, 29(2), 145–162.

[15]   Yin, R. K. (2009). *Case study research: Design and methods* (3rd ed.). London, England: SAGE Publications.

DRONES IN SMART BUILT ENVIRONMENT

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Abstract. The revolution Industrial Revolution (IR) 4.0 offers the introduction of many new technologies to assist in daily human activities, disaster management, crises, pandemics, business, education, research, agriculture, and construction, among others. These new technologies could aid in decision-making, thus saving time and labour, especially in data terms of data mining. Drone technology is also a significant part of IR 4.0, which has been implemented in many modern applications. Specific applications in image acquisition such as aerial mapping require certain overlap and sidelap image percentage, which must remain consistent during flight missions with specific angle views. The three-dimensional model requires image acquisition from an oblique angle view, with a certain persistent overlap percentage. The accuracy and precision of the final results can be assessed using statistical methods to ensure the proposed model is reliable for specific tasks. Drones have become a new norm in the digital industry to provide very high accuracy and precise data, in a series of tasks.

INTRODUCTION

Drones have many different names that are specific to country, such as unmanned aerial vehicles, unmanned aircraft systems, remotely pilot aerial systems, etc. Intelligent drones should have the basic components, namely, an inertial navigation system, global positioning system, flight controller, navigation control board, electronic speed controller, motor frame and propeller. According to the Unmanned Aerial Vehicle System Association, drones can be classified based on their mass, range, flight altitude and time endurance. Drone categories include micro, mini, close range, short range, medium range, medium range endurance, low altitude deep penetration, low altitude long endurance, and medium altitude long endurance. There are two general types of drones, namely, fixed wing and rotary wing.

Fixed wing drones have a similar design to manned aircraft, which has an elevator, rudder, aileron and flaps. The payload weight depends on the fixed wing design, whereby some fixed wing drones can carry a heavy payload, while some fixed wing drones can only carry a light payload. Rotary wing drones can be classified into three categories, namely, quadcopters, hexacopters and octocopters (Koeva et al., 2018; Peraka et al., 2020). The quadcopter has four arms, the hexacopter has six arms and octocopter has eight arms. These arms can improve the stability of the platform, and carry different payload weights. The size and weight of the rotary wing drone depends on its design. The largest rotary size could resist wind effects during flight planning. The combination of fixed wing and rotary wing drone qualities are attributed to vertical take-off landing drones (James et al., 2017). The drones are the latest design, and are useful in many new applications, especially in the limited space areas for hovering and landing, but with a large study area.

Vertical take-off landing drones can hover and land like rotary wing drones, but fly like fixed wing drones. The selection of drone type depends on the size of the study area, condition of study area, cost, time and labour (Frey et al., 2018). A large study area with a wide space for launching and landing is preferable for fixed wing drones, while a small study area with limited space for hovering and landing is preferable for rotary wing drones. In other situations, if a large study area with limited space for

hovering and landing is considered, vertical take-off landing drones would be most suitable for this particular scenario. Figure 1 depicts an example of a fixed wing and multirotor drone used for mapping applications.
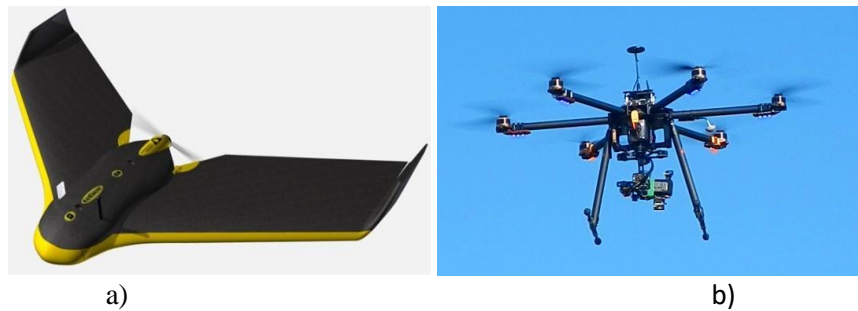
a)   b)

Figure 1. Types of drones; a) Fixed wing, b) Multirotor

DRONE'S SENSOR

Drones can also carry many different types of sensors. Different kinds of sensors are useful in many applications. The types of sensors available for drone payload are optical camera, multispectral sensor, hyperspectral sensor, thermal sensor, light detection and ranging sensor. These sensors have been designed with different spectral signatures and are also known as passive sensors.

Multispectral Sensor

Multispectral sensors have the capability to record various electromagnetic spectrums of objects. The 'multi' means that they have more than one band, where each band has its own electromagnetic spectrum. Therefore, this sensor is capable of analysing plant health and monitoring the conditions of growing plants using vegetation indices algorithms (Sun et al., 2018; Boon et al., 2017). This sensor can help farmers and planters in monitoring their farm and plantation areas. Figure 2 shows an example of a Sequoia multispectral sensor. This sensor is equipped with a sunshine sensor to automatically adjust the radiometric properties of the acquired images.

Figure 2. Multispectral drone sensor

LiDAR Sensor

A LiDAR sensor is an active sensor that can produce its own energy to obtain data from the ground surface. This particular sensor produces laser pulses projected to the earth's surface, including any objects found on the surface. There are over 100,000 pulses produced per second, and the sensor can retrieve multiple returns from the reflected pulses from any object on the surface. This sensor can rotate 360 degrees and is equipped with inertia measurement units to store the sensor's altitude, positioning, orientation and rotations during the data acquisition process. Figure 3 shows an example of the RIEGL LiDAR sensor.

Figure 3. LiDAR drone sensor

DRONE APPLICATIONS

These sensors could be used in the production of digital terrain models (optical camera), orthophotos (optical camera), monitoring of paddy field health (multispectral sensor), estimating nitrogen content (multispectral sensor), evaluating plant height (optical sensor), recording human temperature in crowded open space areas (thermal sensor), building heat estimation (thermal sensor), forest fires (thermal sensor), classification of different species and types of trees (hyperspectral sensor), and biomass estimation (hyperspectral sensor). Light detection and ranging sensors are active sensors that can produce their own energy or pulse to collect information from the study area. Therefore, this sensor can collect data during the day or the night. This sensor can be used in various applications, such as those mentioned above, and provides highly accurate data. This sensor could produce over 700,000 pulses per second, depending on its specifications. Therefore, this sensor can produce a very fine digital terrain model, or digital surface model, and is able to differentiate the types of features on the ground surface such as trees, lamp posts, buildings, transmission towers, cars, etc.
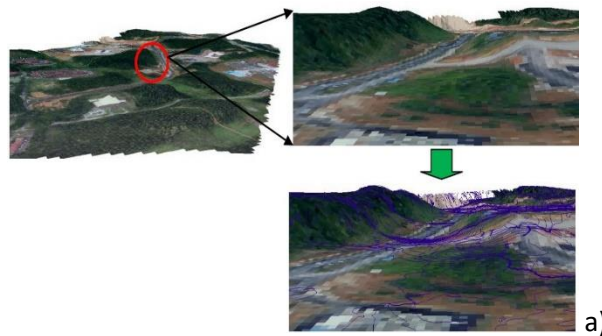
a)

b)

Figure 4. Drone Application; a) Slope Mapping, b) Building's Crack Measurement

CONCLUSIONS

Drones are one of the solutions to obtain results for fast decision-making. These platforms are suitable for projects that have a limited budget and time. The selection of the most suitable drone platform depends on the payload, cost and time of the project. Drones can provide reliable accuracy for specific applications, as long as the correct procedures are followed.

ACKNOWLEDGMENTS

REFERENCES

[1] Boon, M. A., & Tesfamichael, S. (2017). Wetland vegetation integrity assessment with low altitude multispectral UAV imagery. International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archives, 42(2W6), 55–62. https://doi.org/10.5194/isprs-archives-XLII-2-W6-55-2017

[2] Frey, J., Kovach, K., Stemmler, S. & Koch, B. (2018). UAV Photogrammetry of Forests as a Vulnerable Process. A Sensitivity Analysis for a Structure from Motion RGB-Image Pipeline.

[3] James, M. R., Robson, S., Oleire-oltmanns, S., & Niethammer, U. (2017). Geomorphology Optimising UAV topographic surveys processed with structure-from-motion : Ground control quality , quantity and bundle adjustment. *Geomorphology*, *280*, 51–66. https://doi.org/10.1016/j.geomorph.2016.11.021

[4] Koeva, M., Muneza, M., Gevaert, C., Gerke, M., & Nex, F. (2018). Using UAVs for map creation and updating. A case study in Rwanda. *Survey Review*, *50*(361), 312–325. https://doi.org/10.1080/00396265.2016.1268756

[5] Peraka, N.S.P. & Biligiri, K.P. (2020). Pavement asset management systems and technologies: A review. Automation in Construction, 119, 103336
Remote Sens., 10 (6), 912. https://doi.org/10.3390/rs10060912

[6] Sun, G., Huang, W.J., Chen, P.F., Gao, S. & Wang, X. (2018). Advances in UAV-based Multispectral Remote Sensing Applications. Trans. Chin. Soc. Agric. Mach. 2018, 49, 1–17.

PHYSICAL LEARNING ENVIRONMENT: IMPACT ON CHILDREN COGNITIVE SCHOOL READINESS

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Abstract. Cognitive abilities of Malaysian children have fallen behind considerably. Recently, the Ministry of Education (MOE) introduced measures to address this issue and MOE preschools were tasked to ensure children are cognitively ready for primary school. But, evidences suggest that the quality of preschool physical environments (PPE) have received little attention. No study on the relationship between PPE quality and cognitive school readiness (SR) in MOE preschools exists in Malaysia. Hence, adopting a Piagetian approach to children's cognitive development, this study is motivated to explore the association between these two elements in Malaysia. A prospective cohort study was done on 6-year old MOE preschool children in Klang Valley, Malaysia. The CPERS5 scale and BSRA-3 instrument were used to assess PPE quality and cognitive SR respectively. Correlation analysis was done to study the relationship between these two aspects and Regression analysis was done to construct predictive models for children's SR. Findings showed a varying degree of PPE quality among the studied MOE preschools – some preschools have good PPE, while others have poor PPE designs. Similarly, the SR improvements among children attending these preschools were also varied – children who attend MOE preschools with higher PPE quality displayed better cognitive SR improvements compared to those in lower PPE quality preschools. Predictive models were also suggested to facilitate the PPE quality improvement among the studied preschools. Conclusively, MOE preschools must be in high PPE quality to maximise children's cognitive SR, thus ensure Malaysia achieves a preschool system that commands international recognition in the future.

RESEARCH BACKGROUND

Current understanding on the impact of PPEs on children development is comprehensive. The interaction between many elements of the PPE and various aspects of children development have long been studied and are well documented. Blair & Raver (2015) and Moore (2012) concur, physical aspects such as planning, spatial design, Indoor Environmental Quality (IEQ) and the quality of indoor and outdoor areas impact children's learning through their ability to promote and enhance elements that are key ingredients for children development. However, evidence on the nature of interaction between these factors are rather inconclusive.

Nevertheless, the foundational basis for understanding this unique PPE-children relationship exists and has often stemmed from the interactionist-constructivist approach, based on the famous Theory of Cognitive Development by Jean Piaget. Thus, many developed countries have long adopted this approach and theory to preschool design to promote better education for children (Schultz & Schultz, 2016).The preschool age is crucial a crucial period in one's life – the foundation for one's personalities andbehaviour as well as other important emotional, social and cognitive abilities take foot during this

period(Boon, 2010). As children spend more time in preschools, the preschool environment therefore becomesever more important for the child's early learning, development, and growth.
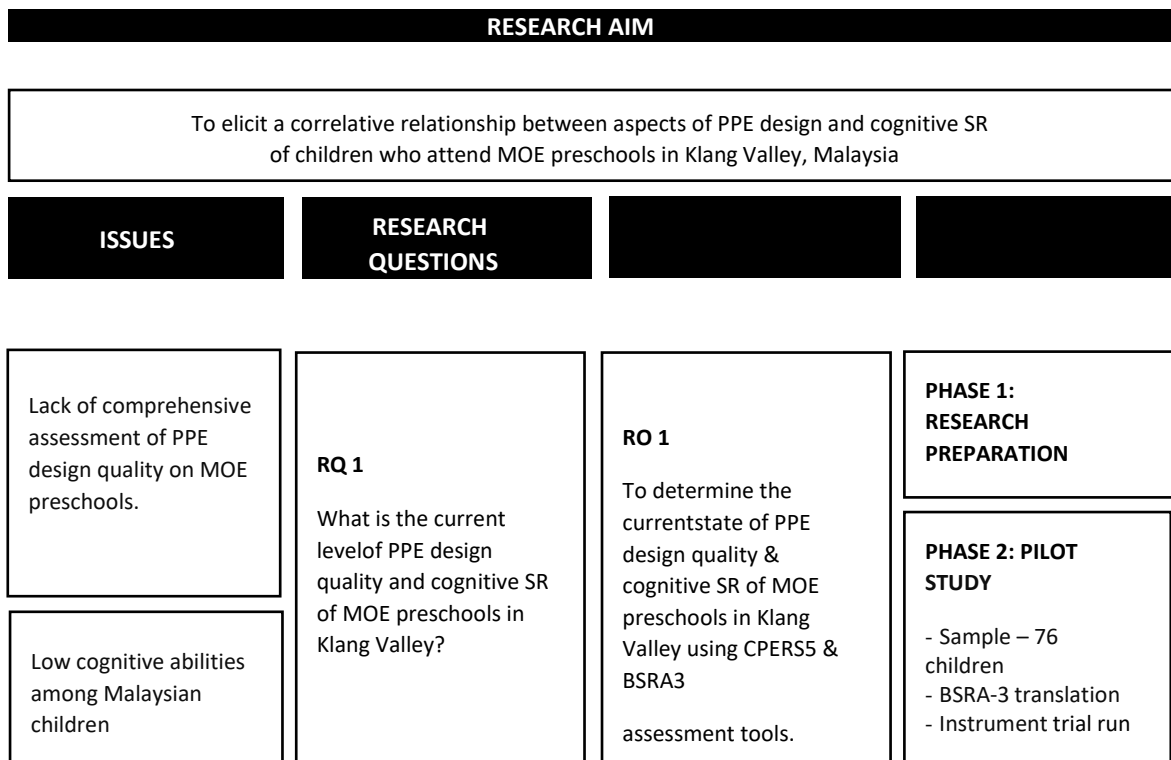
SR is an important aspect of children education (UNICEF, 2012) where ensuring children are ready for primary school is arguably one of the main objectives of current national policies on preschool education – the Malaysian Education Blueprint (MEB) 2013 - 2025 and National Standard Preschool Curriculum (NSPC) 2016. Because a child's SR is directly affected by the child's development, it reflects the level of development the child has achieved throughout their pre-schooling period (Majzub& Rashid, 2012; Majzub, 2009).

However, PPE design quality among Malaysian preschools are low compared to international standards (Abbas & Othman, 2010); more attention is needed to improve PPE design standards. Abbas et al. (2012) conclude, unlike Malaysia, design processes and considerations of preschools in developed countries are richer and more holistic; crucial elements of the PPE are often given more attention and better tailored to suite children learning and development. In fact, education systems in developed countries take pride in implementing children's developmental theories in the design of PPEs to ensure robust preschool settings are in place for children. Adopting this, an evidence-based approach and culture must therefore be encouraged in Malaysia toguarantee a better start to life for children and it starts with better understanding of the interaction of PPE elements and aspects of cognitive development, especially in the Malaysian context.

RESEARCH FRAMEWORK

Research Issues, Aim, Questions, Objectives and Methodology (Processes) of the study are summarisedin the Research Framework below.

Research Framework

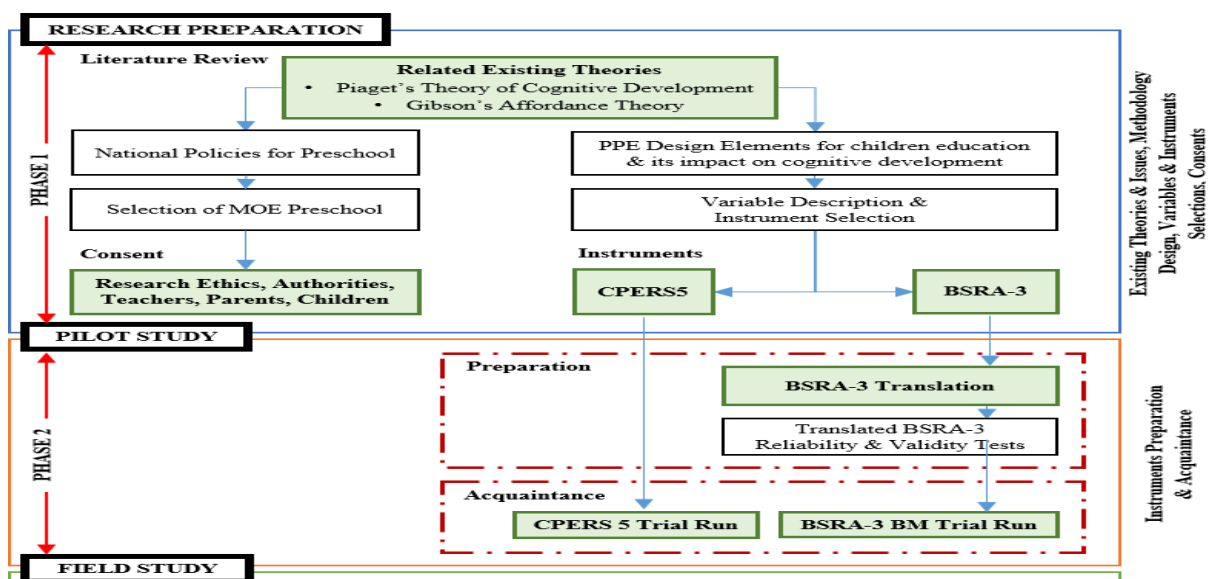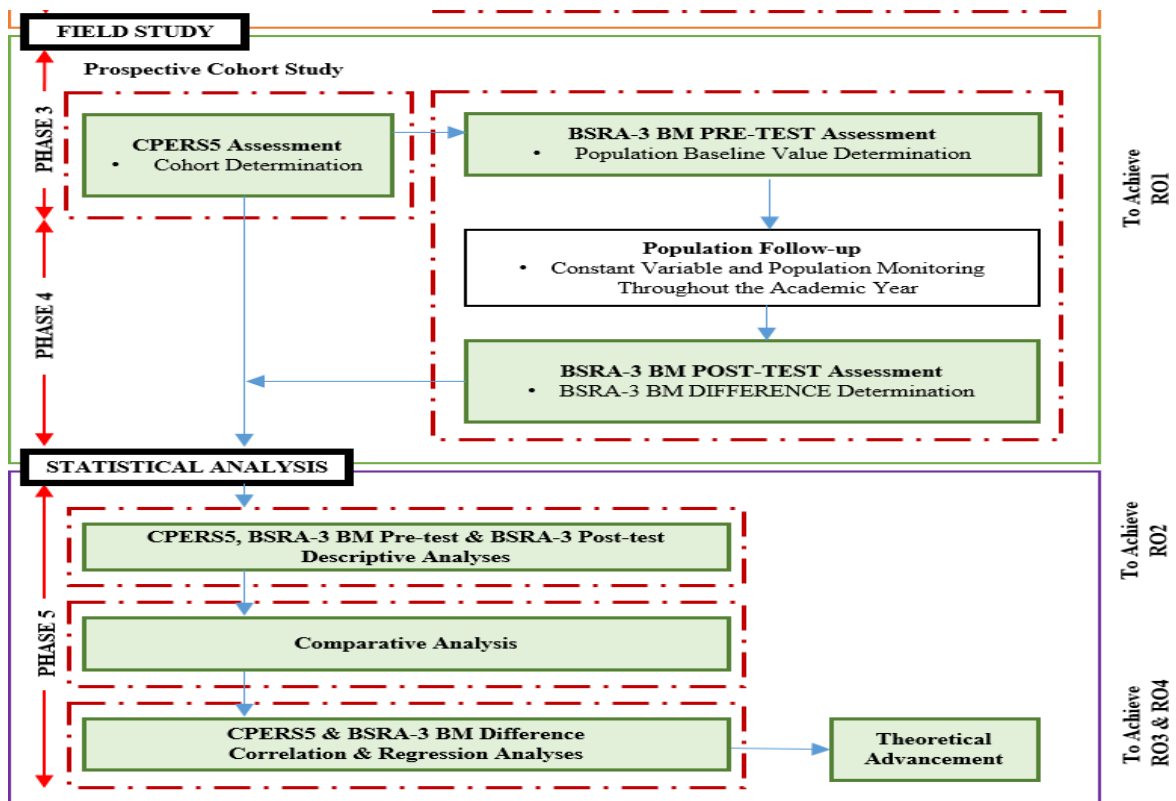| RESEARCH AIM			
To elicit a correlative relationship between aspects of PPE design and cognitive SR of children who attend MOE preschools in Klang Valley, Malaysia			
ISSUES	**RESEARCH QUESTIONS**		
Lack of comprehensive assessment of PPE design quality on MOE preschools.	**RQ 1** What is the current levelof PPE design quality and cognitive SR of MOE preschools in Klang Valley?	**RO 1** To determine the currentstate of PPE design quality & cognitive SR of MOE preschools in Klang Valley using CPERS5 & BSRA3 assessment tools.	**PHASE 1: RESEARCH PREPARATION**
Low cognitive abilities among Malaysian children			**PHASE 2: PILOT STUDY** - Sample – 76 children - BSRA-3 translation - Instrument trial run

