Malaysian Construction Research Journal
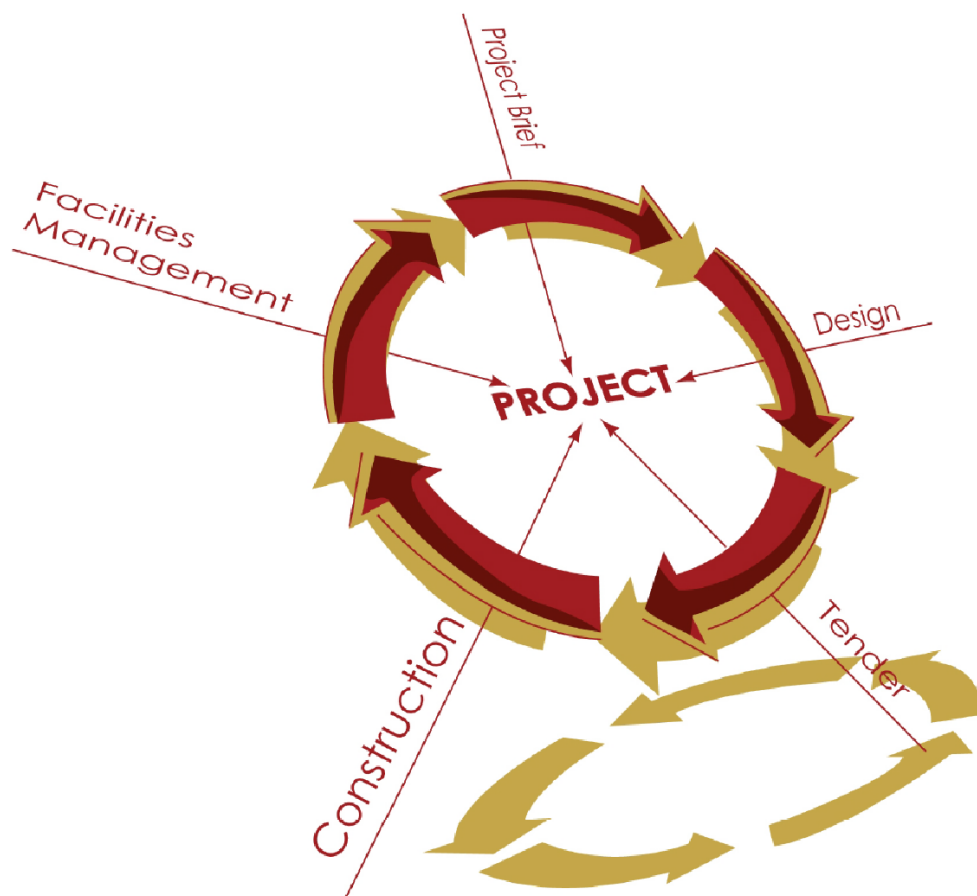
INTERNATIONAL CONFERENCE ON BUILT ENVIRONMENT AND ENGINEERING 2018 (IConBEE)

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Contents

Introduction

Welcome to the Special Issue of the Malaysian Construction Research Journal (MCRJ) in conjunction with the International Conference on Built Environment and Engineering (IConBEE) 2018. This conference was organised by Universiti Teknologi MARA (UiTM) and was held on 29th – 30th October 2018 in Johor Bahru, Johor. This biannual event aims to be a premier platform for researchers and practitioners to present and discuss the most recent innovations, trends and challenges encountered as well as solutions adopted. The central theme of the conference 'Enhancing Construction Industry Through IR 4.0' is intended to spur new ideas for a technologically advanced sustainable construction industry.

This Special Issue of Malaysian Construction Research Journal (MCRJ) presents extended articles which have been chosen from among the best papers in IConBEE 2018. A total of 16 papers from various backgrounds in the built environment and engineering discipline especially for the process of revolutionizing the industry to be 'future-ready'.

Accepted papers covered six categories of various field under built environment and engineering which are Sustainable Construction and Built Environment, Environment Science and Engineering, Architecture and Urban Planning, Organization Management, Civil, Structure and Material Engineering and Construction Technology. Each paper that was presented and published in this conference had undergone a rigorous review process by independent expert reviewers who are knowledgeable in the pertinent subject area.

The theme '**Enhancing Construction Industry Through IR 4.0**' reflects the relevance of rapid growth of technological advances in the construction industry and how the industry can maximise the benefits of IR 4.0 moving forward.

Editorial Advisory Board

Editorial

Welcome from the Editors

Welcome to this special issue in Malaysian Construction Research Journal (MCRJ) for the International Conference on Built Environment and Engineering 2018 (IConBEE 2018). We would like to express our sincere gratitude to our contributing authors, reviewers, organizers and readers.

This special issue in MCRJ for IConBEE 2018 contains eighteen (18) interesting papers covering the theme of "Enhancing Construction Industry Through IR 4.0". It is hoped that the readers would greatly benefit from the scientific content and quality of papers published in this issue. Brief introduction of each article is given as hereunder:

Azlan Ariff Ali Ariff et al., have presented on how green envelope options affect the Energy Usage Index (EUI) of a two-level library. This study employs a quantitative approach using Revit Building Information Modelling (BIM) simulation software. Variations in the building parameters simulated are building orientation, envelope material, thermal insulation, and envelope treatment. The study reveals that double-glazed windows and green roof contributed a substantial improvement on the as compared to the building control system. The credible results also support the application of building simulation to improve envelope design and to predict the possible outcomes of design alternatives before the building is constructed.

Nur Khaliesah Abdul Malik et al., have explained on the cumulative floatable litter load captured at the log boom during the extreme events by using the Gumbel distribution method for frequency analysis in river discharge of Sungai Batu. The annual maximum river discharge for a period of 35 years (1982 to 2016) was used in Gumbel distribution method to obtain the discharge for different return period (2, 5, 10, 25, 50, 100, and 200). The result shows that the estimated discharge (103.17 m³/s) can estimate the cumulative floatable litter load (53267.27 kg/day) at 50 years return period. The R2 value obtained from non – linear regression analysis is 0.9986 indicate that Gumbel distribution is suitable to predict the expected discharge of the river.

Ismail Abdul Rahman et al., have explored on major reasons affecting productivity of the labour in construction works for the nation of Pakistan which is experiencing low productivity problem. This was achieved by survey using a questionnaire form developed based on 33 common reasons of labour productivity identified from review of published articles in journals and conference proceeding. Fifty-four completed forms received were analysed with weighted average formula. Analysis revealed that all the factors frequent occurrence significantly effect productivity. three most significant reasons include misuse of time schedule, increase of labourer age and weather changes.

Rumaizah Mohd Nordin et al., have studied on the participation of local labour in the Malaysian construction industry as the long-term solution on the over-reliance of foreign labour in Malaysian construction industry. This paper presents a document analysis through two documents which has been chosen for the study. These findings will recapitulate the current situation of the local labour participation in the Malaysian construction industry.

K.L.A.K.T. Liyanage et al., have demonstrated on identifying enablers and barriers to adopt Zero Waste (ZW) concept in the construction industry. This paper critically reviews the secondary data on waste management studies conducted in the construction industry and findings from eight case studies. Along with the qualitative approach, under case studies, semi-structured interviews. The findings revealed that conducting meetings to laborers, assigning supervisors and managers to monitor laborers and procurement coordination were identified as the key enablers to adopt zero waste while poor supervision, lack of skilled laborers, lack of awareness, lack of attitude and lack of housekeeping were identified as the barriers to adopt zero waste concept in the construction industry.

Nur Aqlima Ramli et al., have discussed on identifying the benefits for the implementation of green cleaning practice during maintenance in Malaysian schools. Twelve benefits were identified from the literatures, and a questionnaire survey that involved green cleaning experts was carried out. Frequency analysis and Importance Index calculation were performed to rank the benefits. The result indicates that "improve indoor air quality (IAQ)" and "provide safe and healthy environment to occupants and janitors" are the most important benefits of green cleaning practice during operation and maintenance stages in Malaysian school.

Mohd Hisham Ariffin et al., have identified the influence of the superior's Bourdieu capital upon their creativity. The study adopted interview method among selected subordinates in Malaysian architecture, civil engineering and landscape architecture consulting firms Qualitative thematic coding analysis of the interview transcripts generated the relevant Bourdieu capital categories and theme. The leader's human, emotional, political, cultural and social capitals were found to influence the subordinate's creativity motivation. The data indicate a common theme of followers' creativity motivation through learning from leader's superior human capital. The learning is aided by the leader's emotional capital. The findings imply that four generated capitals are components of two Bourdieu initial capitals (social and cultural) and that the generated political capital is conceptually aligned with symbolic violence.

Misriyanti Saikah et al., have explained on factors which will influence housing developers to accept Industrialised Building system (IBS) as the preferred methods to meet the supply and demand of affordable housing. This research conducted using interview methods with eight project managers who have more than three years working experience in developer's firm. The finding reveals, majority of developers are already familiar with various types of IBS system and factor of acceptance are the lower construction price, short construction time and workmanship quality with minimal defects.

Norliana Sarpin et al., have showed on the key challenges for Malaysian contractors to undertake international construction projects thus identify strategies for Malaysian contractors to undertake international construction projects using quantitative questionnaires method distribute to experienced construction managers of G6 & G7 companies. The revealed that skilled worker shortage, high cost of financing and limited experience of similar projects are the top three challenges. Risk management and joint venture with experienced local contractors are key strategies for Malaysian contractor to undertake international projects.

Abdulazeez Umar Raji, have discussed on the significance of leveraging on Building Energy Efficiency (BEE) project team-competency and commitment organized within a strategic Benefits Realization Management framework to optimize clients' benefits in terms of minimizing Transaction Costs (TC). The focus is on the aspect of developer's competencies and their project team commitment with respect to minimizing TCs that is structured within a Benefits Realization Management (BRM) practice. This model is proposed as a pro-active enabler tool for the purpose of achieving Value for Money in BEE affordable housing projects.