<table>
<tr>
<td>Lack of awareness on the importance of PPE design quality in supporting cognitive development & SR in Malaysia,</td>
<td>**RQ 2**

What is the impact of overall PPE design quality on children's overall cognitive SR of MOE preschools in Klang Valley?</td>
<td>**RO 2**

To determine the impactof overall PPE design quality on children's overall cognitive SR in MOE preschools in Klang Valley.</td>
<td>**PHASE 3: FIELD STUDY (CPERS5 &BSRA-3 PRE-TEST)**

- Sample – 336 children
- Cohort determination
- Population baseline</td>
</tr>
<tr>
<td rowspan="2">MEB 2013 and NSPC 2016 show a lack of emphasis on various important PPE design elements to support cognitive development& SR</td>
<td rowspan="2">**RQ 3**

How does elements of the PPE design impact aspects of children's cognitive SR in MOE preschools in Klang Valley?</td>
<td rowspan="2">**RO 3**

To establish relationship between PPE elements and aspects of children cognitive SR in MOE preschools in Klang Valley.</td>
<td>**PHASE 4: FIELD STUDY (BSRA-3 POST-TEST)**</td>
</tr>
<tr>
<td>**PHASE 5:**

DATA ANALYSES

- Normality Test
- Reliability & Validity
- Paired T-Test
- Correlation Analysis</td>
</tr>
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Research Methodology

The study has three main phases which are Research Preparation, Pilot Study and Field Study. These phases were further subdivided into five phases altogether as illustrated in the Research Flow Chart below.

Research Flow Chart

RESEARCH FINDINGS

Cognitive SR remained moderate and unsatisfactory for a 6 –year old while PPE quality of MOE preschools were fair – none were poor nor excellent. Overall PPE design quality demonstrated significant positive influence on children's overall cognitive SR but overcrowding was found in all MOE preschools; the ratio of usable space per child was too small. Consequently, access to core facilities were unsatisfactory among most MOE preschools. However, among the PPE aspects, preschool size, circulation, modified open-planning and quality of quiet and messy activity spaces were found to the most important aspects to maximise children's cognitive SR. Interestingly, predetermined aspects of MOE preschools such as location, image and scale were praiseworthy and found to be significant compounding factors contributing to higher quality of all PPE aspects especially safety and security. Among activity areas, play yards were found to be the most disproportionately designed and facilities for disabled children were grossly lacking. Likewise, teacher-specific facilities namely private office rooms and storage were also insufficient. Fundamentally, the study found that the Piagetian approach toPPE design is generally appropriate for application in Malaysia, but minor adjustments must be made.

CONCLUSION

Elements of the MOE preschool physical environment, particularly those pertaining to the quality of modified opening plan spaces, are highly associated with children's cognitive development, andtherefore influence children's cognitive school readiness. Findings from this study suggests that MOE preschool must be designed with emphasis of good PPE quality. Moving to the future, the association of the quality of PPE design in MOE preschools on children development could be extrapolated to explore other aspects of children development to provide better understanding of children's development in response to various aspects of the preschool environment.

REFERENCES

[1]   Abbas, M. Y., Othman, M. (2010). Social Behavior of Preschool Children in Relation to Physical Spatial Definition. *Procedia Social and Behavioral Sciences* 5, 935-941.

[2]   Abbas, M. Y., Othman, M., Rahman, P. Z. M. A. (2012). Preschool Classroom Environment: Significant upon Childrens' Play Behaviour?. Procedia - Social and Behavioral Sciences, 49, 47–65.
Behaviour and Society Research Group, University of Sydney, Australia.

[3]   Blair, C., Raver, C. C. (2015). School Readiness and Self-Regulation: A Developmental Psychobiological Approach. Annual Review of Psychology, (66), 711-731.

[4]   Boon, N. S. (2010). Governance of Education Related ECCE Policies in Malaysia. International Journal of Child Care and Education Policy, 4(1), 45-57.

[5]   Majzub, R. M. (2009). The Development Of A Web-Based Ecological Assessment Of School Readiness (WEBEASR). Procedia - Social and Behavioral Sciences, 1(1), 2568-2572.

[6]   Majzub, R. M., Rashid, A. A. (2012). School Readiness Among Preschool Children. Procedia - Social and Behavioral Sciences, 46, 3524-3529.

[7]   Moore, G. T. (2012). The Children's Physical Environment Rating Scale. Environment,

[8]   Schultz, D. P., & Schultz, S. E. (2016). A History of Modern Psychology. Cengage Learning, Nelson Education, Ltd., Boston.

[9]   UNICEF (2012). School Readiness A Conceptual Framework. Retrieved from https://www.unicef.org/earlychildhood/files/Child2Child_ConceptualFramework_FINAL(1).pdf.

AN EVOLUTIONARY PERSPECTIVE OF GOVERNANCE: THE DILEMMA OF PARTICIPATORY PRACTICE IN PLANNING DECISION MAKING

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Abstract. This research is inspired by the theoretical framework of evolutionary governance theory (EGT) in its analysis of the subject and object formation and adopts the techniques of object stabilisation to explain the nature of reality or rhetoric in response to neoliberal globalisation's pressure. A case study highlighting Malaysia examines how its evolution and historical junctures have changed the ways in which the social order is defined and regulated in everyday planning practices. Thus, the research investigates the nature of a consultative process on the ground and thus offers insight into the possibilities of bringing a more democratic form of planning practice to Malaysia's planning system. The data were drawn from document analysis and in-depth interviews with planners, members of parliament, local councillors, developers and non-government organisations. The findings highlighted the tensions between competing actors in the planning system and emphasised the imbalance of power under which the public have few options to resist.

RESEARCH BACKGROUND

Based on Van Assche *et al*.'s (2014) Evolutionary Governance Theory (EGT), this research conceptualises the evolution of governance, market and society in analysing governance practice, particularly the dominant position of neoliberal globalisation in shaping governance practice within the consultative process. Thus, an understanding of the evolutionary perspective of Malaysian governance and the way in which its practices have evolved in planning, offers a useful insight into the ways of the state reform and intertwined with the market-oriented development in the consultative process. A matter of great concern to Malaysian governance is the incorporation of the public in the planning process in order to conform to the Town and Country Planning Act of 1976 (TCPA). This indicates that the Malaysian planning system demonstrates the process of participatory practice by incorporating the public's right to be heard in the planning process.

The avenues for public participation were introduced during the 1927 Town Planning Enactment and CAP 137, in which the provisions allowed members of the public to participate when a draft plan had been finalised (Maidin, 2012). Accordingly, the 1995 amendments of the Town and Country Planning Act 1976 are significant as they are seen to provide the avenues for the participation in a consultative planning process (Marzukhi et al., 2012). This is to demonstrate that governance does engage with the public in a system of democratic governance which can be seen from the reforms of the law. The amendment, according to Dola and Mijan (2006, p. 2), clearly indicates the commitment of governance to "become a democratic, developed nation….[t]his implies that engaging public participation before the plan is finalised could avoid future conflict and assist in legitimising the established policies". In this way, it can be seen that the evolution of the TCPA in 1976 from an earlier stage when the 1927 Town Planning Enactment and CAP 137 allowed the public to participate in the

planning process has brought a new dimension to the consultative process in the Malaysian planning system (Dola & Mijan, 2006).

Arguably, the focal point of discussions is the way in which the progress of Malaysia's economic growth and the historical background of governmental reasoning have influenced the process of adopting the neoliberal ideology, which in some ways allows for the benefitting of some and the marginalisation of others in Malaysia. Not surprisingly, as Maidin (2011, p. 148) claimed, "[d]espite the existence of statutory provisions for ensuring public participation in the planning decision making process, such rights are rarely utilised". In this sense, the consultative process in Malaysia is only successful in situations where the public's right to participate is just a matter of consultation, which does not guarantee their voice being heard and their opinion being incorporated in the process.

CASE STUDY

The case study approach has been selected to map Malaysia's planning practice and consultative process; this map is constructed from the conceptual framework of EGT. As Yin (2009) has suggested, case studies are appropriate to investigate social phenomena and the natural context. A 'green-lung' area, Gasing Hill, has been chosen as a local case study for consideration due to the public's involvement, the use of planning instruments and media attention (Duineveld et al., 2013). An understanding of the case is helpful to investigate three critical aspects: first, the evolutionary perspective of governance practice under the dominant values of neoliberal globalisation; second, the use of governance technologies to shape planning process; and third, the role of planners in democratic participation to face the challenges of neoliberal globalisation. From an EGT perspective, the formation of actors in governance as subjects, and the formation of physical sites as objects will provide an in-depth understanding of how objects "get articulated, negotiated, gain legitimacy, and restructure practices" in neoliberal times (Boezeman & Kooij, 2015, p. 187). Therefore, the case study will demonstrate how the public perceived that development approval was intertwined with a market-directed planning decision. In this setting, the discourses, analyses and events that occurred within the consultative planning process are analysed.

FINDINGS

Accordingly, informed by EGT's perspective, the findings of the case study demonstrated how objects (from 'green lungs' to a 'new generation city') were formed in Malaysia. The word 'generation city' gradually came to signify and emerged in its physical form as a space centered on living with greenery that had been designed to preserve and enhance the environment. Despite public resistance, the object was developed through various sites such as planning department consultations and objections voiced in local newspapers. Thus, the object came into being through constant consultation between subjects in the consultative process. This process of reification can be mapped as the surface of an object's emergence within a discourse. In this case, the development of the generation city was distinguished from its environment.

The case study showed a minimalist consultative approach in planning that manoeuvred within an unquestioned framework of consultative process. The site, within which an object is formed, can increase or decrease resistance (Duineveld *et al.,* 2013). In this sense, the findings suggested a paradoxical discrepancy between actions and policy in the Malaysian planning system. This aspect of the governance tools produces acceptance among the subjects that firmly leads to a form of stability of an object. Thus, planning policies and legislation are a source of stabilisation through participation practice in planning decision making.

CONCLUSION

As a conclusion, this research has argued that a useful way to understand the dilemma of participatory democracy is via an analytical perspective of an evolutionary perspective of governance. The findings revealed that new modes of governance illuminate paradox in Malaysia's planning system. The consultative process is shaped by discourse through a consultative paradigm and the use of governance tools. The Gasing Hill story was found to have resulted from a confluence of how the consultative process uncovered the tensions between subjects in Malaysia's planning system. In this context, the inauguration of new political trajectories in Malaysia reveals the capacity of neoliberalism to have significant effects on the relationship between contemporary global social, economic and even environmental wellbeing. To address this concern, emphasis needs to be placed on the role of planners to accommodate and address a contradictory neoliberal agenda and be up-front about this force.

REFERENCES

[1]   Boezeman, D., & Kooij, H. J. (2015). Heated debates: the transformation of urban warming into an object of governance in the Netherlands. In R. Beunen, K. Van Assche & M. Duineveld (Eds.), Evolutionary Governance Theory (pp. 185-203). Switzerland: Springer.

[2]   Dola, K., & Mijan, D. (2006). Public Participation in Planning for Sustainable Developement: Operational Questions and Issues. Alam Cipta International Journal of Sustainable Tropical Design Research and Practice, 1(1), 1-8.

[3]   Duineveld, M., Van Assche, K., & Beunen, R. (2013). Making things irreversible. Object stabilization in urban planning and design. Geoforum, 46, 16-24.

[4]   Maidin, A. J. (2011). Access to Public Participation in the Land Planning and Environmental Decision Making Process in Malaysia. International Journal of Humanities and Social Science, 1(3), 148-164.

[5]   Maidin, A. J. (2012). Malaysian Town and Country Planning: Law and Procedure. Malaysia: CLJ Publication.

[6]   Marzukhi, M. A., Omar, D., & Leh, O. L. H. (2012). Re-appraising the Framework of Planning and Land Law as an Instrument for Sustainable Land Development in Malaysia. Procedia-Social and Behavioral Sciences, 68, 767-774.

[7]   Town and Country Planning Act 1976 (2009). Laws of Malaysia. Kuala Lumpur: Percetakan Nasional Malaysia Berhad.

[8]   Van Assche, K., Beunen, R. & Duineveld, M. (2014a). Evolution Governance Theory: An Introduction. Heildelberg: Springer.

[9]   Yin, R. K. (2009). Case Study Research Design and Methods (4th ed.). California: Sage Publication.

PERUBAHAN SENI BINA DALAM KONTEKS BUDAYA MERANTAU DAN KESANNYA TERHADAP RUMAH TRADISIONAL NEGERI SEMBILAN, MALAYSIA

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Abstrak. Alam Minangkabau merangkumi wilayah tengah Sumatera Barat yang dikenali sebagai *darek* hingga ke rantau Timur Minangkabau di Riau dan Negeri Sembilan. Peluasan wilayah atau *pemekaran nagari* Minangkabau disebabkan oleh proses merantau menyaksikan berlakunya variasi seni bina Minangkabau dan Rumah Tradisional Negeri Sembilan (RTNS) di Negeri Sembilan, Malaysia. Namun fenomena kesamaan dan perbezaan elemen-elemen seni bina di antara RTNS dengan RAM telah menyebabkan berlakunya konflik pemilikan dan identiti seni bina di antara Malaysia dengan Indonesia di *Shanghai World Expo 2010*. Matlamat kajian ini adalah mengkaji ciri-ciri budaya merantau yang dibawa oleh masyarakat Minangkabau dari Sumatera Barat, Indonesia ke Negeri Sembilan, Malaysia dengan menganalisa prinsip pembinaan serta menilai konsep yang membentuk variasi kedua seni bina. Kajian kualitatif ini berasaskan empat metodologi iaitu fenomenologi, etnografi, kajian kes dan teori asas dijalankan di daerah Rembau, Negeri Sembilan dan di Minangkabau, Sumatera Barat. Kajian mendapati ciri-ciri budaya merantau yang bersifat evolusi, kaedah perhubungan dan berfikiran inovatif telah menyerap unsur-unsur pembentukan seni bina RAM iaitu adat matrilineal, *kelarasan* atau hukum adat dan persekitaran *luhak* atau wilayah pada seni bina RTNS. Kajian berjaya menghubung perkaitan kesamaan dan perbezaan yang wujud di antara RTNS dan RAM di samping menyelesaikan pertikaian pemilikan dan identiti kedua-dua seni bina.

Katakunci: *Merantau, seni bina, tradisional, Negeri Sembilan, Minangkabau*

PENGENALAN

Istilah "merantau" menduduki tempat istimewa pada masyarakat Melayu. Tidak seperti migrasi, merantau merupakan *lembaga* sosial atau institusi sosial (Naim, 1979) yang membudayakan ketika proses pergerakan keluar dari tanah induk bagi tujuan perluasan wilayah (Kato, 2005). Merantau mempengaruhi pembentukan seni bina dengan membentuk identitinya di wilayah Melayu khususnya di Alam Minangkabau. Ia juga mempengaruhi pembukaan penempatan baharu oleh masyarakat Minangkabau dari Sumatera Barat, Indonesia ke Negeri Sembilan, Malaysia dengan terbentuknya seni bina Rumah Tradisional Negeri Sembilan (RTNS) iaitu rumah masyarakat perantau Minangkabau di Negeri Sembilan, Malaysia.

RTNS memperlihatkan variasi elemen reka bentuk berbanding Rumah Adat Minangkabau (RAM) disebabkan perubahan secara evolusi (Idrus, 1996) serta faktor alam, budaya, adat istiadat dan sifat kedaerahan atau *luhak* di sesuatu tempat itu (Ismail N. H., et al., 2014). Merantau memiliki beberapa ciri-ciri berubah dan boleh disesuaikan di tempat dan masa yang berbeza. Ia membawa ciri-ciri berevolusi (Irwana Omar, Salim, & Mohamed, 2015) dan inovatif (Naim, 1979) yang lahir daripada faktor-faktor merantau. Berdasarkan kajian migrasi oleh Dixon, (1951) dan Issac, (1947) serta ciri-ciri

merantau (Naim, 1979, 1984), Mochtar Naim telah mengintegrasikan empat ciri-ciri merantau bagi membentuk satu kerangka konsep iaitu:

  i. Agent of Cultural Trasmission (Agen Penyebaran Budaya),
  ii. *Mobilitas Regional* (Penggerak Serantau),
  iii. *Mobilitas* (Penggerak) Ekonomi dan Sosial,
  iv. Perlembagaan Merantau.