Rostam Yaman et al., have explained on the psychobehavioural intervention framework effectiveness on the occurring of positive behaviour towards sustainable awareness in students at tertiary education level using sampling of 220 interior architecture students after undergone training. The main outcome signified that students of interior architecture who attained psycho-behavioural intervention framework obtained better sustainable awareness and psychological traits, and also indicated better positive performance comparatively to the control group when completed the training. Hence, the conclusion is that psycho-behavioural intervention framework able to stimulate positive behaviour and sustainable awareness.

Ruzaini Zahari et al., have presented on the influence of Bourdieu capitals possessed by leaders in Malaysian landscape architecture firms towards the creativity of their subordinates. Three design subordinates from each of the 73 landscape architecture firms in the database of Institute of Landscape Architects Malaysia were surveyed by mail. Factor Analysis on the data generated five leaders' Bourdieu capitals. The capitals are Social, Human, Emotional, Cultural and Political. Stepwise Multiple Regression Analysis ascertained the relationship of the leaders' Bourdieu capitals and their subordinates' creativity. The regression equation showed that Leader's Social and Emotional capitals are directly related to the subordinate's creativity.

Wong Ching Ching et al., have identified on the extent of risk implementation based on Risk Management Framework and the effect of risk management on construction Public Listed Companies performance. The sample of this study consists of 227 construction Public Listed Companies in Malaysia Bourse from 2011, 2014, 2015, 2016 and 2017. Content analysis is conducted on the companies' annual reports for the five years focuses on Risk Management Framework components and financial information. The study revealed the presence of both guidelines had increased risk disclosure among construction Public Listed Companies but there is no significant improvement in their financial performance.

Roshartini Omar et al., have studied on the technology transfer in the MRT project in the country by identifying all the technologies involves and barriers in the process of technology transfer within the MRT project in Malaysia. The study adopted interview methods with respondents that involved in technology transfer MRT project namely MRT Corporation Sdn. Bhd. and MMC-Gamuda KVMRT (PDP) Sdn. Bhd. The result showed that advance technologies transferred mainly for tunnelling work, signalling, train assembly, train control, track work, underground work, rail work and stair tower project. Meanwhile, barriers for technology transfer are language barriers, work environment and culture between transferor and transferee at the workplace.

Abdul Rauf Abdul Rasam et al., have presented on the adoption a sociospatial method to assess potential risk factors of TB in the rural-urban areas of Shah Alam and then used for targeting missing cases of the disease which involved 3 steps approaches namely; Framework development, data sets acquisition, risk investigation and modelling. 65% of possible high-risk TB areas identified for this research and the results revealed vast majority of TB areas are urban high-rise housing accumulated around industrial area with high mobility of human flow of low financial income group. The result also supports the pointers by the ministry of Health (MOH) to manage TB as tabled in the national TB technical report in 2015 that emphasised that existing detection strategies of TB at locations need to be integrated with all relevant methods.

Izatul Farrita Mohd Kamar et al., have demonstrated on the safety and health cost dimensions effects to the contractors based on multiple regressions methods for the 62 accident cases reported for the MRT 1 SBK (Sungai Buloh-Kajang) lines project as part of the Klang Valley Mass Rapid Transit (KVMRT) system. The finding managed to identify factors affecting the total cost incurred by the contractors based on classification of accidents, type of body injuries, the number of working days lost due to stop work order and remobilisation.

GREEN ENVELOPE AS AN ARCHITECTURAL STRATEGY FOR AN ENERGY EFFICIENT LIBRARY

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Abstract
Green envelope plays an important role to regulate the indoor environment for the temperate climate. However, in the case of hot and humid climate such as Malaysia, the benefits of having green envelopes need further quantitative investigations due to limited published literature. Incorporating green envelope during the design phase of an air-conditioned library could potentially improve its indoor thermal comfort, provide a pleasant indoor environment with reduced energy consumption. Hence, this study aims to analyse how green envelope options affect the Energy Usage Index (EUI) of a two-level library. This study employs a quantitative approach using Revit Building Information Modelling (BIM) simulation software. Variations in the building parameters simulated are building orientation, envelope material, thermal insulation, and envelope treatment. The study outcome indicates that various permutations of the green envelope presented various impacts on the EUI of the library. The double-glazed windows and green roof contributed a substantial improvement on the EUI indicated by the lowest mean EUI of 188 and 193 kWh/m²/year respectively compared with the control building that recorded a mean EUI of 226 kWh/m²/year. This study verifies the benefits of the green envelope as a strategy for energy efficiency. The credible results also support the application of building simulation to improve envelope design and to predict the possible outcomes of design alternatives before the building is constructed.

Keywords: *Green Envelope; Energy Efficiency; Energy Consumption; Building Information Modelling (BIM).*

INTRODUCTION

Cities in developing countries are confronted with increased population and growing need for resources and energy. Between 2012 and 2040, a 48% increase in global energy usage was projected by the US Energy Information Administration (Sieminski, 2016). The energy usage for air-conditioning buildings accounts for 40% of global energy use. Through 2050, Asia would anticipate about 80% of building air-conditioning demand, according to the International Energy Agency (Sieminski, 2016).

In urban areas, there are commonly discussed topics in building science, among them passive design strategies such as building configuration and placement, envelope design, sun shading systems, and thermal insulation (Chen et al., 2018). When choosing the green building envelope, which functions as the first level of protection against the elements due to its passive design advantages, architects should consider the green building framework (Del Grosso and Basso, 2010).

The swift rise in building energy demand needs alternative approaches such as sustainable strategies to reduce excessive usage of energy and resources (Ali et al., 2018). This paper aims to analyse how green envelope options affect the Energy Usage Index (EUI) of a two-storey library building.

LITERATURE REVIEW

Green Envelope

The fundamental purpose of the building envelope is to protect the indoor spaces of a building against outdoor climatic threat where it functions as a physical barrier in between the two environments (Mirrahimi et al., 2016). Components of building envelope constitute walls, floors, roofs, and apertures of windows and doors. The basic principles of the building envelope are resistance to climate and thermal, air-barrier, heat insulation, illuminance and aural characteristics (Nasser, 2016) and fulfilment of these criteria makes up an effective building envelope (Al-Homoud, 2005).

Building orientation, building form, structure, passive cooling systems, glazing and sun shading are also applicable criteria for evaluating the envelope (Gago et al., 2013) subjected to weather conditions. A green building energy strategy is to design a building that adopts net-zero energy (NZE) concept based on a strong emphasis in passive design to optimise natural light and passive cooling (Kibert, 2016). Architects should design buildings that provide excellent user experience while performing at the cost of minimal energy without compromising the quality of users' experience such as visual, acoustic and thermal comfort.

In brief, a green envelope may be described operationally as a physical barrier which provides great indoor human comfort against outdoor threats while operating on efficient energy consumption with a barely adverse environmental impact.

Envelope for Tropical Hot-Humid Climate

The best type of building envelope is the envelope that is designed to meet the needs of the local weather condition. In the context of the tropical climate, the primary design strategy of a building envelope to protect the indoor spaces against solar radiation and heavy rain while optimising sufficient natural ventilation into the building (Al-Tamimi and Fadzili, 2011).

The building envelope can be appraised as successful by its ability to shelter indoor spaces of a building from outdoor environment, maintain acceptable indoor air quality, maintain durability, admit natural light and have energy efficient properties (Liu and Baskaran, 2003). The components of a building envelope include the following items:

i. Walls. It is essential for designers to be familiar with the theory of thermal transmission through the walls (Hoo et al., 2016). Incorporation of an active system in thermal mass and insulation is responsible for increased energy consumption in the building. The use of an active system can be alleviated by adopting a passive design approach, including walls which makes up a big fraction of a building enclosure, thus allowing significant contribution towards energy saving and efficiency.

ii. Insulation. Insulation limits the thermal transmittance into the building from solar radiation (Kreith et al., 2012). A sustainable approach to architecture mostly involves insulation as part of an energy efficiency strategy, thus minimising the excessive heat gain from outside, to maintain existing thermal state.

iii. Windows. Window apertures permit deeper access of ventilation and natural light into the buildings. However, this causes the surface of the windows to be subjected to

thermal transmittance, where specific design treatment is required in order to achieve acceptable thermal comfort (Lyons et al., 2000). Improvements of the fenestration such as high-performance window glazing can be tailored with a wide range of selection and performance according to the specified needs in order to achieve optimal energy efficiency (Salleh et al., 2018).

iv. Roof. Compared to the traditional roof without insulation, the green roof is more efficient in controlling heat gains with recorded reduction of 95% in heat gains and 26% in heat loss besides overall reduction of 47% in heat flow during the observation period (Liu, 2005). Since Malaysia experiences the hot and humid tropical climate, incorporation of extensive green roofs in buildings will contribute positively towards energy saving by a significant drop in energy usage due to the reduction of the cooling load. (Shams et al., 2018).

v. Building Orientation. Orientation according to the cardinal compass points is the direction of the building. Accurate building positioning that complements building form in design strategy is a significant move in creating a building with "passive thermal and visual comfort" (Sherif et al., 2012). A practical building orientation benefits the building mass by reduction of heat/cooling loads and ensures optimal use of free energy from natural lighting and ventilation.

vi. Sun shading and Redirection of Sunlight. Sun shading is a critical strategy in achieving "visual and thermal comfort" (Ochoa et al., 2012). Various types of sun-shading devices include overhangs, louvres and vertical fins. Devices such as light shelves and baffles work by redirecting natural lighting. Sun-shading devices function in filtering visual glare and reduce thermal transmittance from direct sun exposure through windows yet allow generous visible light and views to penetrate the building. These applications can keep the building envelope away from excessive sunlight exposure, thus contributes to the reduction of cooling loads (Tzempelikos et al., 2007).