Komponen-Komponen Pada Rumah Tradisional Negeri Sembilan (RTNS) Yang Dipengaruhi Oleh Ciri-Ciri Budaya Merantau Sehingga Membentuk Variasi Seni Bina Berbanding Dengan Rumah Adat Minangkabau (RAM)

  Pengaruh budaya merantau ke Rembau sejak abad ke-12 telah membentuk variasi seni bina pada RTNS dan RAM walaupun kedua-duanya wujud dari kebudayaan yang sama. Ini dibuktikan dengan penemuan ciri-ciri kesamaan yang terdiri daripada tiga kebudayaan Minangkabau iaitu adat matrilineal, *kelarasan* atau hukum adat dan persekitaran *luhak* atau wilayah pada kedua-dua seni bina. Selain itu ciri-ciri perbezaan juga dikesan pada komponen seni bina RTNS dan RAM kerana perantau Minangkabau berpegang kepada konsep *Alur dan Patut yang memberi kelonggaran kepada perantau dalam memutuskan sesuatu perkara di tanah rantau.*

  Fenomena variasi seni bina Minangkabau di antara darek dengan rantau akibat budaya merantau dikesan berdasarkan tiga ciri-ciri pengaruh budaya merantau iaitu bersifat evolusi, kaedah perhubungan dan berfikiran inovatif. Ia telah mempengaruhi komponen tapak dan organisasi ruang, kerangka struktur, komponen ruang dan ragam hias hingga menyebabkan berlakunya variasi seni bina Minangkabau terhadap RTNS dan RAM. Bagi mengesahkan variasi pembentukan seni bina RTNS dan RAM akibat daripada pengaruh budaya merantau, Jadual 1.0 menunjukkan pengkelasan variasi seni bina yang terbentuk berdasarkan komponen tapak dan organisasi ruang, kerangka struktur, komponen ruang dan ragam hias rumah RTNS dan RAM serta perkaitannya dengan ciri-ciri budaya merantau.

Jadual 1.0: Variasi pembentukan seni bina RTNS dan RAM pada komponen tapak dan organisasi ruang, kerangka struktur, komponen ruang dan ragam hias yang dipengaruhi oleh ciri-ciri budaya merantau.

Komponen	Variasi RTNS dan RAM		Ciri-Ciri Budaya Merantau Yang Mempengaruhi RTNS
	Persamaan elemen	*Perbezaan elemen*	
Tapak dan Organisai Ruang			
Persekitaran	Keduanya dibina di persekitaran sawah padi.	RTNS dibina di bahagian pesisir sungai di atas tanah rata. Hujung rumah mengarah tanah tinggi. RAM dibina di bahagian pedalaman di atas tanah rata. Hujung rumahnya mengarah ke gunung.	**_Ciri Kaedah Perhubungan_** RTNS mengekalkan corak perancangan rumah yang dibina di atas tanah rata di persekitaran sawah padi yang di kelilingi tanah tinggi.
Orientasi	Orientasi hujung rumah menala ke tanah tinggi.		**_Ciri Kaedah Perhubungan_** Orientasi huujung rumah ke arah tanah tinggi dikaitkan dengan persekitaran Gunung Merapi di perkampungan tua

			Pariangan Padang Panjang yang diasaskan oleh nenek moyang masyarakat Minangkabau.
Tapak Rumah	Tapak rumah milik persukuan. Terdapat kebun, kolam, telaga, sungai dan *rangkiang* (kepuk padi).		***Ciri Kaedah Perhubungan*** Perancangan tapak dikaitkan dengan aturan hidup berdasarkan potensi tanah.
Organisasi Ruang Dalaman	Organisasi ruang dalaman terdiri daripada ruang serambi atau Balai Adat, tengah rumah atau *labuah* dan *bandua*, anjung, loteng, dapur dan kolong.		***Ciri Kaedah Perhubungan*** Ruang dalaman berasaskan kedudukan Balai Adat atau serambi di mana upacara adat matrilineal dijalankan.
Kerangka Struktur			
Tiang	RTNS dan RAM menggunakan satu balak untuk setiap satu tiang tanpa penyambungan. Di bahagian dasarnya dialas dengan batu untuk menstabil dan menghalang mendapan dan kerosakan struktur.	Tiang RTNS dipotong empat sisi manakala RAM dipotong dua belas sisi.	***Ciri Bersifat Evolusi*** Sisi pada tiang adalah kepercayaan tradisi mewakili arah penjuru mata angin. Ia bermaksud rumah akan peroleh sumber rezeki dan keharmonian dari penjuru tersebut (Ny. Wahyuningsih & Rivai Abu, 1986). Penggunaan tiang empat sisi lebih praktikal dalam penggunaan sistem tanggam pada rumah RTNS.
Rasuk dan Gelegar	Kaedah pemasangan rasuk lantai secara dua lapisan dan disusun sisi. Pemasangan pangkal rasuk secara menindih hujung rasuk dilakukan pada lubang tiang dan ditetapkan dengan tiang guntung atau tetupai serta kayu kambi.		***Ciri Berfikiran Inovatif*** Penggunaan pasak dan kayu kambi pada RTNS membolehkan ia dibuka dan dipasang semula. Selain itu, susunan sisi membolehkan penyambungan rasuk lantai dilakukan bagi membina ruang baharu pada RTNS.
Bumbung	Prinsip pembinaan bumbung RTNS dan RAM adalah sama. Bentuk struktur bumbung 'V' terbalik merupakan ciri-ciri rumah rumpun Melayu di samping bahan atap dari tumbuhan serta struktur sokongan seperti perabung, tunjuk langit, kekuda dan gulung-gulung. Kedua-dua bumbung juga dihiasi dengan papan tumpu kasau atau *dompa-dompa* serta dilengkapi dengan tebar layar bertingkap.	Perbezaan bumbung RTNS dan RAM adalah analogi reka bentuknya.	***Ciri Bersifat Evolusi*** Lentik bumbung RTNS berasaskan bentuk perahu mengambil sifat persekitaran pesisir yang bersungai dan perahu sebagai pengangkutannya. Ketinggian bumbung RAM lebih bergonjong berasaskan tanduk kerbau mewakili persekitaran darat yang bergunung dan bersawah padi. Kerbau adalah haiwan penting yang membantu mencari rezeki.
Ruang			
Tangga	Tangga asal jenis larian lurus. Bilangan anak tangga adalah ganjil. Lokasi peletakan tangga adalah di hadapan rumah.	Tangga RTNS terletak di bahagian pangkal (hilir) rumah berbanding RAM di tengah-tengah. Bilangan anak tangga	***Ciri Kaedah Perhubungan*** Tangga RTNS yang terletak di sebelah pangkal atau hilir dipengaruhi oleh kedudukan sungai paling hampir sebagai

		RTNS adalah lima manakala RAM adalah tujuh.	laluan utama apabila memudik melawan arus.
			Perbezaan jumlah anak tangga mencorakkan jenis ternakan yang diusahakan oleh penghuni rumah. Lima anak tangga RTNS untuk ternakan kambing, ayam dan itik. Tujuh anak tangga RAM untuk kerbau atau lembu.
Lantai	Kedua-dua seni bina menggunakan lantai mendatar jenis beraras atau bertingkat.	Terdapat rumah RAM yang berlantai mendatar.	**_Ciri Bersifat Evolusi_** Aras lantai berkaitan dengan _kelarasan_ atau hukum adat. Lantai bertingkat, menunjukkan corak persukuan bersifat autokratik dengan struktur kepimpinan Ketua Adat. Bagi rumah berlantai mendatar, ia menunjukkan corak _kelarasan_ bersifat demokratik. Tingkat tertinggi dalam RTNS adalah di rumah ibu di mana _ibu soko_ barada ketika upacara adat berlangsung. Berbeza dengan RAM di mana _Penghulu Pucuak_ berada di anjung yang merupakan tingkat lantai tertinggi dalam RAM.
Dinding	Bahan dinding RTNS dan RAM adalah papan kayu yang dipasang menegak dan melintang.	Dinding RTNS yang boleh dibuka dan dipasang semula. Dinding RAM adalah tetap dan tidak boleh dibuka-pasang dan diubahsuai.	**_Ciri Berfikiran Inovatif_** RAM adalah rumah induk yang membawa sifat kekal di situ. RTNS pula adalah rumah bersifat sementara. Ia boleh dibuka dan dipasang malah dipindah lokasi.
Siling	Siling terhasil dari lantai loteng yang menutupi ruang bawah bumbung iaitu bilik RAM dan RTNS serta rumah ibu.		**_Ciri Berfikiran Inovatif_** RTNS menggunakan ruang loteng bukan sahaja sebagai tempat penyimpanan padi seperti RAM malah ruang menginap jika ada keperluan.
Ragam Hias			
Dinding Dalaman	Ukiran kaligrafi arab dan gasing-gasingan dikesan pada ruang dalaman RTNS dan RAM.	RAM tiada ragam hias pada ruang dalaman.	**_Ciri Berfikiran Inovatif_** RTNS mengadaptasikan ukiran di luar hingga ke dalam rumah.
Dinding Luaran	Ukiran tebuk timbul bermotifkan flora dan fauna pada dinding luaran RTNS dan RAM.		

KESIMPULAN

Kajian membuktikan bahawa tiga ciri-ciri budaya merantau Minangkabau iaitu sifat evolusi, kaedah perhubungan dan berfikiran inovatif telah mempengaruhi pembentukan seni bina RTNS. RTNS yang terletak di rantau Rembau berasal dari susur jalur RAM dan tidak terikat sepenuhnya dengan Adat *Pangkal Tanah* di tanah asal. RTNS dianggap sebagai model evolusi seni bina rumah Minangkabau

yang membentuk variasi seni bina berasaskan tiga ciri-ciri kebudayaan Minangkabau iaitu adat matrilineal, *kelarasan* atau hukum adat dan persekitaran *luhak* atau wilayah. Walaupun terdapat perbezaan bentuk seni bina, aturan ruang dan persekitaran, namun wujud kesamaan dari segi amalan adat matrilineal di dalam ruang RTNS, pewarisan rumah kepada kaum perempuan dari persukuan dan prinsip pembinaan asas rumah Minangkabau seperti talaan orientasi dan bentuk lentik bumbung.

RUJUKAN

[1] Dixon, R. B. (1951). Migration. In *Encyclopedia of a Social Sciences vol. IX*.

[2] Idrus, Y. (1996). *Rumah Tradisional Negeri Sembilan Satu Analisis Seni Bina Melayu*. Shah Alam: Penerbit Fajar Bakti Sdn. Bhd.

[3] Irwana Omar, S., Salim, N., & Mohamed, B. (2015). Tradisi Merantau Masyarakat Melayu Dahulu dan Sekarang: Suatu Perbandingan. In M. K. A. R. N. Zainun, R. A. Hamid (Ed.), *Kearifan Tempatan: Pengalaman Nusantara: Jilid 1 – Berasal dari Akar* (pp. 28–42). Penerbit Universiti Sains Malaysia.

[4] Ismail, N. H., Surat, M., Raja Shahminan, R. N., & Yunus, S. K. (2014). Identiti Rumah Tradisional Negeri Sembilan Melalui Evolusi Reka Bentuk. *Journal Design and Built*, *7*.

[5] Issac, J. (1947). *Econonics of Migration*. London: Kegan Paul Ltd.

[6] Kato, T. (2005). *Adat Minangkabau Dan Merantau Dalam Perspektif Sejarah*. Jakarta: Balai Pustaka.

[7] Naim, M. (1979). *Merantau: Pola Migrasi Suku Minangkabau*. Gadjah Mada University Press.

[8] Naim, M. (1984). Migrasi Dan Sistem Adat Minangkabau. In *Seminar Kebangsaan Adat Pepatih & Wilayah Budaya Negeri Sembilan*. Serdang: Universiti Pertanian Malaysia.

LEAN CONSTRUCTION TOOLS FRAMEWORK FOR ENHANCEMENT OF CONTRACTOR'S TIME PERFORMANCE

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Abstract. Non-physical waste, which is an avoidable delay in project completion, is a common underlying cause of construction project complexity, especially in developing countries. Construction in Malaysia is no exception, with time overruns and disappointing costs. The use of lean construction (LC) is promoted as a solution to the problem of construction waste. LC is a construction project continuous improvement approach that aids a construction company's growth and profitability. The goal of this research is to establish an LC tools framework that can help contractors save time by eliminating construction waste on the construction site. With a response rate of 37.4 %, a quantitative technique approach was adopted. The findings also revealed how LC tools are critical to an organisation's ability to improve time performance in the occurrence of a construction project's correction, over-processing, and delay. Furthermore, having the LC tools framework can help enhance the time performance of a construction project, which is valuable to LC practitioners. As a consequence, it will be able to contribute to the greening of future construction products.

INTRODUCTION

According to Kupusamy et al. (2019), the construction sector has been quickly evolving in recent years as a result of rising demand for infrastructure projects, changes in consumer behaviour, and population expansion aimed at improving a country's quality of life. Despite these contributions, the construction industry, has a number of difficulties such as poor quality, cost overruns, delays, and construction waste (Ahuja, 2013; Mohd Zain et al., 2018) that must be addressed quickly.

This research concentrates on non-physical construction wastes such as time and cost overruns. According to Yap et al. (2020), in developing countries, avoidable project performance delays are a prevalent underlying cause of construction project complexity. In addition, delays might result in higher construction costs, lost earnings owing to low productivity, and contract termination (Gbahabo and Ajuwon, 2017; Sambasivan et al. 2017; Yap et al., 2020). Furthermore, in the Malaysian construction industry, cost overruns are a major concern (Memon et al., 2019). As a nutshell, resolving these issues is required in order to save a huge amount of money, not only for an organisation but also for the industry.

LC advocates resolving construction wastes, despite the fact that construction participants may adopt waste management systems and management tools. LC can help to make construction more cooperative and conflict-free (Yahya and Mohamad, 2011). LC can also manage and improve construction procedures to meet the client's requirements. In addition, Adamu and Adulhamid (2016) pointed out in their study that this strategy can assist in the reduction of construction waste. Furthermore, according to Cho (2011); Howell and Lichtig (2008); Womack and Jones (2003), LC is

effective at lowering overall costs and cycle times while maintaining quality and improving project performance. As a result, LC is the most appropriate technique for the Malaysian construction industry.

The goal of this research is to develop an LC tools framework for future LC practitioners in Malaysia's construction industry. This research sought to determine the extent of construction waste affecting time performance, to identify the potential of LC tools in reducing construction waste, to analyse the most significant LC tools in reducing construction waste for enhancing time performance, and to develop a framework of LC tools in reducing construction waste for improving time performance in the Malaysian construction industry. The LC tools framework potentially thereby increase the quality of construction projects, resulting in a more promising future for the industry.

LEAN CONSTRUCTION TOOLS FRAMEWORK

The average mean score value for the level of agreement ranged from 3.57 to 4.14, according to the findings. Furthermore, all of the indicators were greater than 3.00, indicating that there was substantial agreement on the LC tools framework. It also implies that the majority of respondents are satisfied with the LC tools assigned for decreasing specific construction waste that affects project's time performance. As a result, it can be argued that the LC tools framework is capable, applicable, and legitimate, as all of the variables have a mean score greater than 3.50.

The outcomes of this research's hypothesis testing were used to create the framework. Construction wastes, LC tools, and time performance are all affected by the LC tools framework, which compromises their correction, over-processing, and delay. Industrialised building system, the 5S process, the five whys, error-proofing, computer-aided tools, just-in-time, supply chain management, standard forms, and value-based management are among the suggested LC tools in the framework. Procurement, management, planning or control, design, supply, and installation are the six focus areas outlined by these LC tools. This LC tools framework has been rated as suitable for the Malaysian construction industry by LC practitioners.

RECOMMENDATIONS FOR FUTURE RESEARCH

This research also opens up new possibilities for future research, particularly on people's skills to investigate LC potentials in order to improve their daily construction operations.

The challenges of implementing LC

It should be investigated further, particularly in the proper and precise LC tools. Although this research presents a framework for LC implementation, it is important to assess the potential barriers. There may be some relevant aspects to examine in order to resolve the issues that have arisen. As a result, all challenges and potential solutions must be considered in future study.

Consideration of new variables

The capabilities of the LC tools framework towards decreasing construction waste construction projects have been emphasised on improving time performance in this study. As a result, future study should incorporate the LC tools with other management tools such as risk management, value management, and building information modelling to maximise the framework's usefulness. Furthermore, to concentrate on many aspects of project performance such as quality, safety, and construction project cost.

REFERENCES

[1] K. Kupusamy *et al.*, "Construction waste estimation analysis in residential projects of Malaysia," *Eng. Technol. Appl. Sci. Res.*, vol. 9, no. 5, pp. 4842–4845, 2019.

[2] R. Ahuja, "Sustainable construction: is lean green?," *ICSDEC Am. Soc. Civ. Eng.*, pp. 903–911, 2013, Accessed: Apr. 04, 2014. [Online]. Available: http://ascelibrary.org/doi/abs/10.1061/9780784412688.108.

[3] A. F. Mohd Zain, M. F. Hasmori, S. Nagapan, A. H. Abdullah, and R. Yunus, "A review of construction management practices in minimizing on-site construction waste," *J. Adv. Res. Dyn. Control Syst.*, vol. 10, no. 6, pp. 9–14, 2018.

[4] J. B. H. Yap, P. L. Goay, Y. B. Woon, and M. Skitmore, "Revisiting critical delay factors for construction: analysing projects in Malaysia," *Alexandria Eng. J.*, 2020, doi: 10.1016/j.aej.2020.11.021.

[5] P. T. Gbahabo and O. S. Ajuwon, "Effects of project cost overruns and schedule delays in Sub-Saharan Africa," *Eur. J. Interdiscip. Stud.*, vol. 3, no. 2, pp. 46–58, 2017, doi: 10.26417/ejis.v3i2.p46-59.

[6] M. Sambasivan, T. J. Deepak, A. N. Salim, and V. Ponniah, "Analysis of delays in Tanzanian construction industry Transaction cost economics (TCE) and structural equation modeling (SEM) approach," *Eng. Constr. Archit. Manag.*, vol. 24, no. 2, pp. 308–325, 2017, doi: 10.1108/ECAM-09-2015-0145.

[7] A. Q. Memon, A. H. Memon, M. A. Soomro, and I. A. Rahman, "Common factors affecting time and cost performance of construction projects in Pakistan," *Pak. J. Sci.*, vol. 71, pp. 64–68, 2019.

[8] M. A. Yahya and M. I. Mohamad, "Review on lean principles for rapid construction," *J. Teknol. (Sains Kejuruteraan)*, vol. 54, pp. 1–11, 2011.

[9] S. Adamu and R. Adulhamid, "Lean Construction Techniques for Transforming Nigeria Project Delivery Process - A Case Study Report," *Indian J. Sci. Technol.*, vol. 9, no. 48, pp. 10–13, 2016, doi: 10.17485/ijst/2016/v9i48/109625.

[10] J. Womack and D. Jones, *Lean thinking - banish waste and create wealth in your corporation*. Free Press, 2003.

[11] S. Cho, "The relation between lean construction and performance in the Korean construction industry," University of California, 2011.

[12] G. Howell and W. Lichtig, "Lean construction opportunities ideas practices," 2008.

CONSTRUCTION COST ESTIMATING INCORPORATING BUILDING INFORMATION MODELLING (BIM) IN THE MALAYSIAN CONSTRUCTION INDUSTRY

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Abstract. Construction cost estimating is one of the main activities performed by Quantity Surveyors. Various factors influence the reliability of a cost estimate, but Quantity Surveyors' understanding and knowledge of project information provide the most vital input towards the accuracy of estimates. While Building Information Modelling (BIM) has been acknowledged as contributing to more efficient and effective construction industry working practices; it also provides a significant advantage in the preparation of cost estimates. The adoption of BIM technology and processes is currently accelerating worldwide. However, compared to other countries, Malaysia has made slower progress, although it has urged Quantity Surveyors to take appropriate actions in evaluating the influence of BIM in the country, especially for their practices. Therefore, the aim of this research is to build a framework to guide the Quantity Surveyors in Malaysia to use BIM to achieve more dependable results in their cost estimating practices. A questionnaire survey was used to explore these and other factors leading towards BIM technology adoption. Structural Equation Modelling (SEM) was applied to examine causal effect relationships between the elements. This study then employed further focus group interviews to better understand the surveyed outcomes. Most of the surveyed respondents observed or forecast better understanding of input information through the use of BIM capabilities, including data visualisation, a reliable database and data coordination. The focus group discussions subsequently validated those factors' interconnections and delineated guidelines for incorporating cost estimating within BIM. The overall analysis contributes to the establishment of a framework of BIM adoption in cost estimating practices in Malaysia. It produces a strategy to promote the BIM innovation endeavour amongst Quantity Surveyors.

RESEARCH BACKGROUND

Cost estimating is one of the main tasks to be performed by Quantity Surveyors in their practices. It becomes part of the crucial responsibilities of Quantity Surveyors as estimators to ensure that proposed construction projects are within the budget set by the clients. A traditional cost estimating process entails using various methods, which are evolved throughout the construction phases, starting from the inception until the completion of a project. Providing a reliable and accurate cost estimate is a very challenging task, as it is not only used as a tender basis but also functions as a reference for future project management. Hence, the right choice of cost estimating methods & improvement to its process and procedure are essential to improve the accuracy of cost estimates. There are numerous factors that affect the accuracy of cost estimates, ranging from project information and its characteristics, project team, clients, contractual matters, and also other external influences. Those relevant factors will be significantly considered by Quantity Surveyors before they start estimating the project costs to obtain clients' optimum satisfaction towards their profit.

Building Information Modelling (BIM) as a strategy is gaining increasing attention in the Architecture, Engineering and the Construction (AEC) fields. It is emerging as a prerequisite for many projects and is increasingly demanded by clients. While conventional practices are still poorly integrated, the implications of BIM to the construction industry are significant (Olatunji, 2011). BIM had its origins in the 1970s, was developed in the 1980s-90s, and today increasingly functions to produce data-rich models of buildings and structures for information exchange between stakeholders (Egbu & Coates, 2012; Wong et al., 2011). The application of BIM in construction can make the industry more efficient, effective, flexible and innovative (Takim et al., 2013; Sebastian & van Berlo, 2010) and is believed to reduce many building industry problems (Jensen & Jóhannesson, 2013). Additionally, BIM has the potential to restructure the quantity surveying profession (Olatunji et al., 2010). due to its capability in generating automated take-offs and measurements from the model (Lee et al., 2013; Cho et al., 2011). BIM technology that allows semi-automated measurements and cost estimates from the models has offered new skills and knowledge to the QS profession, in advising the project team (RICS, 2014).

USA, Finland, Denmark, Norway, Netherlands, UK, Australia, Hong Kong & Singapore are among the countries heading towards BIM. Malaysia, where the growth of BIM has been driven mainly by the private sector since 2009 (CIDB, 2014), has made slow progress in developing BIM systems (Quek, 2012); the level of implementation falling on 0 and 1 scale of the BIM UK maturity model (Zahrizan et al., 2013), indicates the need for a solution to these issues. The Malaysian government proposed to implement BIM for their construction projects in 2016 (CIDB, 2013). Thereby CIDB, as the professional body that has been given the mandate for managing BIM uptake in Malaysia, has urged BIM implementation amongst the construction players in their practice to produce more effective construction projects (CIDB, 2013; Bernama, 2014). Subsequently, in September 2015, CIDB in collaboration with the Ministry of Works Malaysia released the Construction Industry Transformation Programme (CITP) 2016-2020 to promote the adoption of BIM technology to improve the productivity of the Malaysian construction industry (CIDB, 2015).

This research aims to build a framework to guide the Quantity Surveyors in Malaysia to use BIM to achieve more dependable results in their cost estimating practices. The objectives of this research include identifying the factors that influence cost estimating practice and investigating the potential BIM drivers that lead to more accurate cost estimates amongst Malaysian Quantity Surveyors. This research will also analyse the significant relationships between the cost-estimating factors and BIM drivers in promoting better accuracy for construction cost estimates. Overall, this research will establish a framework to provide guidelines towards cost-estimating practice, incorporating BIM in the Malaysian construction industry.

RESEARCH METHODOLOGY

The type of sequential explanatory design of mixed method was utilised for the research. It started with the data collected quantitatively using a questionnaire survey. A set of closed-ended questionnaires was prepared based on the information gathered from the previous literature review and expert interviews. The drafted questionnaire was then pre-tested before distributing to the actual respondents to check for its clarity so that any potential problems could be identified and eliminated. The final questionnaire after a few series of pre-testing was then released to the sampled respondents. This questionnaire survey was conducted for this research to determine the current BIM practice amongst the respondents and also to investigate the effects of BIM on the reliability of their cost estimates, which leads towards the adoption of the technology. Subsequently, an SEM model produced from the survey results was then translated into an appropriate framework and

verified through focus group discussions. The focus group interviews were attended by both BIM and non-BIM users in separate sessions, to discuss further the relationships and dependencies between the factors shown in the framework. Based on the final findings, an appropriate strategy for implementing BIM in the quantity surveying practice pertaining to the reliability of cost estimates was then formulated as a guideline.

RESEARCH FINDINGS AND CONCLUSION

Figure 1 ultimately illustrates the whole findings derived from the analysis, hence generates the final framework for the research. The validated findings discussed the BIM capability impacts of data visualisation, reliable database and data coordination towards the reliability of cost estimates concerning the input information, understanding and knowledge. In contributing towards the reliability of cost estimates, it has been highlighted that the use of data visualisation and coordinated data could improve understanding of project input information by Quantity Surveyors as cost estimators. However, it builds upon the human effort to develop and manipulate the details in the model to produce high-quality information and perform a better assessment towards the project costs. The use of a reliable database and coordinated data indeed promote a better understanding in preparing cost estimates, particularly for the non-experienced estimators amongst the Quantity Surveyors. Yet, understanding the traditional method of measurement is crucial before using the 3D model to assist Quantity Surveyors in taking off the quantities for the building measurement purpose. The data visualisation and coordination from the BIM model could improve the knowledge of estimating process provided that Quantity Surveyors adapt both skills of traditional measurement and the ability to use the technology.
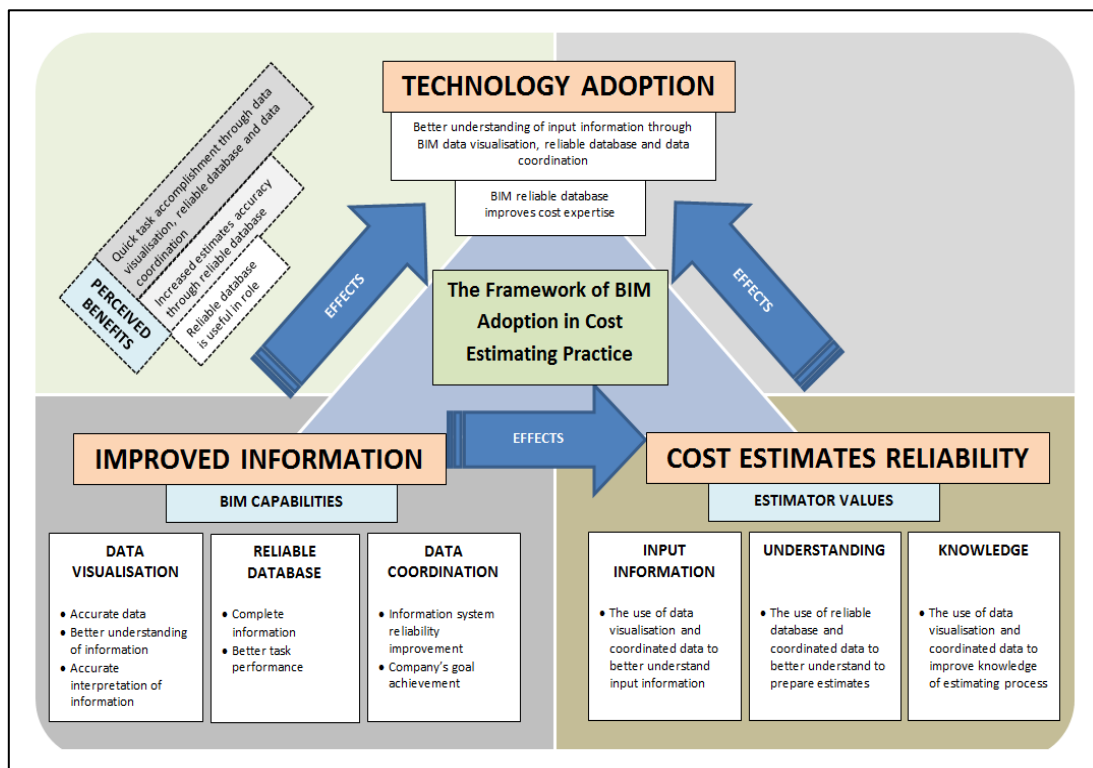

Figure 1: Framework of BIM adoption in cost estimating practice

REFERENCES

[1]   Bernama. (2014, September 23). Adopt BIM technology, CIDB urges industry players. Daily
          Express. Kuala Lumpur.
[2]   Cho, J. H., Son, B. S., & Chun, J. Y. (2011). Application of OLAP information model to parametric
          cost estimate and BIM. Journal of Asian Architecture and Building Engineering,
          (November), 319–326.
[3]   CIDB. (2013). BIM in Malaysia. Retrieved January 1, 2014, from www.bimcenter.com.my
[4]   CIDB. (2014). Issues and challenges in implementating BIM for SME's in the construction
          industry. Kuala Lumpur.
[5]   CIDB. (2015). Construction Industry Transformation Programme (CITP) 2016-2020. Kuala
          Lumpur: Construction Industry Development Board (CIDB) Malaysia.
[6]   Egbu, C., & Coates, P. (2012). Building Information Modelling (BIM) implementation and
          remote construction projects: Issues, challenges and critiques. Journal of Information
          Technology in Construction, 17(May), 75–92.
[7]   Jensen, P. A., & Jóhannesson, E. I. (2013). Building information modelling in Denmark and
          Iceland. Engineering, Construction and Architectural Management, 20(1), 99–110.
[8]   Lee, S., Kim, K., & Yu, J. (2013). BIM and ontology-based approach for building cost estimation.
          Automation in Construction.
[9]   Olatunji, O. A. (2011). Modelling organizations' structural adjustment to BIM adoption: a pilot
          study on estimating organizations. Journal of Information Technology in Construction
          (ITcon), 16, 653–668.
[10]   Olatunji, O. A., Sher, W., & Gu, N. (2010). Building Information Modeling and quantity surveying
          practice. Emirates Journal for Engineering Research, 15(1), 67–70.
[11]   Quek, J. K. (2012). Strategies and frameworks for adopting Building Information Modelling
          (BIM) for Quantity Surveyors. Applied Mechanics and Materials, 174-177, 3404–3419.
[12]   RICS. (2014). Overview of a 5D BIM project : RICS information paper, UK 1st edition.
[13]   Sebastian, R., & van Berlo, L. (2010). Tool for benchmarking BIM performance of design,
          engineering and construction firms in the Netherlands. Architectural Engineering and
          Design Management, 6(4), 254–263.
[14]   Takim, R., Harris, M., & Nawawi, A. H. (2013). Building Information Modeling (BIM): A new
          paradigm for quality of life within Architectural, Engineering and Construction (AEC)
          industry. Procedia - Social and Behavioral Sciences, 101, 23–32.
[15]   Wong, A. K. D., Wong, F. K. W., & Nadeem, A. (2011). Government roles in implementing
          building information modelling systems: Comparison between Hong Kong and the United
          States. Construction Innovation: Information, Process, Management, 11(1), 61–76.
[16]   Zahrizan, Z., Ali, N. M., Haron, A. T., Marshall-ponting, A., & Abd, Z. (2013). Exploring the
          adoption of Building Information Modelling (BIM) in the Malaysian construction industry: A
          qualitative approach. IJRET: International Journal of Research in Engineering and
          Technology, 2(8), 384–395.

AN IMPROVED PROJECT MANAGEMENT FOR INTERIOR DESIGN PRACTICE

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Abstract. The abilities of interior designers overseeing construction projects, particularly in thearea of project management, have been brought into question on multiple times. Central to this argument is the claim that the interior designer competencies, which was developed through education and practice tend to be very biased on design skills and knowledge at the expanse of project management. The purpose of this study was to determine the extent to which project management is overlooked in interior design education and practice. A mixed method research method was employed for the research. A quantitative research method with seventy-eight respondents was first adopted to establish the validity and extent to which project management was lacking in interior design practice. This was followed with a qualitative research method toidentify precisely where the gap in project management education and interior design practice exists. To identify the gaps, fourteen key respondents were selected for interviews during the data collection. This was triangulated with content analysis method, which critically analyses theinterior design syllabus offered by four leading local higher institutions. Activities undertaken by the interior design professional associations were also analysed. The findings found significant gaps in learning project management in the interior design higher education and interior design practice. The most important solutions to bridge the gaps is to improve the projectmanagement competencies of interior designers through education and practice were identified and suggested.

Keywords: project management, interior design practice

INTRODUCTION AND BACKGROUND OF RESEARCH

The job of a professional Interior design is to turn interior spaces into effective and useful setting for human activities. Interior designers are required to be competent in developing the project throughout the project lifecycle, from the conceptual stage to the project handover stage. It is crucial that every creative design must adhere to the law, codes and regulatory requirement and promote the value of sustainability. They must have the ability to balance the creativity of the design and the practical execution. This necessitates them to also be competent in project management.

Rogers (2001) in Interior Design Handbook of Professional Practice stated that design professionals need to also be good managers. They are required to employ leadership skills, management skills, professional and industry knowledge and practical experience. The importance for Interior designer to be competent in project management was also noted from CIDA (2009). In their Professional Standards 2009 by Council of Interior Design Association (CIDA) in USA highlighted the importance of project management to be included in interior design education

programs. International Federation of Interior Designers (IFI), which is the association for interior design in the Commonwealth countries, in their IFI Professional Practice (2005) related to the design of interior design education in higher education statesthat competencies in verbal communication techniques, office organization and practice, legislation andvisiting projects in the course of being made or built in the minimum standard of interior design education. NCIDQ (1990) document states that interior designers shall include of provision of project management services. This covers preparation of project budgets and schedules, coordination and collaboration with other allied design professionals who may be retained to provide consulting services.In addition to that, the Professional Interior Design book of knowledge by Guerin and Martin (2010), under Group B.3: Professional Practice also states that project management is one of the knowledge areas in interior design practice.

Within the current circumstances when professions in the built environment are evolving with changein procurement systems and new technology, much more appears in need to be done to reassess the validity of the claim that Malaysian interior designers are not adequately prepared with the required project management knowledge and skills to be competent in their project. This research suggests that this is a critical subject that needs to be investigated to support the development of sustainable interior design professionals. In summary, the culminating literature reviews emerge to suggest that the lack ofproject management competency in interior design profession is contributed by:

i.   Inadequate project management learning in ID education program and;
ii.   Lack of emphasis on project management skills and knowledge in ID professional development programs.

The goal of this research is to make a significant contribution to research relating to the project management knowledge and skills of interior design project managers by offering an improved framework based on the current education and professional practice.

THE ESTABLISHMENT OF RESEARCH PROBLEM

This research study involved collecting and analyzing both quantitative and qualitative data, a mixedmethod approach was needed to address the research questions. mixed method design is applied byembedding quantitative secondary data into a larger qualitative primary data. By this method, this studygathered quantitative data from questionnaire surveys in order to have a clear picture regarding the issuesin the industry by the practitioners embedded with qualitative data from interviews and content analysis to describe the issues in detail. The results will provide the evaluation from both analysis and outcome.The collection of interrelated concepts was first developed by determining the effects drawn from the literature review followed by the investigation done. From the findings, a statistical relationship willoccur to measure the concepts and definitions as the theoretical framework is crucial in exploratory studies. It was conceptualized that within the interior design industry scenario, the interest in project management education and training is greatly lacking. Drawing from that, 2 key propositions emerge to propose the justifications for the phenomenon as follows:

iii.   The current interior design education programs in higher institutions tend to lack emphasis in learning of project management subject.
iv.   The current provision within the interior design professional practice is limited in promoting and training interior designers to skills and knowledge of project management.

It was visualized that these 'insufficiencies' or 'deficiencies' are significantly lacking project management competency in interior design education and professional practice provision. This was demonstrated by:

i. Inability to produce an interior design project manager with the correct skills and knowledgeto manage interior project together with other consultants.

ii. Incapability of training seminars and workshops provided to complement interior design education programs as well as professional provisions in order to produce a knowledgeableand professional interior designer.

iii. The small number of interior designers with project management qualification who are trained to manage interior projects.

iv. The inability of the framework to support better career opportunities for interior design project managers which resulted in a small number of qualified and trained interior design project managers within the industry.