Energy Efficiency

One of the strategies aiming at reducing energy consumption is energy-efficient building design. An energy-efficient building is mainly designed to perform similarly or more effectively with lower energy consumption compared with other similar buildings (Marszal et al., 2011). "Site planning and microclimate, building scale and form, construction detailing, building orientation, thermal performance and fenestration systems" are the key factors affecting building energy consumption (Aun, 2009).

The core strategy of building design within Malaysian tropical hot-humid climate is to construct buildings which provide adequate shading by protecting users from solar radiation while not jeopardizing the quality of indoor environments such as "thermal and visual comfort" (Aun, 2009). Incorporation of energy-efficient strategy helps to improve building envelope to be greener by reducing energy consumption passively (Castleton et al., 2010). Therefore, it is essential to highlight the potential of the green envelope and consider its application in energy-efficient building design.

GBI Rating System

The Green Building Index (GBI) is the green rating tool for buildings recognised by the Malaysian industry to promote green practice in the building sector and to educate

professionals in the built environments about the need to adopt green culture and to raise awareness between the general public about environmental issues besides responsibility of taking care the environment for future generations (Greenbuildingindex, 2018).

The non-compulsory GBI rating tool offers architects and building owners with a platform for designing and building sustainable, energy conscious buildings that provide a high-quality indoor environment with optimum energy and water consumption, improve connectivity and incorporate recycling and innovation in building projects to reduce their impacts to the environment.

Malaysian Standard MS 1525:2007

MS 1525:2007 is a code of practice for energy efficiency and utilisation of sustainable energy for non-residential buildings. MS1525:2007 is a "Code of Practice (CP) and is incorporated into UBBL hence becomes part of a By-law". Under this Code of Practice, architects and engineers are required to submit OTTV and RTTV calculations (Malaysian Standard MS 1525:2007, 2007). The Malaysian Standards are prepared to provide guidelines and criteria on energy efficiency throughout the operation period of buildings.

As only the minimum requirements are described by the MS1525:2007, architects are allowed to model and install equipment above that stated in the Standard. The recommendations for good practice in renewable energy applications are:

"• Optimise passive solar design
 • Incorporate passive cooling strategies
 • Utilise environmental cooling through natural means such as vegetation, site planning, landscaping and shading
 • Optimise the availability of renewable energy resources such as solar heating, solar photovoltaics, solar lighting and solar-assisted technologies."

The classifications of the requirements for energy efficiency are as follows:

"• Designing an efficient lighting system (Clause 6)
 • Minimise wastage in electrical power distribution equipment (Clause 7)
 • Designing efficient air-conditioning and mechanical ventilation systems (Clause 8)
 • Designing a smart energy management system (Clause 9)."

<div align="right">(Malaysian Standard MS 1525:2014, 2014)</div>

Malaysian Standard MS 1525:2014

MS 1525:2014 "is a second revision based on MS1525:2007 is a code of practice for energy efficiency and utilisation of sustainable energy for non-residential buildings" (Malaysian Standard MS 1525:2014, 2014). Thanks to the "Technical Committee on Energy Efficiency in Buildings (Passive) with the support of experts from Industry Standards Committee on Building, Construction and Civil Engineering, this Malaysian Standard" received major modifications as follows:

"• improvement on the description of passive design strategies especially daylighting and facade design;
• diagrammatic representation of shading coefficients;
• improved power intensities and inclusion of Colour Rendering Index (CRI);
• efficiency classification for motors according to IEC;
• introduction of MPLV (Malaysia Part Load Value); and
• prerequisites for optimising EMS operation."

<div align="right">(Malaysian Standard MS 1525:2014, 2014)</div>

Concept of OTTV

The Overall Thermal Transfer Value (OTTV) calculates the value of the thermal transfer from solar radiation through the building envelope into the indoor spaces of a building. OTTV measures the building performance in terms of energy consumption by its envelope. OTTV aims at minimising the heat gain via the building envelope that contributes to cooling load reduction. The building envelope OTTV maximum value is set at 50 W/m2 as specified by MS1525:2014.

The definition of OTTV suggests that the building's exterior is completely sealed. Solar reflection from the surrounding structures and internal blinds and curtains to shield sunlight are not included in the OTTV equation.

The following are possible improvements to the OTTV value:

"i.   Determine which envelope component that contributes the highest value to OTTV.
 ii. Reanalyse Solar Correction Factor (CF) based on Table 4 of MS1525:2014.
 iii. Revise on glass selection based on its shading coefficient (SC) value.
 iv. Reconsider sunshades and its shading coefficient (SC) value as per recommended in Tables 5, 6 and 7 of MS1525:2014.
 v.   Consider the adjustment of Wall-to-wall ratio."

<div align="right">(Malaysian Standard MS 1525:2014, 2014)</div>

Concept of RTTV

The development criteria of Roof Thermal Transfer Value (RTTV) are specifically designated for roofs with skylights in order to reduce solar radiation via the roof. The RTTV value is set at a maximum of 25 W/m2 (Malaysian Standard MS 1525:2014, 2014). Compared with OTTV, it is easier to calculate the RTTV value for the roof without skylight, where glazing properties need to be considered (Vijayalaxmi, 2010).

RESEARCH METHODOLOGY

This study employs a quantitative approach using Revit Building Information Modelling (BIM) simulation tool. Variations in the building parameters simulated are building orientation, envelope material, thermal insulation, and envelope treatment. In contrast to comparative study, this methodology uses the measurements collected from the simulations as primary data which are highly precise (Aksamija, 2013). This paper describes building simulation as a reliable technique to calculate the efficacy of building envelopes, which matches the study's complexity.

Building Simulation using Autodesk Revit

Revit is an effective BIM simulation tools that can be employed as a method for collaborative analysis and documentation of actions during the design process (Krygiel and Nies, 2008), where the project team could analyse alternative solutions and informed decisions could be made based on the collected data (Kensek and Noble, 2014). Immense experience, coupled with broad knowledge in BIM practice helps the project team to improve project productivity and cost-efficiency with reduced mistakes (Mohd et al., 2017). This expertise assures the completion of high-performance buildings within the expected construction timeframe (Muhammad et al., 2017).

A sequence of building simulations was performed using Autodesk Revit using settings and parameters that matched the actual building conditions. Instead of monthly, the effect of the green envelope on the energy efficiency of buildings is measured based on annual building performance, where significant variations between the variables can be anticipated.

Parameters of Green Envelope

The simulations are expected to show the output of each type to confirm the energy consumption impact of the related green envelope strategy and to better comprehend envelope actions and quality. A more efficient envelope is shown by the lower energy consumption.

Upon determination of the base case (control), five green envelope variants including wall insulation, double-glazed window, green roof, design orientation (north-south orientation) and the use of sun-shading devices (Figure 1).

| Base Case (Control) | Insulated wall | Double-Glazed Window |
| Green Roof | Orientation (north-south) | Sun-shading Device |
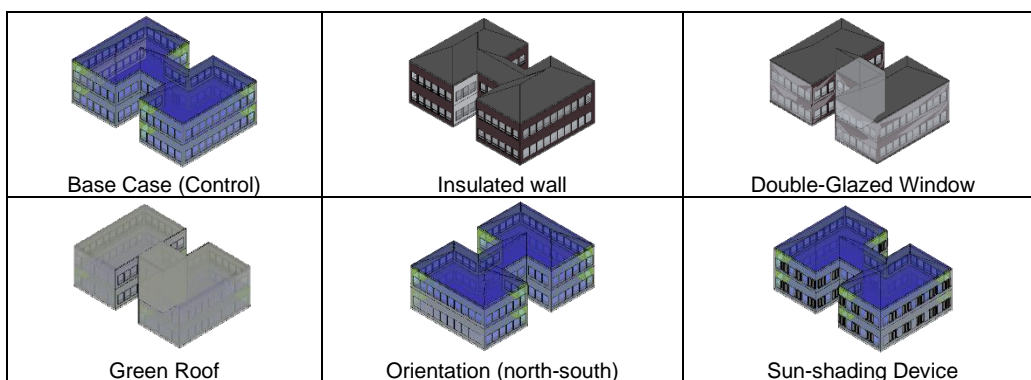
Figure 1. Variances of green envelope

The first step is to create the base case or the control building in 3D model of a pre-designed library that includes the building skin. The library envelope components include a conventional wall, typical windows, conventional roof design and concrete flooring as control unit. The components are assembled using default architectural construction settings readily available in Revit software.
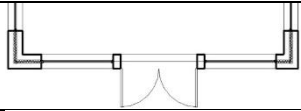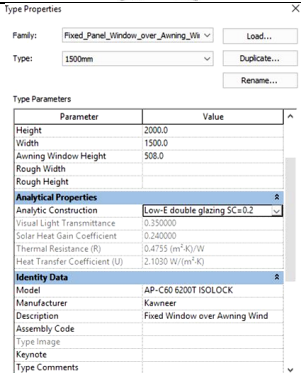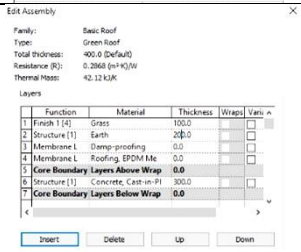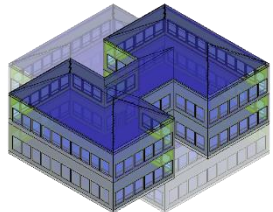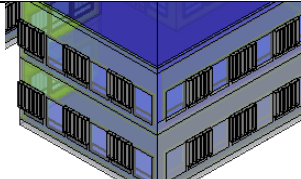
Next, the control building is oriented facing east-west, and the setting used is to follow the environmental conditions of Kajang, Selangor for a 12 months period (January-December). The climatic parameters are maintained as constant as shown in Figure 1 top left box.