THE DEVELOPMENT OF KNOWLEDGE AND SKILLS OF PROJECT MANAGEMENT FOR INTERIOR DESIGN PRACTICE

On the provision that better understands project management during education and professional practice, the new knowledge and skill training would improve the current education and professional practiceprovisions. It is crucial that this establishment is achieved.
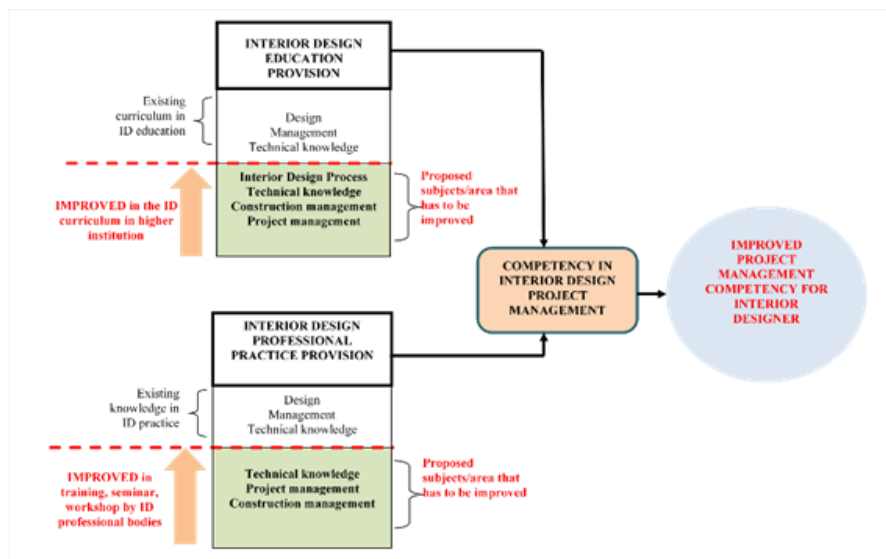

Figure 1: The research model to establish the improved competency for interior designer

The deficient of project management understanding among interior designer can be improved by developing the knowledge within the curriculum in the university level and development of skill duringprofessional practice.

The findings support the validity of the proposition that the deficient of project management amonginterior designer can be improved. The approaches proposition is by establish the curriculum within theinterior design education program on the important issues as follow:

A. Learning in Project management
  1) Develop the awareness of importance of Project management
  2) Enlighten the roles and responsibility of interior designer

3) Expand the knowledge of new product and material
4) Establish the project work progress for interior project
5) Introduce the collaboration system in the interior design scope of work
6) Setting up the Interior design handbook
7) Introduce the communication skill within stakeholder
8) Increase the Law of contract awareness
9) Expand the Contract management knowledge

B. Learning in Technical aspect of construction
1) Develop the understanding of BOMBA and safety requirement and local authority approval.
2) Introduce the concept of Green Building and awareness of the material suits to the GBI concept.
3) Increase and expand the understanding and knowledge of M&E and C&S.

The poor of project management understanding among interior designer can be supported by expanding the knowledge within the professional practice and professional bodies.

A. Promote the knowledge and understanding of Project management through training, seminar or workshop by interior design professional bodies
1) The appropriate of Interior design practice
2) Increase the knowledge for effective Project management within coordination and integration system, tender document process, contract document process, work schedule and project documentation.
3) Reboost the knowledge for the efficiency of Project manager including leadership skill, communication skill, motivation skill and teamwork skill.
4) Expand the knowledge and understanding of roles and responsible on construction site.
5) Increase the understanding of Project objectives.
6) Increase the responsibity in Project implementation.
7) Increase the knowledge of understanding in Project execution.

B. Promote the knowledge and awareness of technical aspect of construction through training, seminaror workshop by interior design professional bodies.
1) Increase the understanding and knowledge of M&E and C&S .
2) Expand the understanding and knowledge structural works, engineering structural works, architectural works, piling system, soil and investigation and project suitability and constructability.
3) Increase the understanding of BOMBA and safety requirement.
4) Reboost the knowledge and awareness of Law and Arbitration, Local authority approval requirements, Malaysia building by-law and Malaysia Act regarding OKU.
5) Expand the knowledge of Green Building concept including the material that suits to the GBI concept.

CONCLUSION

In conclusion, the research study visualizes that interior design industry need urgently the knowledge ofproject management followed by the training. For that reason, it is important for interior designer to change the paradigm of their profession is no longer regarding design and concept but the implementation process is more crucial to a project. Therefore, any provision and proposal designed forpromote the development their knowledge and skills should fundamentally focus on creating and encourage the 'environment' that support in nourishing the understanding towards the importance of project management application. To improve the project management understanding among interior designers, a significant effort needed to expand in developing its

knowledge to face the challenge in difficulty managing interior projects.

REFERENCES

[1]   Council of Interior Designers Association, (2009). Available at: www.cida.org
[2]   Guerin, D. A. & Martin, C. S. (2010), The State of the Interior Design Profession, University of Michigan, New York, USA
[3]   International Federation of Interior Architects/Designers, (1963). available at: www.ifiworld.org
[4]   National Council for Interior Design Qualification, (1990). available at: www.ncidq.org
[5]   Rogers, K. (2001). cited in Interior Design Handbook of Professional Practice, McGraw Hill

THE PERFORMANCE OF MALAYSIAN LISTED PROPERTY COMPANIES

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Abstract. The Malaysian listed property companies (MLPCs) playing are significant role in theMalaysian economic country. Property has proved to be a hedging against inflation as well as financial crises. Consequently, it is important to analyse the performance of MLPCs in a mixedasset portfolio. The research aim is to analyse the performance of MLPCs to provide strategic investment allocation. This study used price indices for all asset classes. The findings have revealed that MLPCs have low performance. Therefore, MLPCs need to revolutionize to become more competitive compared to other assets. This study provided useful information for LPCs players for making more informed investment decision, while understand the current implication.

THE PERFORMANCE OF MALAYSIAN LISTED PROPERTY COMPANIES IN A MIXED ASSET PORTFOLIO

Research on the empirical analysis of listed property companies (LPCs) in a mixed asset portfolio are important for investment strategies. The strategies can be used by investors, academician as well as policy maker. It is significant to study the performance of LPCs because by identifying the historical performance and volatility (risk) it can be beneficial in the future. Nature of MLPCs are now penetratingthe global, even local market make it very important in shaping the future of the real estate sector. The performance of LPCs analyse in a mixed asset portfolio. Mixed asset portfolio includes other asset classes such as shares, bonds, finance, industrials, plantations and REITs (Hoesli et al., 2004; Liow, 2010; Liow and Sim, 2006; Ooi and Liow, 2004; Rehring, 2012; Rozman et. al. 2015, Rozman et. al. 2016 and Azmi et. al (2018). The more the total assets classes in a mixed asset portfolio could enhancethe risk reduction by diversify the overall assets (Markowitz, 1952).

According to the gap found from previous research, thus this research covers a broader scope than previous studies in terms of period and number of countries (Liow 2008; Liow & Adair 2009; Liow et al. 2009, 2011; Liow & Sim 2006; Nguyen 2011; Ting 2002). Thus, this research also expands the number of assets classes and extends the period in the analysis. Thus, this research delivered a profile of a Malaysian property market from the local investors' point of view for 20 years period from 1994 to2014.

The findings from this study suggest that Malaysian investors that interested in high risk portfolio investment could consider MLPCs in one of their investment portfolios. Generally, MLPCs is not a stable asset because its performance changing from time to time. Other asset classes that work well withMLPCs are shares, bonds and plantations because it showed some significance to form a mixed asset portfolio. However, investors that plan to invest in plantations together with MLPCs should take extra precautions due to same characteristic of shares pricing. Nevertheless, investors could avoid investing MLPCs together with industrial, finance and REITs because that investment portfolio could give loss.

RECOMMENDATIONS FOR FUTURE RESEARCH

Recommendations for future research can be considered to extend this empirical research.

Methodology

This research measured the performance of listed property companies using past performance. However, in recent years, several studies have continued the methodology to measure the performance level by forecasting future performance. It would be better if the analysis were extended until the forecasting analysis. Therefore, the performance of the asset classes can be forecast for the future rather than merely acknowledging past performance. The forecasting analysis can be suggested for a period of 25 days ahead.

Macroeconomic factors

Next is additional variables in a mixed asset portfolio. This research was analysed for microeconomics factors to study the behavior of the individual asset class and decision making regarding the allocation of investment. This would enable the best property portfolio with better returns and risk reduction. However, the research can also be performed in the future by identifying macroeconomic factors. Accordingly, it is necessary to determine the factors that influence the asset classes' return either by inflation, unemployment rates, taxation level, growth development product and national economic policies respectively. The return, risk or performance of the asset are somewhat influenced by macroeconomic factors or national economic policies. This is because a property player will tend to invest in properties that have less of a taxation burden (as an example). Future research can be carried out based on how far the influence of macroeconomic factors towards MLPCs performance. Once the research has been carried out for towards microeconomic and macroeconomic factors, decisions regarding the investment portfolio will be much easier to make.

New Variables considerations

This empirical research can be used to extend Malaysian literature knowledge by adding new asset class in the study. Recently new asset was introduced such as Islamic bonds, sukuk and green Sukuk. Therefore, combination of this new asset classes can extend the literature knowledge for Malaysian investment market.

REFERENCES

[1] Hoesli, M., Lekander, J., & Witkiewicz, W. (2004). International Evidence on Real Estate as aPortfolio Diversifier. *Journal of Real Estate Research*, 26(2), 1–46.

[2] Hoesli, M., Lekander, J., & Witkiewicz, W. (2004). International Evidence on Real Estate as aPortfolio Diversifier. *Journal of Real Estate Research*, 26(2), 1–46

[3] Liow, K. H., & Sim, M. C. (2006). The Risk and Return Profile of Asian Real Estate Stocks. Pacific Rim Property Research Journal, 12(3), 283–310.

[4] Liow, K. H. (2010). Integration between Securitized Real Estate and Stock Markets : A Global Perspective. *Journal of Real Estate Portfolio Management*, 16(3), 249–265.

[5] Liow, K. H., & Sim, M. C. (2006). The Risk and Return Profile of Asian Real Estate Stocks. *Pacific Rim Property Research Journal*, 12(3), 283–310.

[6] Liow, K. H. (2008). Financial Crisis and Asian Real Estate Securities Market Interdependence: Some Additional Evidence. *Journal of Property Research*, 25(2), 127–155. http://doi.org/10.1080/09599910802605400

[7] Liow, K. H., & Adair, A. (2009). Do Asian real estate companies add value to investment portfolio? *Journal of Property Investment & Finance*, 27(1), 42–64.

http://doi.org/10.1108/14635780910926667

[8]   Liow, k. H. (2011). The dynamics of the singapore commercial property market. 255 *Journal of property research*, 17(4), 279–291. Http://doi.org/10.1080/09599910010001402

[9]   Markowitz, H. (1952). Portfolio selection. *Journal Of Finance*, 7(1), 77–91. http://doi.org/10.1111/j.1540-6261.1952.tb01525.x

[10]   Nguyen, T. K. (2011). The Signigficance and Performance of Listed Property Companies in the Philippines. *Pacific Rim Property Research Journal*, 17(2), 260–286.

[11]   Ooi, J. T. L., & Liow, K. (2004). Risk-adjusted performance of real estate stocks evidence from developing markets. *Journal of Real Estate Research*, 26, 371–395.

[12]   Rehring, C. (2012). Real estate in a mixed asset portfolio: The role of the investment horizon. *Journal ofReal Estate Economics*, 40(1), 65–95. http://doi.org/10.1111/j.1540-6229.2011.00306.x

[13]   Rozman, A. T., Azmi, N. A., Mohd. Ali, H. M., & Mohamed Razali, M. N. (2015). The performance and significance of Islamic REITs in a mixed-asset portfolio. *Jurnal* Teknologi, 77(26), 1–9. http://doi.org/10.11113/jt.v77.6850

[14]   Rozman, A. T., Razali, M. N., Azmi, N. A., & Ali, H. M. (2016). The dynamic of linkages of Islamic REITs in mixed-asset portfolios in Malaysia. *Pacific Rim Property Research Journal*,22(3), 245–265. http://doi.org/10.1080/14445921.2016.1235758

[15]   Ting, K. H. (2002). Listed property companies in Malaysia: A comparative performance analysis. *Seventh Annual Pacific Rim Real Estate Society Conference*.

ADAPTIVE OUTDOOR THERMAL COMFORT IN HOT AND HUMID CLIMATE OF URBAN PARK IN MALAYSIA

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Abstract. Thermal comfort has become a vital issue in the built environment since concerns on climate change have attracted significant attention recently. The broad aims of this study are to establish an adaptive outdoor thermal comfort model according to users' behavioural patterns and physical conditions of urban recreational parks in Malaysia. This study is carried out to satisfy the following objectives; to assess the outdoor thermal comfort level for microclimate conditions in the Shah Alam Lake Garden; to determine an improved adaptive outdoor thermal comfort model based on hot and humid climate conditions; to analyse the behavioural patterns of urban recreational parks users as affected by the climate conditions; and, to simulate the physical conditions and materials that promote better outdoor conditions at the Shah Alam Lake Garden. The study would be extended to the people's responses to "thermal discomfort". The outcomes of this study determine to distinguish findings from the existing thermal comfort indices that have been developed for a temperate climate. The findings show that the perception of the urban park users in Malaysia is uniform. Moreover, people in Malaysia are adapted to the microclimate condition as they agreed that the microclimate condition is comfortable at the most time. As a final point of the objectives of this study, the study has investigated the physical conditions and materials that promote the better outdoor condition by using the simulations method. The study highlights how adaptive outdoor thermal comfort is implemented by the park user in Shah Alam.

Keyword: Thermal Comfort; Hot and Humid Climate; Urban Park

INTRODUCTION

Thermal comfort is defined as "the state of mind that expresses satisfaction with the surrounding environment" (ANSI/ASHRAE Standard 55, 2004), and this must be made aware to parks designers. As defined by British Standard BS EN ISO 7730, thermal comfort is "that condition of mind which expresses satisfaction with the thermal environment" (ISO7730:2005), which demonstrates that thermal comfort also addresses the physiological and psychological aspects of space users. Thermal comfort can be expressed using terms such as "warm", "hot", "cold", "neutral", "comfortable", and can also be overstressed using expressions like "very"," slightly" or "extremely".

Thermal comfort and heat stress studies related to outdoor activities must be better considered when designing green spaces or urban parks. For this reason, the physiological and psychological impacts must be considered when designing green spaces. All the studies mentioned earlier have shown the importance of sustainable and comfortable outdoor spaces. Thermal comfort, when related to climate and weather becomes a motivation of individual well-being (Mansor, Said, & Mohamad, 2010). Designers should emphasis on the ergonomic aspects of outdoor spatial design as

park users look at the weather as a factor to do activities. Open spaces or urban parks provide the public with the ideal settings to rejuvenate.

ADAPTIVE OUTDOOR THERMAL COMFORT IN AN URBAN PARK OF MALAYSIA

A review of numerous studies on adaptation (Brager & de Dear, 1998; Ebi, Burton, McGregor, Jendritzky, & de Dear, 2009; Kwok & Rajkovich, 2010; Mahoney & Bergman, 2002) proved that respondents consciously or unconsciously do show adaptation behaviours. The behaviour may be an individual response, adaptive cultural actions, and practices. The actions are usually influenced by the environment, socioeconomic or physical settings. The level of control a person has over the surrounding environment. In the current standard predictive model (Gagge, Fobelets, & Berglund, 1986; Lin, de Dear & Hwang, 2011; Schiavon & Lee, 2013), there are six inputs; air temperature (T_a), relative humidity (RH), mean radiant temperature (T_{mrt}), wind velocity, metabolic rate, and clothing insulations (I_{cl}) included as factors of behavioural adaptation. The clothing insulation (I_{cl}) might increase if one puts on a blanket, while ambient air temperature (T_a), might decrease when changing rooms. Adaptive behaviour is accounted for as an act of psychological effect, not a physiological or physical effect (Park, Furuya, Kasetani, Takayama, Kagawa, & Miyazaki, 2011).

Thermal Sensation Vote (TSV) and Physiological Equivalent Temperature (PET)

From this study, the researcher may suggest that the park users enjoyed the time they spent at the park regardless of what they wore, did, and perceived. Thermal sensation showed proof of this, even when the PET results showed the other way around (Figure 1).
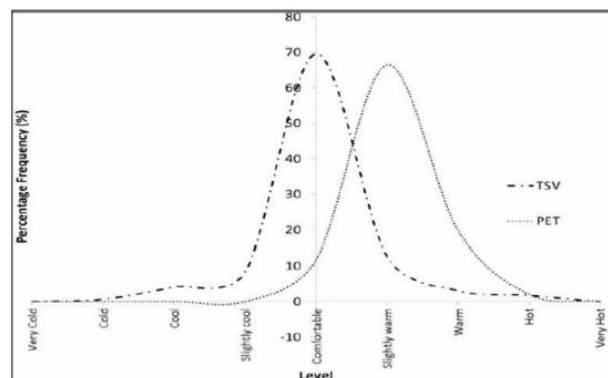

Figure 1. Comparison between Thermal Sensation Votes (TSV) and Physiological Equivalent Temperature (PET)

The PET level as compared with (Thorsson, Honjo, Lindberg, Eliasson, En-Mi, & Lim, 2007) shows that Malaysian adapted to the condition in the warmer range. This study approach allows for the conception of adaptive behaviour to represent behavioural responses to hot-humid sensations with regards to the physical, and psychology parameters by previous research (Ali-Toudert, Djenane, Bensalem, Fazia, Moussadek, Rafik, & Helmut, 2005; Goto, Toftum, de Dear & Fanger, 2006; Juutinen, Mitani, Mäntymaa, Shoji, Siikamäki, & Svento, 2011; Knez, 2005; Knez et al., 2009). These findings may in the future be incorporated into an adaptive predictive approach (Lin, 2009) or as part of feedback where the previous state of thermal comfort has already been revised as in indoor condition for by current adaptive behaviours to form the future state of outdoor thermal comfort by ASHRAE (ANSI/ASHRAE Standard 55, 2004). Respondents' responses to outdoor thermal comfort were compared, with results showing a marked difference between the respondents. Therefore, this research showed how is the importance of adaptation in outdoor hot and humid conditions. For instance, participants ignored the diversity in thermal conditions by staying longer in the park and finding the temperature comfortable. The action may be identified as a form of adaptation.

The Mean Thermal Sensation Vote (MTSV)

The respondents were requested to express their thermal sensation opinions according to a 9-point scale. The data were then compared with those estimated by the PET index. Most of the respondents expressed their sensations as at "the comfortable level".
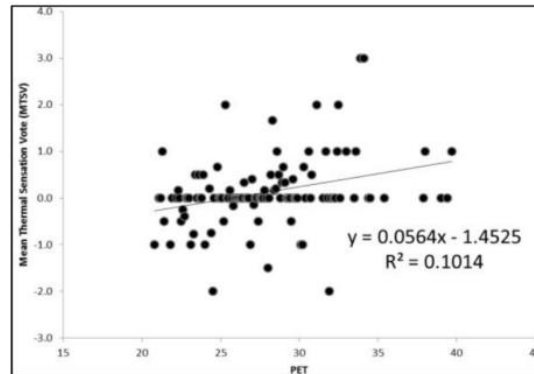

Figure 2. Mean Thermal Sensation Vote (MTSV)

The Mean Thermal Sensation Vote (MTSV), R square (R^2) value was 0.1014. The result is contradicted from previous studies done by (Ali-Toudert et al., 2005; Onomura, Grimmond, Lindberg, Holmer, & Thorsson, 2015; Thorsson, Lindqvist, & Lindqvist, 2004). In the previous studies, MTSV linear regression R^2 value ranges between 0.7-0.8. The low value of R^2 should not evade being discussed. The analysis derived from the TSV indicated that the respondents voted the perceived sensation by their feelings. It shows that the respondents adapted to the conditions. They voted "Comfortable" even the conditions classified as "Hot".

The behavioural patterns of urban recreational park users as affected by the climate conditions

The physical activities of park users Sitting was most of the respondents' activity before the interview session. Sitting also happened to be the most popular activity at the park throughout the day. Jogging and running were done during the early morning and late afternoon. Perhaps the respondents preferred to jog and run when the air temperature was not at its peak. Walking is an activity that occurs throughout the day.

There are correlations between the time of the day (hours), activity and Heat Index (HI). There is a significant association between time and activity, r = -0.291, p < 0.001 and between Heat Index and activity, r = 0.302, p < 0.001. The result seems to represent the fact that respondents were at ease, which correlates with the period they were doing the activity and the condition of Heat Stress.

There is no significant link between time spent at the park and the respondents' sensation. The finding seems to represent the fact that the respondents' comfort is not related to the period they were active at the park. Based on this odd ratio, the time when the respondents felt comfortable did not correlate with the time spent in the park. The perception determines that the respondents could be feeling comfortable during the middle of the day when it is hotter.

Among the respondents, most of the respondents were under shaded areas. The respondents chose the area that they felt "Comfortable" staying for an extended period. So, the shaded area plays a major role in providing comfort even when the air temperature is high.

The clothing value was between 0.30 and 1.50 clo which is quite high for temperate climates. The average value of clothing was 0.6261 clo, which is considered high. For instance, 0.6 clo means that the respondent is dressed in a hijab and *baju kurung* for female, and t-shirt and long pants for a male.

The physical conditions and materials which promote better outdoor conditions

The settings that are optimised and guaranteed as 'comfortable' were simulated. Three different scenarios developed in this study used to estimate the optimised settings. The finding to prove that the microclimate condition offers a better condition is by comparing the local and microclimate air temperature. Most of the time during the day of data acquisition, the microclimate has a lower air temperature by 2-4 °C compared to the local environment.

Lower humidity at shaded areas and additional trees for extra ventilation, while the 'extra trees' scenario showed the lowest temperature (24.0-29.9 °C) and humidity (76.0-86.9%) and higher wind speed (1.9 – 2.1 ms^{-1}) especially in the afternoon, the 'ground cover' scenario showed vice versa. This trend supports the theory that when shading provided by denser vegetation and mature plants are established in an area, the microclimate condition improves the comfort state of thermal comfort conditions (Leuzinger, Vogt, & Körner, 2010; Mochida & Lun, 2008; Williams, Hunter & Waechter, 1990). The simulation data show that the cooling effect is significantly governed by the "extra trees" scenario.

SUMMARY

This study offers to fill the gap in the knowledge on thermal comfort in hot and humid tropical regions. Moreover, this study tries out new and rarely applied indices Universal Thermal Comfort Index (UTCI) and Heat Stress Index (HSI) instead of widely used indices Physiological Equivalent Temperature (PET) and Outdoor Thermal Comfort Index (Out_SET). This study is aimed to develop a baseline for the adaptation of hot and humid thermal comfort in urban parks in Malaysia. This study discusses the conclusions of the relationship, differences, and analysis on the statistics of adaptive outdoor thermal comfort in an urban park.

REFERENCES

[1] Ali-Toudert, F., Djenane, M., Bensalem, R., Fazia, A.-T., Moussadek, D., Rafik, B., & Helmut, M. (2005). Outdoor thermal comfort in the old desert city of Beni-Isguen, Algeria . Climate Research, 28(3), 243–256. https://doi.org/10.3354/cr028243

[2] ANSI/ASHRAE Standard 55, Thermal Environmental Conditions for Human Occupancy (2004). Atlanta: American Society of Heating, Refrigerating, and Air- 218 Conditioning Engineers.

[3] Brager, G. S., & de Dear, R. J. (1998). Thermal adaptation in the built environment: a literature review. Energy and Buildings, 27(1), 83–96.

[4] Ebi, K. L., Burton, I., McGregor, G. R., Jendritzky, G., & Dear, R. (2009). Adaptation and Thermal Environment. In G. R. McGregor (Ed.), Biometeorology for Adaptation to Climate Variability and Change (Vol. 1, pp. 9–32). Springer Netherlands.https://doi.org/10.1007/978-1-4020-8921-32

[5] Gagge, A. P., Fobelets, A. P., & Berglund, L. G. (1986). Standard Predictive Index Of Human Response to The Thermal Environment (pt 2B, Vol. 92, pp. 709–731). Portland, OR, USA: ASHRAE.

[6] Goto, T., Toftum, J., de Dear, R., & Fanger, P. (2006). Thermal sensation and thermophysiological responses to metabolic step-changes. International Journal of Biometeorology, 50(5), 323–332. https://doi.org/10.1007/s00484-005-0016-5

[7] ISO7730:2005 Ergonomics of the thermal environment - Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria. (2005).

[8] Juutinen, A., Mitani, Y., Mäntymaa, E., Shoji, Y., Siikamäki, P., & Svento, R. (2011). Combining ecological and recreational aspects in national park management: A choice experiment

application. Ecological Economics, 70(6), 1231–1239. https://doi.org/10.1016/j.ecolecon.2011.02.006

[9] Knez, I. (2005). Attachment and identity as related to a place and its perceived climate. Journal of Environmental Psychology, 25(2), 207–218.

[10] Knez, I., Thorsson, S., Eliasson, I., & Lindberg, F. (2009). Psychological mechanisms 235 in outdoor place and weather assessment: towards a conceptual model. International Journal of Biometeorology, 53(1), 101–111. https://doi.org/10.1007/s00484-008-0194-z

[11] Kwok, A. G., & Rajkovich, N. B. (2010). Addressing climate change in comfort standards. Building and Environment, 45(1), 18–22. 236 https://doi.org/10.1016/j.buildenv.2009.02.005

[12] Leuzinger, S., Vogt, R., & Körner, C. (2010). Tree surface temperature in an urban environment. Agricultural and Forest Meteorology, 150(1), 56–62.

[13] Lin, T.-P. (2009). Thermal perception, adaptation and attendance in a public square in hot and humid regions. Building and Environment, 44(10), 2017–2026.

[14] Lin, T.-P., de Dear, R. and Hwang, R.-L. (2011), Effect of thermal adaptation on seasonal outdoor thermal comfort. Int. J. Climatol., 31: 302-312. https://doi.org/10.1002/joc.2120

[15] Mahoney, J. L., & Bergman, L. R. (2002). Conceptual and methodological considerations in a developmental approach to the study of positive adaptation. Journal of Applied Developmental Psychology, 23(2), 195–217.

[16] Mansor, M., Said, I., & Mohamad, I. (2010). Experiential contacts with green infrastructure's diversity and well-being of urban community. ajE-Bs, *Asian Journal of Environment-Behaviour Studies*, 1(2), 33–48. https://doi.org/10.1016/j.sbspro.2012.07.024

[17] Mochida, A., & Lun, I. Y. F. (2008). Prediction of wind environment and thermal comfort at pedestrian level in urban area. Journal of Wind Engineering and Industrial Aerodynamics, 96(10–11), 1498–1527. https://doi.org/http://dx.doi.org/10.1016/j.jweia.2008.02.033

[18] Onomura, S., Grimmond, C. S. B., Lindberg, F., Holmer, B., & Thorsson, S. (2015). Meteorological forcing data for urban outdoor thermal comfort models from a coupled convective boundary layer and surface energy balance scheme. Urban Climate, 11(C), 1–23. https://doi.org/10.1016/j.uclim.2014.11.001

[19] Park, B.-J., Furuya, K., Kasetani, T., Takayama, N., Kagawa, T., & Miyazaki, Y. (2011). Relationship between psychological responses and physical environments in forest settings. Landscape and Urban Planning, 102(1), 24–32.

[20] Schiavon, S., & Lee, K. H. (2013). Dynamic predictive clothing insulation models based on outdoor air and indoor operative temperatures. Building and Environment, 59, 250–260.

[21] Thorsson, S., Honjo, T., Lindberg, F., Eliasson, I. I., En-Mi, L., & Lim, E.-M. (2007). Thermal Comfort and Outdoor Activity in Japanese Urban Public Places. Environment & Behavior, 39(5), 660–684.

[22] Thorsson, S., Lindqvist, M., & Lindqvist, S. (2004). Thermal bioclimatic conditions and patterns of behaviour in an urban park in Göteborg, Sweden. International Journal of Biometeorology, 48(3), 149–156. https://doi.org/10.1007/s00484-003-0189-8

[23] Williams, C. J., Hunter, M. A., & Waechter, W. F. (1990). Criteria for assessing the predestrian wind environment. Journal of Wind Engineering and Industrial Aerodynamics, 36, 811–815. https://doi.org/10.1016/0167-6105(90)90078-Q

AN ASSESSMENT TOOL OF SUSTAINABLE DESIGN AND CONSTRUCTION ACTIVITIES FOR GREEN HIGHWAY

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Abstract. The construction industry is one of the major contributors to the CO2 emission which cause environmental impacts on the earth's climate. Malaysian government is committed in reducing the CO2 by 40% in 2020 and 45% by 2030 as compared to the levels in 2005. Hence, there is a need to reduce the impact on the environment. Currently, there is no specific tool or standard of green highway assessment for the tropical region. Therefore, the main objective of this study is to develop an assessment tool for sustainable design and construction activities for highway development. Basically, the approach used in this study is to identify the significant criteria for sustainable design and construction activities and to determine the weightage and score for each criterion. The development of an assessment tool was based on the score for each criterion and the validation of an assessment tool was carried out by using the case studies. The significant criteria on established sustainable design and construction activities for green highway consist of construction management plan, noise mitigation control, equipment and machinery efficiency, quality management, context-sensitive design, erosion and sedimentation control, alignment selection, reused and recycled non-hazardous materials, recycled materials for subgrade improvement/soil stabilization and usage of local materials generated through survey and expert discussion. Questionnaires were developed and distributed to 140 respondents consisting of highways experts from concessionaires company, consultants, and engineers to obtain the agreement levels of listed criteria of sustainable design and construction activities for green highways. The weightage and score point were obtained on analyzed data using factor analysis from the Statistical Package for Social Science (SPSS) version 20 software. The weightage of each criterion was used to rank the criteria based on the importance of the criteria at the design and construction activities stages. The results showed that there are seven main criteria of design and construction activities for green highway development. Construction management plan is the most important criteria for achieving green highway development in Malaysia and followed by noise mitigation, equipment and machinery, quality management, context sensitive design, erosion and sedimentation control and alignment selection. All the main criteria and sub criteria had been developed into an assessment tool as a scorecard. In conclusion, the development of scorecard as an assessment tool of sustainable design and construction activities had been validated and is essential for green highway in Malaysia.

INTRODUCTION

In earlier decade, sustainable development idea has grown up from numerous environmental movements. Recently sustainable issues have been widely discussed especially in construction industry. Sustainable development is a key issue in order to meeting the environmental objectives and fulfils the demand of the large infrastructure projects due to increasing numbers of population growth and urban density (Frank et al., 2010). Sustainable design can be one of the factors that can minimize the impacts of the highway to the environment. Noise, ground and water pollution, habitat

disturbance, land use, air, climate change vibration and contamination to plant and wildlife are the effects of construction and vehicle emissions (Melanta et al., 2013). The impact can change by design, construction and management of road, parking, and other facilities. Highway system is an inevitable component for present mobility and economic development; however, the development of existing highway had caused many issues on environmental impact, economics and social. There was an innovation in management practices adopted to improve the issues, but the improvement was still insufficient and the highway development continues facing persistent threats such deteriorating conditions, green gas houses emissions, pollution, and financial scarcity.

AN ASSESSMENT OF SUSTAINABLE DESIGN AND CONSTRUCTION ACTIVITIES FOR GREEN HIGHWAY

It is necessary to have new techniques and tools that will allow the environmental social an economics commitment to be met in building and civil engineering sector (Fernández-Sánchez & Rodríguez-López, 2010). Fernandez-Sánchez and The most of the sustainable assessment tools were focus on building construction rather that infrastructure especially highway (Befani & Stedman-Bryce, 2017). However, there were several developments of sustainable assessment tools for highway development in United State but not in tropical region especially Malaysia (Stephen Muench et al., 2008). Therefore, ever since Malaysia for the moment does not have any green highway rating system, it is therefore, needs criteria verification thoroughly. The development of these criteria is largely based on conducting a comprehensive literature review. Criteria related to sustainable design and construction activities in other green highway rating systems were chosen based on literature review. The criteria that had been selected and discussed among the expertise that involve in highway development to select the most appropriate criteria. They would share their experience, opinion and suggestion on the best criteria in sustainable design and construction activities. The criteria are developed from a complete process across the project life cycle and enable all project participants to understand and contribute to the project sustainability.

The comparison of 9 assessment tools had been taken from all over the world such United State, United Kingdom, Australia, Singapore and Malaysia. Most of the tools had 9 to 14 criteria that related sustainable design and construction activities. It had been summarised by every tool had noted that design and construction activities had similar issues to be care about (Balubaid et al., 2015) - (Rooshdi & Abd Majid, 2014). The criteria are based on the green highway rating systems, highway project guidelines as well as a few related case studies. There were studies has been used as a guide that has similar criteria in indicating the criteria for this study (Steve Muench, 2009). Most of the criteria for sustainable design and construction activities from those assessments had similar factors such quality, environment, waste, water, and pollution. All factors are related to each other during design and construction stage.

The main criteria and sub-criteria in sustainable designs and construction activities had been developed into an assessment tool of sustainable designs and construction activities for green highway development. The assessment tool is named as Scorecard of Sustainable Designs and Construction Activities for Green Highway. It is a table that contains the main criteria, sub-criteria, and element description. It also contains a column of the scores which represent a point that can be given to the criterion.

The total score is the total of each score from the sub-criteria or element description. The maximum score column represents the maximum point that can be achieved by the criterion. The minimum score allocated for each criterion is 1 point and the maximum score is 3 points. Total maximum points for sustainable designs and construction activities were 69. The focus group

discussion had decided to set up 4 categories of certification based on the total points. The points will be converted into percentages. Depending upon the credit points awarded to the project, these levels can be called as certification levels.

RECOMMENDATIONS FOR FUTURE RESEARCH

Sustainability has become an important topic in engineering and construction, of which highway is an important part. An assessment tool can potentially provide a common metric for considering sustainability in highway design and construction. Fundamentally, such metric can help people make better highway sustainability decisions. Several recommendations are proposed to be made in future research in order to obtain reliable and effective results. The recommendations are as follows:

1. The expert discussion should be involved by all the construction stakeholders in the highway development in Malaysia; thus, all valuable information and knowledge will be gathered during the opinion exchange.

2. The backgrounds of respondents in the highway development should be taken into main consideration in response to the questionnaires; therefore, the agreement level obtained is valid and accurate.

3. The distribution of respondents should be more extensive and covers all types of highway construction parties. This will offer more opinions that can be analysed from various angles

REFERENCES

[1] Balubaid, S., Bujang, M., Nur Aifa, W., Kian Seng, F., Rafidah Raja Muhammad Rooshdi, R., Hamzah, N., Salfiza Mohd Yazid, Y., Zaimi Abd Majid, M., Mohamad Zin, R., Zakaria, R., Rosli Hainin, M., Yaacob, H., Haidar Ismail, H., Bahru, J., Malaysia, T., Johor Bahru, U., Malaysia Highway Authority, M., Lebuhraya, W., & Serdang-Kajang, J. (2015). *ASSESSMENT INDEX TOOL FOR GREEN HIGHWAY IN MALAYSIA. 77*, 2180–3722. www.jurnalteknologi.utm.my

[2] Befani, B., & Stedman-Bryce, G. (2017). Process Tracing and Bayesian Updating for impact evaluation. *Evaluation*, *23*(1), 42–60. https://doi.org/10.1177/1356389016654584

[3] Fernández-Sánchez, G., & Rodríguez-López, F. (2010). A methodology to identify sustainability indicators in construction project management - Application to infrastructure projects in Spain. *Ecological Indicators*, *10*(6), 1193–1201. https://doi.org/10.1016/j.ecolind.2010.04.009

[4] Frank, L. D., Greenwald, M. J., Winkelman, S., Chapman, J., & Kavage, S. (2010). Carbonless footprints: Promoting health and climate stabilization through active transportation. *Preventive Medicine*, *50*(SUPPL.). https://doi.org/10.1016/j.ypmed.2009.09.025

[5] Melanta, S., Miller-Hooks, E., & Avetisyan, H. G. (2013). Carbon Footprint Estimation Tool for Transportation Construction Projects. *Journal of Construction Engineering and Management*, *139*(5), 547–555. https://doi.org/10.1061/(asce)co.1943-7862.0000598

[6] Muench, Stephen, Anderson, T. J., & Söderlund, M. (2008). Green Roads: A Sustainability Rating System for Roadways. *Revista de Psicodidactica*, *16*(2), 367–380.

[7] Muench, Steve. (2009). *Research Project Work Plan for GREENROADS DEVELOPMENT AND ASSESSMENT FOR ODOT*.

[8] Rooshdi, R. R. R. M., & Abd Majid, M. Z. (2014). Sustainable Design and Construction Assessment Tool for Green Highway in Malaysia. *Journal of Applied Science and Agriculture*, *9*(21), 35–40. www.aensiweb.com/JASA

THREATENED RURAL CULTURAL LANDSCAPES IN MALAYSIA

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Abstract. The idea of the cultural landscape as heritage became legitimised globally by adopting the UNESCO World Heritage in 1992. Although there has been a growing interest in cultural landscape conservation globally, the rural cultural landscapes in Peninsular Malaysia are not yet protected as heritage landscapes. Current rapid development threatens the rural cultural landscapes with heritage value, contributing to the disappearance of these landscapes. Furthermore, buildings, monuments, and archaeological sites have been the central focus of Malaysia's current heritage conservation practice and dominate national heritage listings. Rural cultural landscapes as heritage remain neglected. Hence, this study explores the rural cultural landscape that has heritage value yet at the same time receives threats from the current development. This study employs a quantitative method, where 117 experts from government agencies such as the National Landscape Department, National Heritage Department, and Federal and State Town and Regional Planning Departments participated in the survey questionnaire. The survey result shows experts' preference for rice field landscapes in the Northern Region of Peninsular Malaysia. Malaysian experts who work in planning, landscape, and heritage, have more awareness of the potential of rural cultural landscapes as national heritage, more readiness to be involved in this domain, a higher sense of urgency concerning the threats to historic rural landscapes.