For all simulation runs, the construction materials selected from Revit library are maintained the same for all simulations. The simulation is first carried out with a control model as a case study on energy efficient building. Autodesk Revit tracks and delivers the output of simulations. The simulations are replicated using various models with different green envelopes applications on the building models, as displayed in Table 1.

Table 1. Fixed environment settings of Revit building simulation

Location	Jalan Bukit, Taman Kajang Jaya, 43000 Kajang, Selangor, Malaysia
Weather Station	1446802 (GPS Location – Malaysia)
Coordinate	2.9935° N, 101.7874° E
Floor Area	827 m^2
Exterior Wall Area	571 m^2
Average Lighting Power	12.70 W/m^2
Building Occupancy	83 people

Table 2. Variable setting of Revit simulation

Wall insulation	Wall insulation is positioned within exterior wall and indicated on building plan.	
Double Glazed Window	The glazing property is set to match Low-E double glazing with shading coefficient value of 0.2	
Green Roof	The pitch roof is changed to flat roof with 10° incline degree to replicate typical green roof construction. The roof composition is changed to green roof composed of turf finish, earth substrate, damp-proof membrane and in-situ concrete slab.	
Building Orientation	The entire building model orientation is shifted to north-south orientation	
Sun-shading Device	Sun-shading devices are applied on windows. The sun shading device emulates vertical louvers, which is typical strategy in tropical climate, with response to study of Malaysian context.	

Finally, results and data from all simulations are converted into Excel sheet bar charts. Chart and figures are analysed, discussed and concluded.

RESULTS AND FINDINGS

In the energy analysis report generated by building simulation there are many types of energy performance. Due to the relevant contribution factors of this assessment, the following energy aspects were selected: construction performance, annual energy use and cost, annual electricity use, intensity of energy consumption (EUI), green energy efficiency envelope and yearly energy use. The debate on the conclusions focuses mainly on energy efficiency and consumption.

Annual Energy Use

Figure 2 illustrates the overall yearly energy usage of various green building envelope types. When compared to control, energy consumption made by green roof showed a significant decline of 62.6% from 207,693 kWh down to 77,738 kWh. However, the use of double-glazed windows reported more than twice the energy consumed by the green roof at 163,368 kWh.
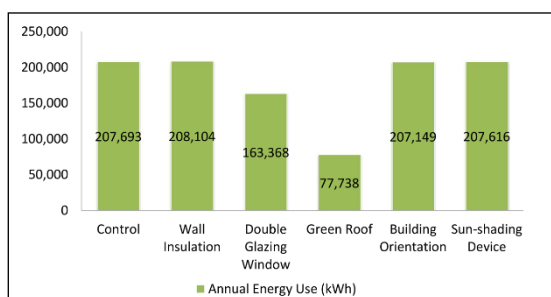
Figure 2. Annual Energy Use of Green Envelope

Electricity Usage

The total yearly energy use (electricity) analysis based on a variety of green envelopes applications is shown in Figure 3. As an overview, each green envelope shows almost the same energy usage for lighting and miscellaneous equipment, except for the green roof displaying a reading of 35.612 kWh, 70.6% decrease of power consumption in MVAC (Mechanical Ventilation and Air-Conditioning) less than the control building.
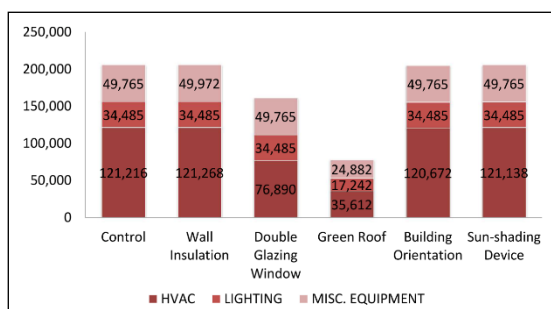
Figure 3. Electricity consumption breakdown of Green Envelope

Energy Use Intensity (EUI)

Figure 4 shows the building simulation outputs of the yearly electricity energy use intensity (EUI), in which the green roof application can be appraised as the most efficient green envelope strategy in EUI with a decrease of 25.1% from the control with an annual energy saving of 63kWh/m2/year. The double-glazed window is second to the green roof with a mere difference of 10kWh/m2/year.
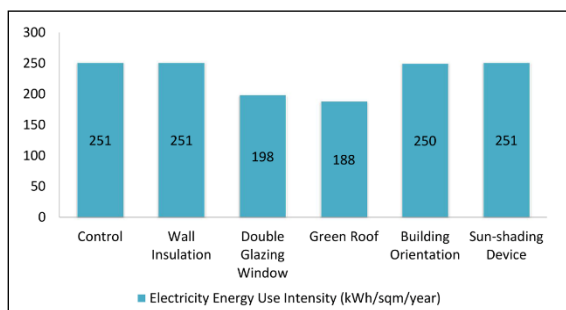
Figure 4. Energy Use Intensity of Green Envelopes

Energy Efficiency of Green Envelopes

For each sustainable envelope technique, Figure 5 indicates the overall energy efficiency. The efficiency results are generated by building simulation, taking all energy consumption measuring factors into account such as total energy consumption, total power (electricity) consumption and EUI.
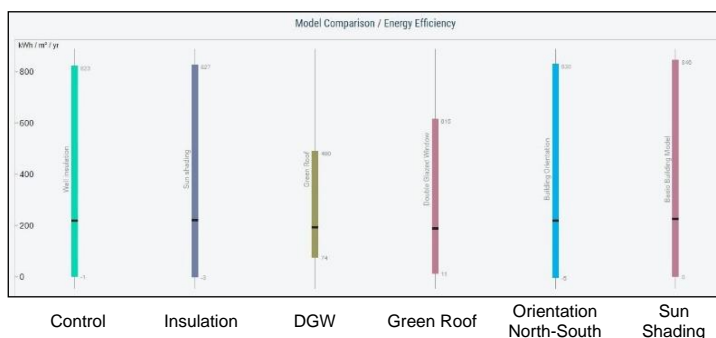
Figure 5. Energy Efficiency of Green Envelopes

Table 3. Overall Energy Consumption of Green Envelope (kWh/m^2/yr)

Model	Basic Control Model	Wall Insulation	Double Glazed Window	Green Roof	Building Orientation	Sun Shading
Maximum	846	823	615	490	830	827
Mean	226	218	188	193	218	220
Min	0	-1	11	74	-5	-3

Table 3 also displays the peak, average and minimum energy consumption levels for each green envelope. As an overview, the reduction from the base control building is recorded by each green envelope strategy. The reduction in energy consumption verifies the green envelope approach as energy efficiency and energy consumption reduction strategy.

The best way to detect the most energy-efficient green envelope is to compare the mean energy consumption across each envelope policy based on the wide range of maximum and minimum value differences. The green roof is outperformed by the double-glassed window following a persistent and substantial decline for each energy study, showing obviously the lowest mean when all actions are taken into account. By contrast with other sustainable envelope approaches, the double-glazed window therefore becomes the most energy efficient.

CONCLUSION

As part of a passive architectural design, the green envelope strategy includes application of wall insulation, building position/orientation and sun shading devices. The research aims to investigate the applications of green envelope strategies which contribute to energy efficiency of buildings based on the results of computerised building simulations. The double-glazed windows added most to energy efficiency in the house with the significant reduction in the energy consumption.

Revit construction simulations proved that practical improvements in window systems could reduce building energy consumption by 30 percent with the integrations of two-glazed windows into the Green Envelope. The trend is compatible with the different energy analysis: MVAC, the energy usage, which contributes significantly to the annual saving of energy resources.

The hypothesis is further checked in Revit by means of building modelling using the green roof as a green envelope technique. The green roof well responds to the hot and humid tropical environment, which reduces the cooling pressure of building by reducing amount of solar radiation under its roofs, thus increasing its energy efficiency.

Revit's energy analysis report demonstrate that green roof efficiency decreases electricity consumption to less than half as compared to green roof buildings. The findings therefore justify the need for RTTV requirements for MS 1525:2014, which explicitly are designed to improve energy efficiency.

This study has shown that different types of green envelopes make a positive contribution to improving the energy efficiency of a library building through the optimisation. The findings were accomplished by the use of construction modelling as a reliable research methodology, which clearly demonstrated that different green integration influences the energy consumption of a library. In short, the application of building simulation as a research methodology is highly recommended, which helps to enhance the authenticity and accuracy of theoretical statements.

Additional research could be carried out to investigate the impact on building quality of varying width or thickness of each component of the green envelope. Besides, the use of different material as building envelope as different materials exhibits different thermal transmittance performance. Other design method and solutions can be evaluated and anticipated through the advancement of BIM software.

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FREQUENCY ANALYSIS ON PEAK DISCHARGE TOWARD THE CUMULATIVE FLOATABLE LITTER LOAD: CASE STUDY AT LOG BOOM SUNGAI BATU

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Abstract
The accumulation of floatable litter in the river is mainly influenced by the increasing number of human populations, rapid urbanization and development which indirectly lead to the changes of hydrological processes in river discharge, decreasing the water quality and aesthetical value of the river. The main objective of this paper is to determine the cumulative floatable litter load captured at the log boom during the extreme events by using the Gumbel distribution method for frequency analysis in river discharge of Sungai Batu. The annual maximum river discharge for a period of 35 years (1982 to 2016) was used in Gumbel distribution method to obtain the discharge for different return period (2, 5, 10, 25, 50, 100, and 200). The result shows that the estimated discharge (103.17 m³/s) can estimate the cumulative floatable litter load (53267.27 kg/day) at 50 years return period. The R^2 value obtained from non – linear regression analysis is 0.9986 indicate that Gumbel distribution is suitable to predict the expected discharge of the river. This study is very crucial for the related agencies in highlighting this environmental issue for their future references which can be used as a guideline during the decision-making process in making better improvement.

Keywords: *Discharge; Floatable litter; Frequency Analysis; Gumbel Distribution Method; Return Period.*

INTRODUCTION

The emergence of floatable litter issue along the river system in Malaysia is very challenging. This problem had been raised due to the rapid population growth, urbanization and land development. These changes indirectly have resulted to the change of hydrological processes in river flow and discharge, deteriorating in water quality and its aesthetical value. Furthermore, according to Balas et al. (2001); Malik and Manaf (2018), there are still limited studies which regard on the floatable litter in the river. The reason for this situation is mainly subjected to the complexity in carry out the site assessment that needed a wide temporal integrative sampling method (Gasperi et al., 2014).

According to Armitage (2003), the floatable litter can be described as an urban litter. They can be easily found in the river system due to the lack of environmental awareness which mainly derived from fly tipping (Williams and Simmons, 1999; Gasperi et al., 2014) and littering activities (Franz and Freitas, 2012). The tourism activity (Sadri and Thompson, 2014), inefficient of riverine litter management and maintenance (Malik and Manaf, 2018) also can be contribute to the emergence of floatable litter load in river system. These conditions can bring a much bigger threat to the health of river, the quality on water usage to people, sustainability of environment and also can negatively affect the socio-economic and public health.

The accumulation of floatable litter can be influenced through several natural causes in terms of climatic and hydrological factors such as; seasonality on climatic condition of rainfall

pattern (McCormick and Hoellein, 2016) and surface runoff (Gasperi et al., 2014; Alam et al., 2017). Rainfall events can generate the runoff, which has the capability to transport the floatable litter from land-based sources into the main river system and it was consistently stated by Castro-Jiménez et al. (2019). Secondly, the physical characteristic of the catchment (Armitage and Rooseboom, 2000; McCormick and Hoellein, 2016; Sidek et al., 2016) also can influence the hydrological response within the catchment. This condition can be assessed in morphometric parameters such as linear, areal and relief aspects. Although there is lack of scientific studies on hydrological response in terms of time to peak, time of concentration and peak discharge from morphometric parameters of the catchment toward the accumulation of floatable litter in river system, it has to be understand that the valuable information on hydrological response derived from morphometric parameters of the catchment can significantly contribute in estimating the flow direction and total discharge, especially in hydraulic structure planning (Salami et al., 2016). The type of land use (Williams and Simmons, 1999) also can affect the accumulation of floatable litter. The combinations for each type of land use for different catchments have led to the various percentage number of impervious surfaces. The level of development in respective area can be determined through the number of impervious surfaces. The high percentage numbers of impervious surface are able to generate more runoff especially during the high intensity of rainfall events, subsequently able to mobilize the floatable litter into the main river.

Furthermore, the dissemination of floatable litter in waterways system is varied and widely disperse as they are depending on the different types classification of buoyancy such as "persistent buoyant", "short-time buoyant", and "non-buoyant" (Rech et al., 2014). Floatable litter movement along the river is generally governed by two natural factors which are known as the condition of river flow (Allison et al., 1997; Williams and Simmons, 1997; Galgani et al., 2000) and wind direction (Fitzgerald and Bird, 2011; Rech et al., 2014). Due to these two natural factors, about 80% of litters derived from riverine input have been found in the coastal beach area (Araújo and Costa, 2007). Besides that, the vast percentages of plastic waste with approximately 95% have been found in the shorelines area, seafloor and sea surface area (Galgani et al., 2015).

The issue in managing the emergence of floatable litter in the river system have been found through the installation of log boom. Log boom can be defined as the barrier to capture the highly buoyant materials in any waterway system (Department of Planning, 2010). In Malaysia, Department of Irrigation and Drainage (DID) is entrusted to install the log boom at downstream area of a catchment with low velocities of water (Allison et al., 1998; Fitzgerald and Bird, 2011) as the floatable litter can be easily intercept in low velocities condition. During extreme rainfall events or flood occurrence due to high rainfall intensity, the log boom might not properly work as planned. This condition was mainly caused by the large river discharge (Syafalni et al., 2015). According to Lun et al. (2011), high distribution of rainfall will directly increase the level of water and thus will cause high discharge volume. Based on a study by Ab Ghani et al. (2011), the floatable litter was easily transported along the downstream during high flow condition. This finding also is supported by previous studies carried out by Gasperi et al. (2014). This is because of the floatable litter had overspill over and under the log boom due to large forces and inability of log boom to evade the high flows (Department of Planning, 2010). As a consequence, the floatable litter have a probability to disperse along the river until it sinks or deposited at the river bank or mobilized toward the coastal area. Therefore, due to the complexity in estimating floatable litter load intercept at

log boom especially during the extreme events, this paper attempts to determine the cumulative floatable litter load captured at the log boom during the extreme events by using the Gumbel distribution method for frequency analysis on river discharge of Sungai Batu. According to Alam et al. (2018), the application of frequency analysis was purposely used in estimating the magnitude value of event corresponding to the given return period. Besides that, Xu (2002) has stated that the hydrologists also have supported that the stochastic model is employed to make an estimation frequency toward the occurrence of extreme events. However, there is lack of study in describing the effect of extreme events toward the accumulation of floatable litter in the river system. Thus, the output from present study can serve as a new input of knowledge and references, especially for decision makers in enhancing the better improvement for long term planning in handling this environmental issue.

MATERIALS AND METHOD

Background of Study Area

Sungai Batu catchment encompassed within the south area of Selangor state; represent the upstream area of Sungai Batu and Federal Territory of Kuala Lumpur; represent the downstream area of Sungai Batu (Figure 1). The catchment with an area of approximately 103.50 km^2 with an elevation stretched from 40 meter to 480 meters. During November 2012, Sungai Batu catchment has confronted with extreme flash flood event that affect several villages such as *Kampung Nakhoda*, *Kampung Laksamana*, *Kampung Sungai Tua Gantian*, *Kampung Sungai Kertas* and *Kampung Ulu Yam Bharu* (BERNAMA, 2012). This severe situation had caused serious properties damage. This was mainly due to the high rainfall intensity in monsoon season on November with maximum annual discharge; 56.57 m³/s. Thus, Department of Irrigation and Drainage (DID) has implement the retention pond which known as *Kolam Takungan Batu.* The retention pond was purposely used in River of Life (RoL) project for flood mitigation measure.
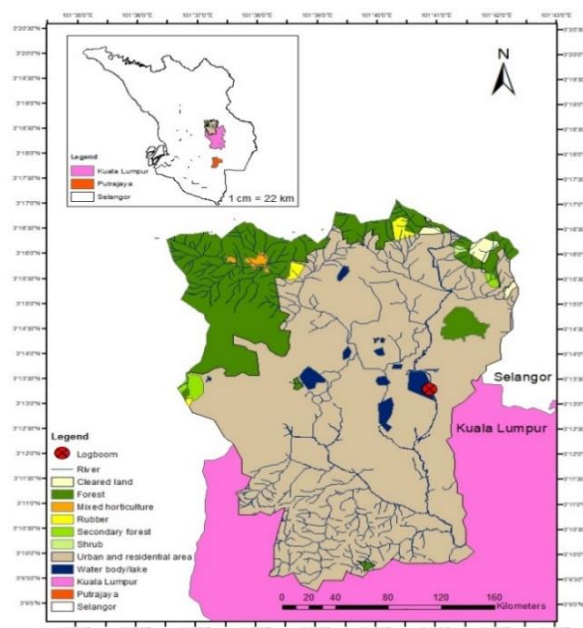
Figure 1. The site of log boom (red circle) within Sungai Batu catchment

Most of the Sungai Batu catchment contains with mixed development including residential area, commercial area and industrial area. The anthropogenic human activities such as littering and various factors in the study area have led to critical condition of floatable litter in the river system. Therefore, in such situation, DID has installed one log boom (Figure 2) in the river system which lies within the coordinate 3°13′17.4″N, 101°40′49.6″E. The purpose of log boom installation was to trap the highly visible and floating litter (>5mm) which subsequently ameliorating the floatable litter from being propagated further toward downstream area. According to Department of Irrigation and Drainage (2012), the log boom installation also required the catchment area with more than 200 hectares.

Figure 2. The vast quantity of floatable litter intercepted at log boom Sungai Batu

Data Collection

The estimation on accumulation of floatable litter load captured at log boom of Sungai Batu at different return period based on developed equations was highly subjected to two main data collection; (1) amount of floatable litter load, and (2) annual peak discharge data. The field sampling for floatable litter have been carried out in 14 days within the period from March to the end of April 2016. The field sampling for floatable litter collection was computed based on the time interval approach for every n^{th} hour of bucket conveyer to elevate the floatable litter (Aminy, 2012). The field sampling also was highly subjected to the contractor schedule for cleaning operation day and also the efficiency of bucket conveyer to elevate the floatable litter to waste collection at sampling site.