Keywords: Rural, Cultural Landscape, Heritage Landscape, Threats, Protection

INTRODUCTION

In June 2012, the Paleolithic site of Lenggong Valley in Perak became the fourth Malaysian World Heritage Site following the earlier selections of two natural sites and the towns of Malacca and Georgetown. This heritage designation demonstrates the Malaysian government's growing interest in heritage conservation. At the national level, forty-seven buildings, six archaeological sites, and seven natural sites have been listed as national heritage (National Heritage Department, 2013). It shows that heritage conservation emphasizes rather spectacular towns, buildings, and archaeological sites within the cultural domain. The late Tun Dato' Seri Ahmad Sarji bin Abdul Hamid, the President of Heritage of Malaysia Trust, wrote a newspaper article entitled 'Not just by laws, but by us all' (Abdul Hamid, A.S. 2012). In this article, he expressed concern about the disappearance of 'common' cultural heritage such as everyday landscapes, both in urban and rural contexts, due to Malaysia's rapid urban and economic development. Furthermore, a balance between heritage conservation and development is essential. He believes that cultural heritage protection in Malaysia can rely on the National Heritage Act of 2005 and requires awareness and involvement of policymakers, planners, other professionals, and the larger public.
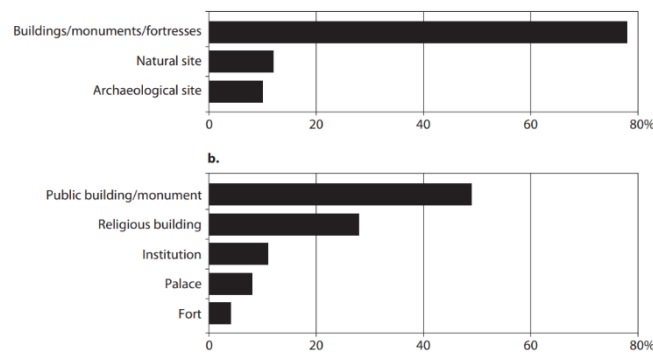
Figure 1.1: Malaysia's national heritage by (a) category and (b)sub-category
Source: Author's analysis from Malaysia's National Heritage List (National Heritage Department, 2013)

Figure 1.1 shows that buildings, monuments, and fortresses dominate the national heritage list as they contribute 78% of the national heritage, 12% for natural sites, and 10% for archaeological sites. Meanwhile, the sub-category analysis demonstrates that almost 50% of Malaysia's national heritage consists of public buildings and monuments, followed by religious buildings (28%), institutions (10%), palaces (8%), and fortresses (4%). The rural cultural heritage remains undervalued and receives little attention from the government and non-governmental agencies.

THE CURRENT STATE OF RURAL CULTURAL LANDSCAPES IN MALAYSIA

The quest towards the current state of the rural cultural landscapes in Malaysia is explored through the expert survey. In the survey questionnaire, one hundred seventeen (117) experts from the built environment government agencies in Peninsular Malaysia, namely, the National Landscape Department, Federal, and State Town Planning, National Heritage Department, and Academic.

Expert's landscape preference

The survey results demonstrate the following landscape preferences, which is rank from the highest to the least preferred landscape types: rice landscapes (41%), followed by orchards (32%), coastal landscapes, and cottage industries. (29%) and fishing villages (28%). The lowest scores in the high preference category are for former mining sites (9%) and the rubber and palm oil plantation landscapes (about 4%). Another item of the questionnaire confirms that most experts see the Northern and East Coast Regions of the peninsula as the most attractive and appealing rural cultural landscapes: of the four regions, experts agreed that the East Coast (38%) and the Northern Region (38%) were the most valuable regions in Peninsular Malaysia in terms of landscape. The rice cultivation landscape is an as important characteristic of the Northern Region, particularly in Kedah, while the traditional landscape of coastal villages with cottage industries is iconic for the coastal areas of Pahang, Terengganu, and Kelantan in the East Coast Region (Figure 2.1)

Figure 2.1: Experts' preferences for landscape types (left) and regional landscape preferences (right)

Threats on cultural landscapes

The rural cultural landscapes in Peninsular Malaysia are threatened by the current rapid urban and economic development (Mohamed, N. 1995; Mohd. Ariffin, N.F. 2007). A survey among the experts revealed that the planners of the federal Town and Country Planning Department seem the most concerned about threats to the rural cultural landscape Figure. Many of them have been involved in preparing the National Physical Plan. They may, therefore, be aware of the current speed of urbanisation and the potential threats posed by the newly implemented regional economic corridors. More generally, all subgroups express a high sense of urgency about the threats of rapid development for rural cultural landscapes. In the open questions, the respondents give many examples of concrete threats to rural cultural landscapes in the four economic regions of the peninsula as briefly described in the followings:

i. The rice paddy landscape in the Northern Region, particularly around Alor Setar, will be affected by large-scale land conversion from agriculture into housing and manufacturing (Azizan, M.U & Hussin, K. 2016).

ii. For the rice paddy areas in Krian District (Perak State), the experts also see threats from the aquaculture activities, such as the breeding of Arowana fish;

iii. Rapid development along the West Coast of the Central Region, particularly in Selangor and Malacca, will dramatically change the coastal landscape. In this context, the reclamation of land in Malacca may cause risk for the fishing villages nestled within the coastal area. Land conversion from palm oil plantation into housing, infrastructure, services, and manufacturing, which is rapidly taking place in Selangor, will diminish the integrity and authenticity of the Central Region's rural cultural landscape;

iv. The Southern Region, mainly south Johor, faces threats similar to the Central Region. Rapid development in Iskandar Region, the gateway from the south, has caused an urban sprawl into the rural areas nearby. The conversion of farmland into commercial, housing, and industrial complexes will affect the integrity as well as the authenticity of the rural cultural landscape in this region; and

v. For the East Coast Region, experts express their concern about landscape degradation due to inland tourism (Jaffar, N. et al. 2019). 7] and due to large scales developments such as the establishment of petrochemical complexes and port extensions, as is now taking place in the coastal area of Terengganu (around Kuala Terengganu and Kemaman) and Pahang (for example, Kuantan).
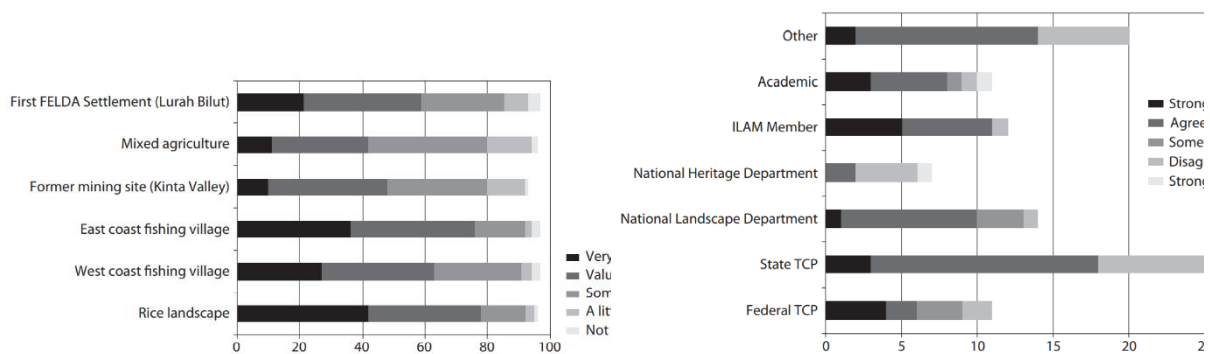
Figure 2.2: Preference for rural cultural landscape types as national heritage (left) and experts' opinion on threats to the rural cultural landscape in Malaysia (right)

The results are presented in Figure 2.2. Whether we look only at the category of highest preference or the two high preference categories together, the picture remains the same: the rice landscape is most preferred for heritage nomination, followed by the East Coast and West Coast fishing villages. Interestingly, the first FELDA settlement ranks fourth (heritage of state-led rural development in the early independence phase). The landscapes of the North and the East and West Coastal areas are distinct in their way and rank highest in the appreciation of the experts. Most experts are undoubtedly aware that precisely these landscapes are under considerable threat of development; this may have played a role in their prioritising of these areas (Yasar, M. & Siwar, C. 2016; Harun, N. Z., Mohd Ariffin, N. A., & Abdullah, F. 2017).

CONCLUSION

Peninsular Malaysia has rural cultural landscapes that meet internationally accepted (heritage) criteria. Nevertheless, the experts see these landscapes are at risk due to rapid development, weak legislation, and lack of awareness of its heritage values. The current planning tools give less consideration to the rural cultural landscape as a heritage; planning and policy experts consider it urgent to improve these tools for future heritage policy and management. This study has also offered new insight into potential topics for future research, for instance, a deeper study of the associative landscape of the *Orang Asli* or further investigation of the spatial organisation and settlement patterns of selected heritage landscapes.

REFERENCES

[10]   Azizan, M.U & Hussin, K. (2016). Multiple Driving Forces of Paddy Land Conversion: A Lesson From Malaysia's Rice Bowl State. Jurnal Teknologi (Science and Engineering), 78(1), 39–43.

[11]   Harun, N. Z., Mohd Ariffin, N. A., & Abdullah, F. (2017). Changes And Threats In The Preservation of The Traditional Malay Landscape. *Planning Malaysia*, *15*(4). https://doi.org/10.21837/pm.v15i4.318.

[12]   http://www.thestar.com.my/story.aspx?file=%2f2009%2f8%2f21%2fsouthneast%2f4518908& sec=southeast accessed on March 25th, 2010.

[13]   https://www.heritage.gov.my/v2/accessed on July 31st, 2013.

[14]   https://www.heritage.gov.my/v2/index.php/ms/daftar-warisan/senarai-warisan-kebangsaan/tapak/ Bangunan-accessed September 21st, 2013.

[15]   Jaffar, N., Harun, N. Z., & Abdullah, S. A. (2019). The Key Determinant Factors for Social Sustainability in Traditional Settlement. *Environment-Behaviour Proceedings Journal*, *4*(12), 43-52. https://doi.org/10.21834/e-bpj.v4i12.1944

[16]   Mohamed, N. (1995). Conservation in Malaysia: Landscape, tourism, and culture. (Doctoral, Institute of Advanced Architectural Studies, University of York, United Kingdom. Retrieved from https://core.ac.uk/download/pdf/9052849.pdf

[17]   Mohd. Ariffin, N.F. (2007). Role of the cultural landscape in improving the identity of the Kuala Terengganu town centre as a historic Malay town. (Unpublished Masters). Universiti Teknologi Malaysia, Skudai (2007). Retrieved from http://eprints.utm.my/id/eprint/10059/

[18]   Yasar, M. & Siwar. C. (2016). Paddy Field Conversion In Malaysia : Issues And Challenges. *Rona Teknik Pertanian*, *9*(2), 168-177.

POST OCCUPANCY EVALUATION MODEL FOR NEIGHBOURHOOD ASSESSMENT TOWARDS SUSTAINABLE DEVELOPMENT

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Abstract. This research is developed based on United Nation's Sustainable Development Goal No. 11 Sustainable Cities and Communities (SDG 11). The aim of the study is to design neighbourhood/township sustainable design tool targeted at households using stakeholder inclusion approach. In this study, Post-Occupancy Evaluation Model (POEM) will be develop based on sustainability holistic pillar in order to assess and redefine the current sustainability assessment criteria for future sustainable development. The scope of the study focusses on GBI-TAC and three (3) certified GBI neighbourhood projects in Malaysia which were occupied for more than one year. The collected data will be analysed using qualitative and quantitative analysis method and structural equation modelling. The findings have indicated that a comprehensive Stakeholder-Inclusion Approach method in developing POEM for SND, supported by key issues of SDP understanding in SND and guided by clear and comprehensive POEM Handbook procedures, can oversee, and foster the neighbourhood and its communities towards an enhanced, balanced and holistic sustainable development.

RESEARCH BACKGROUND

The Malaysian construction and development sector has been over the years emerged and thrived in the direction of a more progressive sustainable urban agendas. The subject of sustainable neighborhood/township benchmarking approach in the field of urban development in Malaysia is relatively new. Although GBI Township Assessment Criteria has been developed and implemented but there is no post-occupancy evaluation being conducted in assessing the performance, effectiveness, and sustainability level on the certified development? There has been lack of study done to measure the greenness' of the tools and the post certified township development (Yaman et. Al, 2021). Even though there is study conducted on environment dimension, however fewer so are conducted on what really signifies socially or/and economically, and/or its application in the sustainable urban development context. Do sustainable neighborhood or township evaluation criteria and frameworks in common signify sustainable holistically? (Sullivan, Rydin et al. 2014). Therefore, proficiency and comprehension on urban sustainability benchmarking criteria could strengthen neighborhood sustainable indicators, effectiveness and sustainability level among the Malaysian sustainable urban development actors are vastly still low. Studies has indicated one of the main obstacles that hinder sustainable township/neighborhood development in ASEAN nations is the deficiency of knowledge in sustainable concerns subjects in relation to the involved building profession (Dahiya, 2012).

Past study done on sustainable building rating system potential in Malaysia also shows that Malaysia construction and development sector key stakeholders have insufficient understanding on sustainability development evaluation, benchmarking & indexing approach. Due to this many green certified urban development projects in Malaysia claim sustainability merely for label advertisement, marketing tools and higher premiums instead of fully addressing the sustainable pillars. Certified GBI township projects normally a high-end urban development projects, study has indicated that sustainable certification does improve leasing and selling rate of developed properties, but this

outcome is further substantial for end-users who are more innately concerned with sustainability, or pushing their 'green' appearance. Even though the noble foundation for sustainable township/neighbourhood is to promote and applied sustainable development, but there is no study was undertaken to address and gauge these issues. Thus, embark the problem of the research whether the existing GBI Township Assessment Criteria and certified urban development project fulfilled the post-occupancy performances, effectiveness, and sustainability level according to dimensions Pillars of Sustainability (Yaman et. Al., 2017). The research also intended to find out the theoretical aspect of the study. Besides the practical study, this research is also to prove study hypotheses; Hypothesis 1. Sustainable pillar dimensions method will improve the sustainability within the community's neighbourhood context, and Hypothesis 2. Post-occupancy evaluation model (POEM) assessment criteria and theory would differ from the pre-occupancy assessment criteria and theory.

Urbanized areas are typically the significant sources of environmental degradation (OWG-UN, 2014), thus, urban assessment criteria tool aiming at equally adapted sustainability dimensions need to be firmly embedded in benchmarking planning and design framework and upon occupancy. In this study, Post-Occupancy Evaluation Model (POEM) will be develop based on sustainability holistic pillar to assess and redefine the current sustainability assessment criteria for future sustainable development. Urban sustainable rating system in Malaysian is rather new. Even though Green Building Index Township Assessment Criteria (GBI-TAC) has been developed and implemented but there is lack of post-occupancy evaluation being conducted in assessing the sustainability level of the certified development? Thus, embark on the research problem whether urban neighbourhood assessment criteria and certified project fulfilled the sustainability concept according to sustainability dimension pillars (SDP). The research objective is to identify and formulate POEM based on SDP towards sustainable neighbourhood development (SND) (Yaman et. al., 2018). The scope of the study focusses on GBI-TAC and three (3) certified GBI neighbourhood projects in Malaysia which were occupied for more than one year. The stakeholder-inclusion approach is used in this research to gather experts' opinion, professional's stakeholders' views and end-users' experiences regarding the proposed POEM. The research design will be formulated into six key stages, which are 1. Content analysis, 2. Expert's surveys and semi-structure interviews, 3. Building's professional surveys, 4. Development of POEM handbook, 5. On-site Household Surveys and 6. Revision and Finalizing of POEM. The collected data will be analysed using qualitative and quantitative analysis method and structural equation modelling. The findings have indicated that a comprehensive Stakeholder-Inclusion Approach method in developing POEM for SND, supported by key issues of SDP understanding in SND and guided by clear and comprehensive POEM Handbook procedures, can oversee, and foster the neighbourhood and its communities towards an enhanced, balanced, and holistic sustainable development.

CONCEPTUAL FRAMEWORK

The significance of this intended POEM framework is to offer an evaluation measurable model for effectual sustainable urban neighbourhood development which addresses the limitations and gaps of the current sustainable neighbourhood assessment criteria upon occupancy. The research conceptual framework discussed the overall conception of the study. From related literature and content analysis at global level on sustainable urban development in particular United Nations (UN) and World Green Building Council (WGBC) policy (UNEP-WGBC, 2012), the study is being narrowed to national level which look upon sustainable township development. At national level, the study cover government development policy such as Low Carbon City (LCC) and Low Carbon Society (LCS) framework aiming at sustainable township development. On the following stage, at local level, the study is narrowed towards sustainable neighbourhood development aspects which concerns local authority policy, guidelines, and green assessment criteria. The study is then further narrowed at institutional level, where it particularly focused in GBI-TAC pre-occupancy evaluation tool which based

on six core criteria of Climate, Energy & Water; Environment & Ecology; Community Planning & Design; Transportation & Connectivity; Building & Resources; and Business & Innovation. Based on Malaysia context, there are two main derivatives of sustainable urban development criteria which are Low Carbon City (LCC) carbon calculator devised by Ministry of Energy, Water and Green Technology; and GBI Township Tools (GBI-TAC) developed by Malaysian Green Building Confederation.

At this point, the study focused on GBI Township Tools due to objectives in developing POEM and measuring certified sustainable neighbourhood upon occupancy. The study justification is that GBI-TAC is implemented in Malaysia, while LCC carbon calculator was not applied hence there is no precedent case studies using this measure. Prior to certify sustainable neighbourhood assessed using GBI-TAC pre-occupancy assessment criteria, the study proceeds via Stakeholders-Inclusion Approach. The GBI-TAC and selected case studies is then measures using POEM framework in addressing the study problem statements, hypotheses and questions. In this study, POEM framework considered the fundamental dimension aspects of sustainable urban neighborhood development which was designed upon environmental, social, and economic issues (Yaman et. al., 2019) The foundation of POEM framework are based of three sustainable dimensions, by which should be assimilated cohesively in order to attain the anticipated aims of this proposal framework. Namely environmental, social, and economic dimension (Dahiya, 2014).