In terms of hydrological data collection, the observed annual peak discharge data beginning from 1982 to 2016 (35 years) was directly obtained from DID, Malaysia (Figure 3). The greater length of recorded discharge data time series was able to provide the better results in flood frequency analysis (Vivekanandan, 2015). Besides that, according to Holmes and Dinicola (2010), the minimum data with 30 years and no gaps was classified as the satisfactory period of time series. Thus, with the satisfactory annual peak discharge value from hydrologic time series data, the frequency analysis with Gumbel distribution function was employed in this study by following the standard methodological procedures. The gauged method was included in the annual series of peak flow rate analysis (Mateo Lázaro et al., 2016). The historical discharge data will serve the time and space variability. The data also was very useful in the project that associated with surface water planning and design; and operational management in post-construction project (Ball et al., 2019).
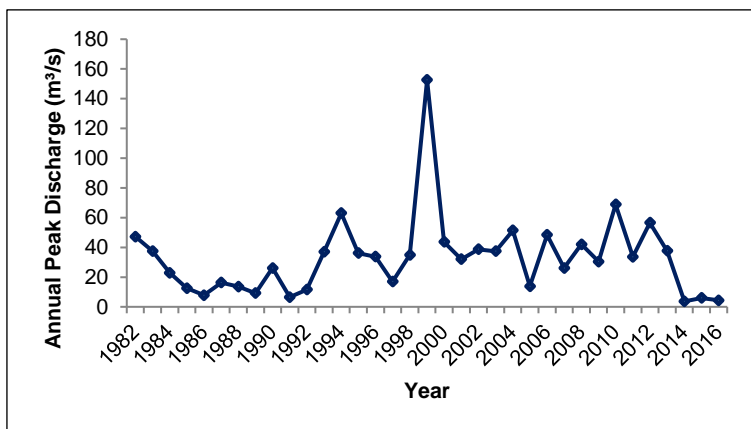
Figure 3. Annual peak discharges for Sungai Batu from 1982 to 2016

Gumbel Distribution Function

Generally, the Gumbel distribution function was frequently applied in various statistical hydrological studies in order to predict the extreme hydrological events over the return period (Syafalni et al., 2015; Alam et al., 2018). The Gumbel distribution function was also known as Extreme Value Type I distribution function. The frequency analysis is the most important statistical tools and subjected on the provided historical discharge data to predict the probability of occurrence extreme events in the future. The frequency discharge (in m^3/s) with specified return period (X_T) for Gumbel distribution function can be expressed as;

$$X_T = \overline{x} + K_T . \sigma_x \qquad \text{(Eq. 1)}$$

Where each statistical variable of time series was computed by using:

- Gumbel frequency factor (K_T) for adjustment method;

$$K_T = - \frac{\sqrt{6}}{\pi} \{0.5772 + \text{In}[\text{In}\frac{T}{T-1}]\} \qquad \text{(Eq. 2)}$$

- Arithmetic average $(\overline{X})$;

$$\overline{x} = \frac{1}{n} \sum_{i=1}^{n} x_i \qquad \text{(Eq. 3)}$$

- Sample standard deviation (σ_x);

$$\sigma_x = \sqrt{\frac{1}{n-1} \sum_{i=1}^{n} (x_i - \overline{x})^2} \qquad \text{(Eq. 4)}$$

Data Analysis

The regression and correlation analysis have been applied in this study for three main purposes such as; (i) to evaluate the strength and derive the estimation equation from the relationship between cumulative floatable litter load and cumulative discharge, (ii) to validate

the relationship between simulated discharge, Q_{sim} and observed discharge, Q_{obs} at different return periods, and (iii) to evaluate the strength and derive the estimation equation from the discharge over return period in frequency analysis.

RESULTS AND DISCUSSION

Influence of Cumulative Discharge toward the Accumulation of Floatable Litter Load

The accumulation of floatable litter that has been intercepted by log boom was mainly derived from the domestic waste. The vast quantity of floatable litter observed in the study area with various types of socio-economic activities was associated with climatic condition, specifically in hydrological parameter (Mohd Shah et al., 2016; Alam et al., 2017). In the present study, the result had revealed that the cumulative floatable litter load and cumulative discharge was highly associated with coefficient of correlation, r was 0.9561 and coefficient of determination value, R^2 was 0.9663. This indicates about 96.63% of the variation in cumulative of floatable litter load can be explained by the variation of discharge (Figure 4). The plot graph in Figure 4 has shown that the amount of floatable litter load was significantly increasing as the discharge increased. This condition was consistently agreed by Alam et al. (2017) that hydrological parameters was significantly act in conveying the gross pollutant into waterways system, in this case referring to floatable litter. Based on the plot graph, about 2281.72 kg/day of floatable litters load have been conveyed when the discharge was at 0.19m³/s in the beginning and intercepted at log boom. Throughout the entire 14 days of field sampling, the cumulative plot of floatable litter load revealed that about 29161.73 kg/day was intercepted when the discharge plot at 4.65m³/s. The result from this study was consistently aligned with Gasperi et al. (2014), where the floatable litter such as plastics had emerged in river system was affected through discharge. The accumulation of floatable litter load which have been influenced by cumulative discharge served a significant output to show the effects of point source pollution derived from land-based sources and its association with hydrological response.
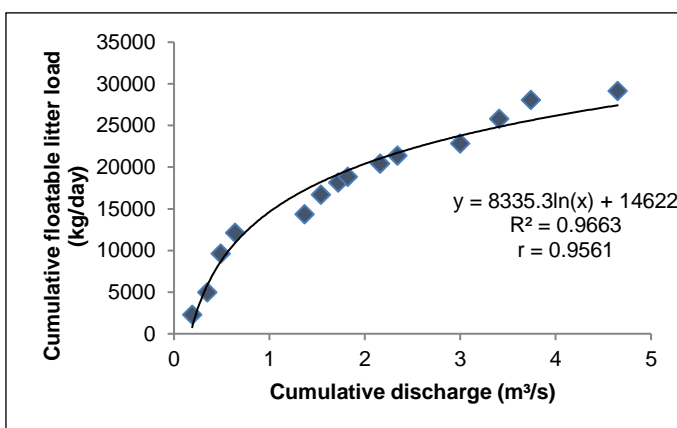
Figure 4. Cumulative discharge versus cumulative floatable litter load at log boom

Additionally, the hydrological response from discharge also have been influenced by different types of land use (Lariyah et al., 2011); physical characteristics of the catchment (Marais et al., 2001) in terms of their morphological characteristics such as linear aspect, relief

aspect and areal aspect. The hydrological response also can be influenced by the impervious surface within the catchment. The developing area had increased the percentage of impervious surface which subsequently affect toward the hydrological process and peak discharge (Ab Ghani et al., 2011). The high percentage of impervious surface are able to generate high volume of discharge and able to mobilize the floatable litter along the river until it reached and intercept by log boom in downstream area.

Discharge Frequency Analysis

As stated previously, Sungai Batu had confronted with severe flash flood event that affect several human inhabitants, their socio-economic activities and properties damage. In order to ameliorate the risk that derived from extreme flash flood event, the frequency analysis for 35 years of largest observed discharge in time series had been carried out to understand the hydrological characteristics of river (Bhat et al., 2019) and to estimate the annual peak discharge over different return periods using Gumbel distribution function. Based on the Figure 5, the plots of discharge over different return period (2, 5, 10, 25, 50, 100 and 200 years) for Sungai Batu obtained through Gumbel distribution function have shown that the discharge plots were increasing with the increase of return periods ($R^2 = 0.9986$). It shows that the frequency analysis also was the most practical approach to predict the long term of river flow behavior and to anticipate the future of extreme events based on the historical data. Thus, the frequency analysis had described that the discharge having a recurrence interval of 2 years and more would able to exceed beyond the carrying capacity of Sungai Batu. In order to ameliorate the impact of recurring flood in this affected area, DID had make an initiative through retention pond, known as *'Kolam Takungan Batu'* for flood mitigation measure project.
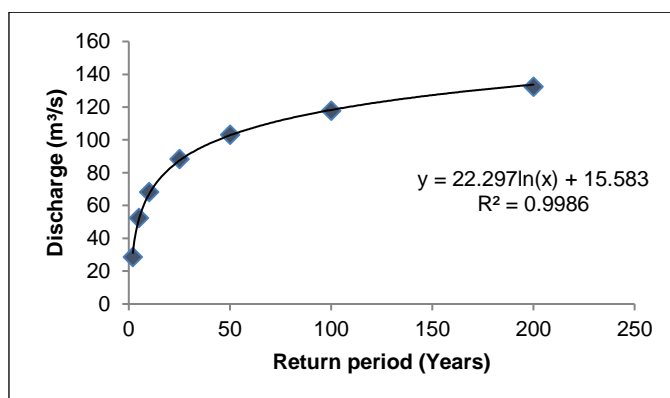
Figure 5. The discharge plots over different return period for Sungai Batu obtained through Gumbel distribution function

From the graph shown in Figure 5, the equation derived with y = 22.297In (x) + 15.583 will be employed to validate the relationship between simulated discharge, Q_{sim} and observed discharge, Q_{obs} at different return periods. The statistical of model performance prior to determine the estimation of cumulative floatable litter load intercepted at log boom have been carried out through correlation and regression analysis. Based on Figure 6, the result from validation test revealed that there was a positive with strong relationship between observed discharge and simulated discharge ($R^2 = 0.9986$, r=0.9993). This condition indicates that there was a less error of variance and suitable to estimate the simulated discharge.
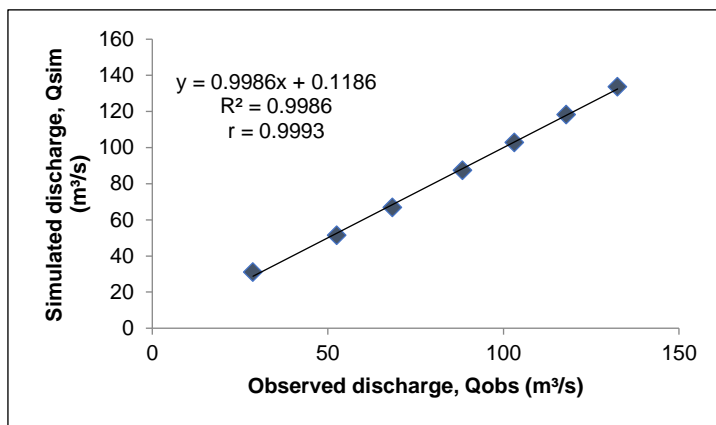
Figure 6. Validation test between observed discharge and simulated discharge

Estimation on Cumulative Floatable Litter Load over Different Return Period

The estimation on cumulative floatable litter load over return period have been computed and systematically presented in Table 1. The derived equation from Figure 4 with y = 8335.3In(x) + 14622 have been applied to estimate the cumulative floatable litter load by using the value of estimate discharge over return period. The result has depicted that the probability on cumulative of floatable litter load to be intercepted at log boom will be increased over the different return period (Figure 7). The estimated discharge that derived from Gumbel distribution function have the capability to estimate the accumulation of floatable litter load at log boom Sungai Batu, where; 28.70 m³/s (42603.73 kg/day), 52.58 m³/s (47648.53 kg/day), 68.38 m³/s (49839.41 kg/day), 88.35 m³/s (51975.11 kg/day), 103.17 m³/s (53267.27 kg/day), 117.87 m³/s (54378.00 kg/day), and 132.52 m³/s (55354.60 kg/day) at 2, 5, 10, 25, 50, 100, and 200 years return period, respectively. As the floatable litter tends to easily intercept at log boom during low flow condition and overflow during high flow condition, it was expected to describe that any recurring flood event with the 2 years and above of return period would have the probability in capturing or overspill the floatable litter beyond the log boom capacity. The results of this study are expected to be beneficial as supported tool during the process of decision making.

Table 1. The discharge rate at different return periods derived from Gumbel distribution function and estimated cumulative floatable litter load

Return period (T_r)	Frequency factor (K_t)	Discharge (m³/s) $X_T = \overline{X} + K_T . \sigma_x$	Estimated cumulative floatable litter load (kg/day) y = 8335.3In(x) + 14622
2	-0.164	28.70	42603.73
5	0.719	52.58	47648.53
10	1.305	68.38	49839.41
25	2.044	88.35	51975.11
50	2.592	103.17	53267.27
100	3.137	117.87	54378.00
200	3.679	132.52	55354.60
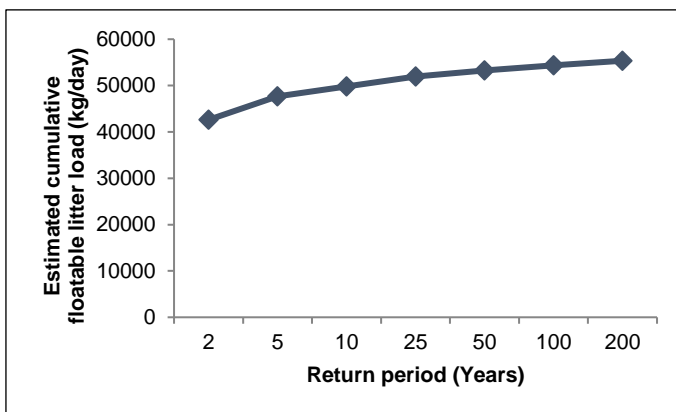
Figure 7. The estimation cumulative floatable litter load captured at log boom Sungai Batu at different return period based on derived equation; y = 8335.3ln(x) + 14622

CONCLUSIONS

The emergence of floatable litter along the river system and intercepted at log boom Sungai Batu was generally derived from land-based source activities especially through littering and illegal dumping activities nearby the river or directly into the river. The vast quantity of floatable litter was mainly being mobilized through river flow toward the downstream area and intercepted at log boom. The main purpose of log boom was to intercept the highly visible materials such as floatable litter (>5mm) from being propagate until it reaches to the coastal area. The frequency analysis through Gumbel distribution function method have been effectively carried out by employing 35 years of annual peak discharge data (1982 to 2016). As the validation test have proved that this statistical model performance have achieved strong and positive relationship with R^2=0.9986, r=0.9993, the discharge rate at different return periods derived from Gumbel distribution function can be used to estimate the cumulative floatable litter load. The cumulative floatable litter load was increasing as the return periods increased. For example, the discharge rates at 50 years of return period have a capability to predict 53267.27 kg/day of cumulative floatable litter load. The extreme conditions especially during flash flood have a probability to intercept or overspill the floatable litter beyond the log boom capacity. Thus, the frequency analysis was highly vital in predicting the discharge rate of extreme events in the future based on long term series of historical data. This output also can be employed to estimate the cumulative of floatable litter as well. Thus, the entire result from this study can be used as a references and guidelines tool for the government authority and relevant stakeholders during the long-term plans and decision-making process. As the future recommendation, the important hydrological parameters such as lag time and time of concentration need to be considered in estimating the river discharge to mobilize the floatable litter along the river until it intercepts by the log boom.

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REASONS OF POOR LABOUR PRODUCTIVITY IN CONSTRUCTION WORKS

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Abstract
Construction works are essential component of economic and social growth of any nation. Hence, it is very critical to complete construction works successfully. Success of the construction works is highly reliant on productivity of the labour. Unfortunately labour involved in construction works of Pakistan is experiencing problem of lower productivity. This problem is because of several reasons which need careful attention to control. This paper highlights major reasons affecting productivity of the labour in construction works of Pakistan. This was achieved by survey using a questionnaire form developed based on 33 common reasons of labour productivity identified from review of published articles in journals and conference proceeding. Fifty-four completed forms received were analysed with weighted average formula. Analysis revealed that all the factors happen frequently also have significant effect. Top three significant reason include misuse of time schedule, increase of labourer age and weather changes.

Keywords: *Labour Productivity; Construction Projects; Pakistan.*

INTRODUCTION

Construction works play imperative part in improving economic situation of country (Soekiman et al., 2011) as well as enhance social level of any nation by offering required infrastructural needs (Chigara and Moyo, 2014). Sukumar and Kumar (2016) highlighted that construction works engage a very significant portion of the human resource which results in notable income of any country. In developed countries approximately 10% of the national income is generated from construction works (Alinaitwe, 2007). In Europe construction works contributes to 7% of employment while in USA 8% of engagement of human resource is reported (Soekiman et al., 2011; Chigara and Moyo, 2014; Sukumar and Kumar, 2016; Alinaitwe, 2007; Abdul Kadir et al., 2005). This contribution is more vital in developing nations as compared to developed nations (Muhammad 2015). This highlights the importance of successful achievement of construction work in which highly depends on productivity of labour (Hicksona and Ellis, 2014). Workforce is uncontrollable and basic components of work (Kazaz and Ulubeyli, 2007). In South Africa, productivity of labour is reported as very poor since last forty years as cited by Chigara and Moyo (2014). This poor performance of labour productivity is being faced due to various reasons. This motivated the research to highlight the reasons which affect the labour productivity, but the focus is restricted to construction activities in Pakistan.

LITERATURE REVIEW

Productivity is governing parameter in construction works in whole both developed and developing nations (Tahir et al., 2015). It influences on time and cost of any works substantially. However, in construction works, labour productivity is very difficult to measure (Hicksona and Ellis, 2014). Regrettably in construction works the productivity of labour is

being declined with the time. In Nigeria, labour productivity is not satisfactory (Enshassi et al., 2007). This declination of productivity is occurring due to different reasons. A study conducted by Tahir et al. (2015) highlighted that lack of Labourer experience is serious matter which exert negative effect of labour productivity in construction works. Follow up of the actual work plan is also major reason affecting labour productivity (Shah and Ahad, 2017). Review of previous research work conducted regarding labour productivity resulted in identified 33 common reasons as listed in Table 1.

Table 1. Reasons of Poor Productivity

	Reasons/Reference	Soekiman (2011)	Chigara (2014)	Sukumar (2016)	Alinaitwe (2007)	Abdul Kadir (2005)	Muhammad (2015)	Hicksona (2014)	Enshassi (2007)	Shah and Ahad (2017)	Gopal and Murali (2016)
1	Material shortages	/	/	/	/	/	/	/	/	/	/
2	Tool and equipment shortages	/	/	/	/	/		/	/	/	/
3	Weather changes	/	/	/	/	/	/		/	/	/
4	Lack of labour experience		/	/	/	/	/		/	/	/
5	Drawings and specifications alteration during execution	/	/	/	/	/			/	/	/
6	Rework / Repairs	/	/	/	/	/			/	/	/
7	Accidents		/	/	/			/	/	/	/
8	Misunderstanding between labour and superintendents	/	/		/			/	/		/
9	Payment delay		/		/			/	/	/	/
10	Labour disloyalty	/			/		/		/	/	/
11	Inspection delay	/		/				/	/	/	/
12	Working within a confined space		/		/	/	/		/	/	
13	Lack of financial motivation system	/			/	/			/	/	/
14	Working overtime		/		/			/	/	/	/
15	Lack of labour supervision				/			/	/	/	/
16	Working 7 days per week without taking a holiday		/	/					/	/	/
17	Misuse of time schedule	/		/				/	/	/	
18	Supervisors' absenteeism	/	/	/					/		/
19	Increase of labourer age		/		/				/	/	/
20	Construction method		/		/			/	/	/	
21	Labour dissatisfaction			/	/				/	/	
22	Low quality of raw materials			/					/	/	/
23	Violation of safety precautions			/					/	/	/
24	Interference				/			/	/	/	
25	Lack of labour recognition programs		/	/					/		/
26	Unsuitability of materials storage location							/	/		/
27	Lack of competition	/							/		/
28	Insufficient lighting				/				/	/	
29	Inefficiency of equipment		/						/		
30	Misunderstanding among labour			/					/		
31	Increasing number of labours								/	/	
32	High quality of required work								/		
33	Method of employment (using direct work system)								/		

METHODOLOGY

This paper is focusing on evaluating reasons of poor labour productivity in construction works. In assessing the level of the reasons, the participants had to rate all reasons for degree occurrence and impact of according to level as in Table 2.