FINDINGS

The findings for research problem based on POEM Handbook on-site testing from selected case studies through end-users/households' opinions, the study concluded that the existing GBI-TAC and certified SND DO NOT FULFILL the post-occupancy effectiveness and sustainability level according to SDP. For research hypothesis 1 and 2: Stakeholders-Inclusion Approach Analysis, SEM modelling and POEM Handbook on-site implementation findings suggested that there is a SDP gap in evaluation criteria between Phase 2 (Pre-Occupancy) and Phase 3 (Pre-Occupancy), and pre-occupancy assessment for SND sustainability level differs from post-occupancy evaluation sustainability level perceived by the end-users/households concluded that POEM evaluation criteria and theory would differ from the pre-occupied assessment criteria and theory; therefore, there is a room for improvement and enhancement upon post-occupancy within the community's neighbourhood context. Hence, SDP method will improve sustainability and in supporting this hypothesis.

CONCLUSION

The study outcome suggested there is still a sustainable dimensions gap that need to be addressed in maintaining the continuity neighborhood community sustainable practices and management upon occupancy. Thus, this study claims that the adoption and implementation of POEM for SND will facilitate to enhance the current and future sustainable condition of urban development. The expected output of this research is the POEM Handbook for future SND in Malaysia and similar development phenomenon in the ASEAN region and country throughout the world (Dahiya, 2016). The POEM is also expected to be a reference model for future review and revision of GBI-TAC, Local Authorities and Ministries related sustainable and green policies.

REFERENCES

[1] Dahiya, B. (2012). "Cities in Asia, 2012: Demographics, economics, poverty, environment and governance." Cities **29**: S44-S61.

[2] Dahiya, B. (2014). "Southeast Asia and Sustainable Urbanization." Global Asia **9**(3): 84-91.

[3] Dahiya, B. (2016). "ASEAN Economic Integration and Sustainable Urbanization." Journal of Urban Culture Research **13**(1): 8-15.

[4] OWG-UN. (2014). "Open Working Group Proposal for Sustainable Development Goals." Full report of the Open Working Group of the General Assembly on Sustainable Development Goals. New York: United Nations Open Working Group.

[5] Sullivan, L. J., Rydin, Y., & Buchanan, C. (2014). Neighbourhood sustainability frameworks-a literature review.

[6] UNEP-WGBC (2012). "Sustainable Cities: Building Cities for The Future." UNEP Sustainable Buildings and Climate Initiative and the World Green Building Council.

[7] Yaman, R., Thadaniti, S., Dahiya, B., Abdullah, J., & Ahmad, N. (2017, December). Post occupancy evaluation model for sustainable neighborhood development. In *Proc. of the Korea Ecological Environmental Society Conference* (Vol. 17, No. 2, pp. 47-50).

[8] Yaman, R., Thadaniti, S., Ahmad, N., Abdullah, J., & Ismail, F. Z. (2018). POST OCCUPANCY EVALUATION MODEL: ADAPTIVE MEASURE TOWARDS SUSTAINABLE NEIGHBORHOOD DEVELOPMENT. *PLANNING MALAYSIA*, *16*.

[9] Yaman, R., Ahmad, N., Ismail, F. Z., & Kokchang, K. (2019). Effective sustainability awareness using psycho-behavioral intervention framework for sustainable development. *Malaysian Constr. Res. J*, *8*, 123-132.

[10] Yaman, R., Abdullah, J., Adnan, H., Ismail, F. Z., & Ahmad, N. (2021). Post Occupancy Evaluation of Space Energy Intensity on Green Building Index Energy Efficiency (EE) Criteria. *Engineering Journal*, *25*(1), 233-243.

RENTAL DEPRECIATION PLSR MODEL FOR PURPOSE-BUILT OFFICE IN KUALA LUMPUR GOLDEN TRIANGLE AREA.

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Abstract. Kuala Lumpur has been a major focus of study related to the commercial office market, where most of the purpose-built office (PBO) is situated and heavily invested. Despite this, depreciation and obsolescence-related risks reduce the investment potential integral to PBO buildings. It was interesting to find out what are the main factors that drove the acceleration of rental depreciation of the PBO buildings in this area. This study was conducted using the exploratory approach on forty-one (41) PBO buildings using the questionnaire survey and secondary data. The impact of explanatory variables (Building appearance and design, building engineering and services, green building classifications, or Location and site) on the rental depreciation was investigated using Partial Least Square Regression (PLSR). Results showed that a total of twenty-nine (29) building and site factors significantly contribute to the rental depreciation of PBO samples in the KLGT area. This research assists in identifying the critical factors of PBO rental depreciation using an alternative analytical approach namely PLSR, hence providing a key understanding of managing and controlling depreciation and obsolescence risks.

INTRODUCTION

Purpose-built office (PBO) building has seen rapid changes over the years driven by tenants' and investors' technology and economic demand. Besides providing a workplace that accommodates business activities, the role of PBO has evolved into becoming a vehicle for indirect investment. With the introduction of Real Estate Investment Trusts (REITs) in Malaysia, PBO buildings became part of the property portfolio (Safian et al., 2011) which contributed to the return on investment. Despite this, one of the key risks inherent to real estate investment is depreciation and obsolescence. There should be a consideration to understand, evaluate and provide response options in managing risk (Roslee, 2018). Depreciation is a rate of decrease in the rental or capital value of the existing or older assets when compared to new assets with up-to-date designs.

Depreciation is accounted for as it influences the projection of growth and decline in rental income, while unreliable estimates of depreciation may produce property market mispricing (Yusof, 1999). The previous study has addressed the issues concerning depreciation by identifying buildings and site factors that contribute to the obsolescence and deterioration of buildings. However, the increasing number of green buildings where may be attributable to pressure from customers that perceived sustainable certification as significant (Ong et al., 2018) creating sustainability impairment that in turn leads to economic depreciation of existing property stocks (Surmann et al., 2015). A review from the previous study concerning commercial office real estate study has identified four (4) major characteristics of buildings and sites that may contribute to the rental depreciation of PBO buildings including Building appearance and design, Building engineering and services, Building classifications, and Land and site variables. Hence, this study in total uses 56 explanatory variables adapted from

selected prominent studies (Adnan et al., 2012; Azizi et al., 2015; 2017; Safian et al., 2014; Wan Rodi et al., 2018).

METHODOLOGY AND ANALYSIS

This study focuses on the Kuala Lumpur Golden Triangle (KLGT) area since there is a high density of office buildings compared to the other area. Specifically, this area comprises 90 units of PBO buildings [11]. Secondly, this study attempts to reduce the spatial impact of different locations by focusing on KLGT. Hence, its effects can be controlled and minimized. In total, there were fifty (50) PBO buildings identified as suitable as building samples. The survey was conducted using questionnaires as a means for data collection targeting property managers representing each building. The survey managed to obtain 41 valid questionnaires that are necessary for the analysis. The findings from the analysis using Partial Least Square Regression (PLSR) show that 29 explanatory variables out of 56 were significant to rental depreciation.

The PLSR analysis involves several procedures including the model's quality, the development of the PLSR depreciation model, and the assessment of the prediction model accuracy. The analysis produces a one-factor model with a strong variance (81%) of explanatory variables (X) in explaining the depreciation (Y). Also, the value of Q2 which exceeds zero (0.773) indicates that the relation between the independent variables and dependent variables in the predicted model was large and suitable. This result shows that the PLSR depreciation model exhibits an attribute of a good quality model. The results benefitted in terms of controlling and managing the impact of rental depreciation by focusing on the identified indicators. All these key indicators and constructs have given huge barriers to improving rental value for older PBO buildings in KLGTA. Hence, it needs to be integrated within the assessment model when investigating the relationship between building and site features towards rental depreciation.

CONCLUSION

It is believed that the research aims stated in the introduction have been met with the completion of this study. PLSR analysis has identified twenty-nine (29) variables that are significant in influencing rental depreciation for PBO buildings in the KLGT area. Also, the study shows that the PLSR approach can also be employed to develop a Rental Depreciation model. Further improvement can be made in the future by increasing the sample size and testing other locations or cities. The model serves as a guideline to assist property managers in managing and controlling the impact of rental depreciation and obsolescence by focusing on the significant factors outlined in this paper.

REFERENCES

[1]   Safian, E.E.M., Bagdad, M. and Nawawi, A. H. (2011). The Characteristics of Purpose-Built Offices in Malaysia: A Review of Issues. in *Sixth International Conference on Construction in the 21st Century*, no. 39944.

[2]   Roslee, R. (2018). Risk Evaluation Triangle (RET) for Landslide Risk Management (LRM): A Case Study from Kota Kinabalu, Sabah, Malaysia. *ASM Science Journal*, 11(3), 206–214.

[3]   Yusof, A. (1999). Modeling the impact of depreciation: a hedonic analysis of offices in the City of Kuala Lumpur. University of Aberdeen.

[4]   Ong, J., Noordin, R., Mohd Kassim, A. W., and Jaidi, J. (2018). Factors Influencing Environmental Management Accounting Practices in Malaysian Manufacturing Industry: Exploratory Findings. *ASM Science Journal.*, 11(3), 98–103.

[5] Surmann, M., Brunauer, W., and Bienert, S. (2015). How does energy efficiency influence the Market Value of office buildings in Germany and does this effect increase over time?. *Journal of European Real Estate Research*, *8*(3), 243–266.

[6] Adnan, Y. M., Daud, M. N., and Razali, M. N. (2012). Property specific criteria for office occupation by tenants of purpose-built office buildings in Kuala Lumpur, Malaysia. *Property Management*, *30*(2), 114–128.

[7] Azizi, N. S. M., Wilkinson, S. and Fassman, E. (2015). Strategies for improving energy-saving behavior in commercial buildings in Malaysia. *Engineering, Construction and Architectural Management.*, *22*(1), 73–90.

[8] Rahman, F., Rowlands, I., and Weber, O. (2017). Do green buildings capture higher market-valuations and lower vacancy-rates? A Canadian case-study of LEED and BOMA-BEST properties. *Smart and Sustainable Built Environment*, *6*(4), 102–115.

[9] Safian, E.E.M., Nawawi, A. H., and Sipan, I. (2014). Building and Locational Characteristic's Quality of Purpose-Built Office and their Relationship with Rentals. *MPRA*, *64908*(61160).

[10] Wan Rodi, W. N., Che-Ani, A. I., Tawil, N. M., Ting, K. H., and Aziz, F. (2018). The driving factors to rental depreciation of purpose-built office (PBO) buildings: A PLS-SEM approach. *Journal of Facilities Management, 17*(1), 107-120.

[11] NAPIC. (2017). Property Market Report 2016. Valuation and Property Services Department, Ministry of Finance Malaysia, Putrajaya.

THE DEVELOPMENT OF PROTECTED AREAS MANAGEMENT CATEGORIESFRAMEWORK IN PENINSULAR MALAYSIA

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Abstract. The application of protected areas management categories in Peninsular Malaysia wascarried out without considering the importance of using criteria/sub-criteria based on the local values. There is no specific framework or standard measure used to determine the protected areamanagement categories. Therefore, this study aims to develop a framework for protected area management categories. The objective is to identify the criteria/sub-criteria, such as the principal criteria used in sustainable development (environmental, economic and social) and management. The criteria/sub-criteria were identified by examining substantive theories on protected area management categories, related models, and guidelines from local and overseas. Delphi techniques have been used to gathers, evaluates, and summarizes expert opinions. As a results 5criteria have been identified i.e i) general criteria (6 sub-criteria), ii) environment (12 sub- criteria), iii) economy (8 sub-criteria), iv) social (8 sub-criteria) and management (12 sub- criteria). These criteria/sub-criteria were used to assess its suitability to the existing protected area management categories in Peninsular Malaysia and to develop the protected area management categories framework.

Keywords: protected areas, management categories, criteria, framework

INTRODUCTION

The protected area management category developed by the International Union for Conservation of Nature (IUCN) is a global framework recognized by the Convention on Biological Diversity (CBD). The application of protected area management categories is an important aspect in managing protectedareas (IUCN, 2008). The protected area management categories involve six categories of management, represent the level of protection and regulation as well as land use activities permitted in protected areas (Table 1). The setting of management categories in protected areas developed by the IUCN aims to establish various management functions for each protected area. It's also intended: i). to provide an overview of the importance of protected areas to the government, ii). encourages the government to develop protected area systems, iii). reduces confusion because of the use of different terms, iv). provide international standards, v). provides a framework for the collection, handling and dissemination of dataand information protected areas and vi). enhance communication and understanding amongst those involved in the management of protected areas.

Table 1. Protected areas management categories

	Categories	Primarily management objective
Ia	Strict Nature	Reserve Scientific purposes
Ib	Wilderness Area	Wilderness protection
II	National Park	Ecosystem protection and recreation
III	Natural Monument or feature	Conservation of specific natural feature
IV	Habitat/Species Management Areas	Conservation through management intervention
V	Protected landscape/seascape	Landscape/seascape conservation or recreation
VI	Protected areas with sustainable use of natural resources	Sustainable use of natural resources

Source: IUCN, 2008

PROBLEM STATEMENT

Protected areas in Peninsular Malaysia include areas with management objectives related to the conservation of biological diversity. Management initiatives through the designation of the existing management categories are relevant. But its design and application do not have clear definitions and objectives. This is because it does not detail the required criteria based on local values. Indirectly, this raises doubts about the suitability and accuracy of the use of such management categories in protected areas. Apart from that, the implementation of the existing protected area management category was carried out on an "ad-hoc" basis without any details regarding the criteria used in determining a particular category. In addition, the use of the existing management category now also creates uncertainty over the suitability of the category allocated to an area. This situation creates uncertainty in terms of its function and management as a protected area which indirectly affects the conservation planning and management agenda as stated in the National Biodiversity Policy (1998). Thus, there is not a clear framework on the designation of a category of protected area management based on appropriate criteria. Therefore, to address this problem, a clear framework on the designation of a management category on a protected area based on the appropriate criteria needs to be developed.

METHODOLOGY AND ANALYSIS

Through the filtering and integration, a total of seventy-one (71) preliminary sub-criteria were identified. However, these sub-criteria have not been grouped into the appropriate criteria. Therefore, confirmation of criteria/ sub-criteria is done through the Delphi technique. The Delphi technique has been used and is a widely accepted method in research for data collection process from respondents who have expertise in a particular field (Hsu, & Sandford 2007). The selection of respondents is an important aspect of this method to ensure the quality of information obtained (Jacobs, 1996). According to Ludwig (1997), the minimum number of respondents required in the process is 10 to 20 respondents. In this study, expert assessment involves the stakeholders directly or indirectly in the management of protected areas in Peninsular Malaysia.

A total of fifteen (15) experts were selected comprises of five (5) academicians, five (5) NGO's representatives and five (5) representatives from various protected area management agencies. Descriptive (frequency) analysis was carried out where a frequency value of more than 50% was selected into account as criteria/sub-criteria to be used in the development of the framework of protected area management category. This form of analysis is used to ensure that the findings of this analysis can give a clear meaning to the criteria and sub-criteria to be applied. As a result, five (5) criteria have been identified i.e: i) the general criteria (6 sub-criteria), ii) environment (12 sub-criteria), iii) economy (8 sub-criteria), iv) social (8 sub-criteria) and management (12 sub-criteria) (Table 2).

Table 2. Citeria and Sub-Criteria

Criteria/Sub-Criteria	• Descriptions
General	• Definition of protected area • Law and regulation • Management • Size • Natural area
Environment	• Protecting values of biological diversity • Maintain ecological processes • Habitat and ecosystem conservation • Containing certain flora and fauna • Contribute to the conservation strategy • Providing ecosystem services • Protecting conservation values • Protecting endangered resources • Protect certain natural monuments • Maintaining genetic resources
Economic	• Eco-tourism opportunities • Reducing the cost of living • Providing job opportunities • investment and business • Sustainable use of natural resources • Drastic changes in property values • Encourage agriculture activities
Social	• Education and learning • Preserving cultural heritage values • Improve living standards • Recreational opportunities • Provide experience for future generations • Preserving the identity and values • Improving infrastructure • Critical to cultural identity
Management	• Continuous control • Staffing • Zoning of areas must be established • Cooperation with the locals is necessary • Monitoring • Visitors' management • Sustainable use • Long-term conservation dedication • Law enforcement • Effective communication • Landscape management

CONCLUSION

Even though the management category of protected areas has undergone changes since it was first introduced, however, the basis in determining protected area management categories must comply with the general criteria. In line with the current developments, sustainability dimensions (environment, economy and social) play an important role and need to be modified in determining the management category of a protected area. This is because protected areas play an important role in the environmental criteria that dominate the existence of a protected area. For example, the importance of this area in implementing the biodiversity conservation agenda is considered as the basis for the establishment of a protected area. On the other hand, economic criteria are often

associated with the contribution of protected areas to their interests in terms of employment opportunities, income returns, sustainable use of natural resources, increasing investment opportunities, and others that are closely related to protected areas today. Not to forget the social criteria also have a significant impact on protected areas especially in terms of community development towards increasing educational opportunities, preserving heritage values, helping to improve living standards etc. Whilst the management criteria are important components in managing the protected area to achieve its objectives. These criteria/sub-criteria were then used to develop the protected area management categories framework and assess its suitability to the existing protected area management categories in Peninsular Malaysia.

REFERENCES

[1] CBD. 2003. Handbook of the Convention on Biological Diversity. Quebec: UNEP
[2] Chape, Stuart. 2004. Systematic assignment of protected area management categories: an opportunity for achieving a measurable framework. PARKS, 14(3), 51–62.
[3] Hockings, M., Stolton, S., Leverington, F., Dudley, N., Courrau, J., Valentine, P. & Editor, S. 2006. Evaluating Effectiveness A Framework for Assessing Management Effectiveness of Protected Areas 2nd Edition. Gland, Switzerland and Cambridge, UK: IUCN.
[4] Hsu, C. & Sandford, B. 2007. The delphi technique: making sense of consensus. Practical Assessment, Research & Evaluation, 12(10), 1–8.
[5] IUCN. 2008. Guidelines for Protected Area Management Categories. Gland, Switzerland and Cambridge, UK: IUCN
[6] Jacobs, J. M. 1996. Essential assessment criteria for physical education teacher education programs: A Delphi study. West Virginia University, Morgantown
[7] Leroux, S. J., Krawchuk, M. a., Schmiegelow, F., Cumming, S. G., Lisgo, K., Anderson, L. G. & Petkova, M. 2010. Global protected areas and IUCN designations: Do the categories match the conditions? Biological Conservation, 143(3), 609–616
[8] Ludwig, B. 1997. Predicting the future: Have you considered using the Delphi methodology? Journal of Extension, 35 (5), 1-4.