Table 2. Measurement Scale

Scale	Level of Occurrence	Level of Impact
1	Not occur	No impact
2	Slightly occur	Slight impact
3	Moderately occur	Moderate impact
4	Often occur	High impact
5	Very often occur	Extremely High impact

Responses collected by participants were analysed with Weighted Average (WA) with equation:

$$WA = \frac{1}{4} * \frac{1X_1 + 2X_2 + 3X_3 + 4X_4 + 5X_5}{X_1 + X_2 + X_3 + X_4 + X_5}$$

Where X_1 is frequency of responses for level 1, X_2 is frequency of responses for level 2, X_3 is frequency of responses for level 3, X_4 is frequency of response for level 4 and X_5 is frequency of responses for level 5.

RESEARCH FINDINGS

Respondent's Characteristics

Respondents are the participants who gave their feedback on questions regarding productivity issues of labour. Among these participants, 25 personnel are engaged with contractors and are directly involved in execution works. 18 professionals are representative of consultants while 11 personnel belong to client organizations. Statistical measures represented that 21 participants are engaged in handling road works; 10 participants have experience of working on projects related to social amenities and 7 participants mentioned that they are engage in construction works of residential building. Other 16 participants have experience of handling multiple projects. These respondents handle the projects of different sizes as summarized in Figure 1.
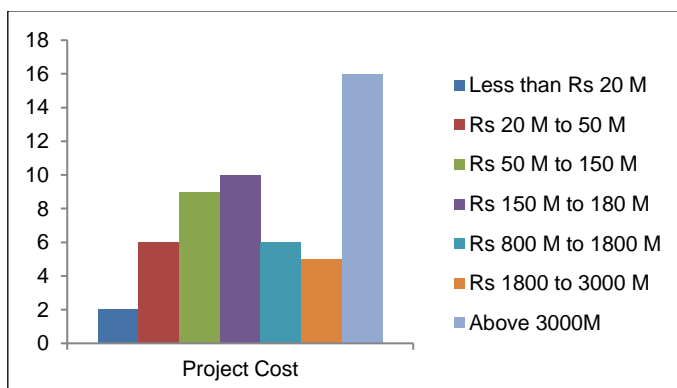
Figure 1. Size of Projects handled by Participants

Figure 1 illustrate that 16 participants are engaged in works with contract amount above Rs 3000 M, 11 participants are handling construction projects of contract amount 800 M-3000 M, 19 participants have experience of handling projects of Rs 50 M-180 M. 6 participants are handling projects with contract amount of 20 M - 50 M while only 2 participants have experience of handling projects less than Rs 20 M. Among these participants, high number of respondents i.e. 29 participants are graduated in civil engineering, 18 participants have attained diploma certification, 3 participants have master's degree while 4 participants did not mention their qualifications.

Reasons Affecting Labour Productivity

Reasons were analysed using WA method. WA value is between 0 to 100 and the highest value explains that level of the reason is highest. All the reasons are assessed and showed in Table 3.

Table 3. Reasons of Poor Labour Productivity

S. No	Factors	Occurrence Level		Impact Level	
		WA	Level	WA	Level
1	Violation of safety precautions	80.09	VOO	76.38	ES
2	Weather changes	75.00	OO	77.31	ES
3	Payment delay	73.14	OO	67.59	VS
4	Working 7 days per week without taking a holiday	73.14	OO	75.92	ES
5	Misuse of time schedule	72.68	OO	79.62	ES
6	Increase of labourer age	71.29	OO	77.77	ES
7	Insufficient lighting	70.83	OO	73.14	VS
8	Tool and equipment shortages	68.98	OO	76.38	ES
9	Lack of financial motivation system	68.98	OO	75.46	ES
10	Misunderstanding between labour and superintendents	68.05	OO	67.12	VS
11	Rework / Repairs	67.59	OO	71.29	VS
12	Working overtime	67.12	OO	68.05	VS
13	Accidents	66.66	OO	73.14	VS
14	Lack of labour experience	66.20	OO	71.75	VS
15	Drawings and specifications alteration during execution	66.20	OO	65.27	VS
16	Inspection delay	65.74	OO	72.68	VS
17	Low quality of raw materials	65.74	OO	56.48	VS
18	Labour disloyalty	64.35	OO	72.22	VS
19	High quality of required work	64.35	OO	72.22	VS
20	Increasing number of labours	64.35	OO	60.18	VS
21	Construction method	64.35	OO	72.22	VS
22	Inefficiency of equipment	63.88	OO	65.27	VS
23	Interference	62.96	OO	69.90	VS
24	Labour dissatisfaction	62.50	OO	72.68	VS
25	Method of employment (using direct work system)	62.50	OO	64.35	VS
26	Misunderstanding among labour	62.03	OO	63.88	VS
27	Lack of competition	62.03	OO	66.66	VS
28	Lack of labour recognition programs	61.11	OO	67.12	VS
29	Working within a confined space	60.64	OO	65.27	VS
30	Unsuitability of materials storage location	60.64	OO	70.83	VS
31	Supervisors' absenteeism	59.72	OO	64.35	VS
32	Material shortages	59.25	OO	65.27	VS
33	Lack of labour supervision	56.94	OO	66.66	VS

From table, this is observed that based on WA value of probability of occurrence only 1 reason is reported as very often occurred i.e. Violation of safety precautions while all other reasons are reported as often occurred. From significant 7 reasons are marked as extremely significant. Other twenty-six reasons are marked as very significant reasons. Among significant reasons misuse of time schedule, increase of labourer age and weather changes are most significant reasons.

CONCLUSION

This paper focused on studying reasons of labour productivity in construction works of Pakistan. This work was carried through getting perception of practitioners involved in handling construction works through questionnaire survey. Survey form was prepared using 33 reasons identified from previously published research articles. Analysis of 54 data samples showed that all reasons are often occurred except violation of safety precautions reported as very often occurred.

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AN OVERVIEW ON THE PARTICIPATION OF LOCAL LABOUR IN THE MALAYSIAN CONSTRUCTION INDUSTRY

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Abstract
Malaysian construction industry is actively working towards its target by 2020 which has been set out for more than a decade. Initiated by the Construction Industry Master Plan (CIMP) which places productivity as one of the critical success factors in their guideline, followed by the establishment of the Construction Industry Transformation Programme (CITP) which also incorporated productivity as one of its four thrust**s** to enhance human capital development in the construction industry. Nonetheless, Malaysia's progress has been deflated by the over-reliance on foreign workers and such dependency prove to become an issue over the years. The situation becomes worse when Malaysia faces the diaspora of local skilled workers for better jobs. Thus, the aim of this study is to have an overview on the participation of local labour in the Malaysian construction industry. This paper presents a document analysis through two documents which has been chosen for the study. These findings will recapitulate the current situation of the local labour participation in the Malaysian construction industry.

Keywords: *Construction Industry, Local Labour, Participation, Productivity.*

INTRODUCTION

As an independent country, Malaysia has shown robust growth in terms of development towards achieving its target in 2020. The progress of development makes Malaysia among the favourable developing countries in the Southeast Asia region. Through the years, the government has come out with a framework such as the Construction Industry Master Plan (CIMP) and the Construction Industry Transformation Programme (CITP) in order to achieve the benchmark as a developed nation. This is to ensure Malaysia is on track with its outline and strategic thrust.

In regard to that, from 2006 until 2015, there are 7 thrusts introduced under the Construction Industry Master Plan (CIMP). One of the strategic thrusts is to strive for the highest standard of quality in the construction industry. CIMP is then followed with the Construction Industry Transformation Programme (CITP) from 2016 until 2020 to cap off the final five-year plan to meet the national target for the construction industry in 2020. Productivity is emphasised as part of the strategic thrust of CITP to seek transformation and improvement of the construction industry image in the local and international arena.

However, the mass influx of foreign workers became the worst-case scenario in the Malaysian construction industry in order to maximise labour productivity. According to Akindele (2013) productivity is measured by the unit of output per unit of labour. The massive development in Malaysia encourage numerous numbers of foreign workers to seek for job opportunities. High capital technologies and the existence of local labour is no longer the first alternative. According to Chan and Hiap (2012), the availability and inexpensive cost of foreign workers were encouraging the industry to hire them.

In short, such scenario affected the productivity of the Malaysian construction industry. According to Yeap (2018), there is proof where Malaysia has been weighed down by the productivity trap and the scenario became worse when the industry continues to depend on foreign workers. Thus, the availability of unskilled foreign workers has slowed the process of industrial improvement for the country (Narayan & Lai, 2014). Furthermore, in order to have a sustainable supply of well-educated and experienced talent in a complex economy, the economy requires a policy to ensure an adaptable workforce which can be reskilled and re-used in the construction industry (Yeap, 2018).

BACKGROUND OF THE STUDY

According to Chu (2015), Minister in the Prime Minister's Department, Wee Ka Siong claimed that the decrease in the level of interest among native talent and high turnover in the construction industry had driven the employers to depend on foreign workers. Various problems or issues arising from the consequences of foreign workers' inexperience and lack of skill has caused the increase in demand among local labour. Productivity and quality control are reduced due to most foreign workers are unskilled in the construction industry (Abdul-Rahman et al., 2012). Added by Zannah et al. (2017) the major contributor towards inefficient construction project productivity is the low performance level of skilled workers.

As reported by Rao (2018) Malaysian Institute of Economic Research (MIER) stated that there are structural challenges affecting the industry today, which are low wages, productivity and skills, along with the influx of foreign workers. Furthermore, immigrants have filled the important gap between low and mid-skilled jobs due to Malaysians' improved education level who demand for higher-skilled jobs and causing the labour market to remain tight. (Moreno et al., 2015). Furthermore, for every ten locals in Malaysia, one would elect to leave the country and that is double of the world average rate (Devadoss, 2012).

According to Mohamed et al. (2012) in spite of the many initiatives done by the government to produce local skilled workforce to fill the gaps, it remains in shortage of supply for the construction industry. Added by Salleh et al. (2016) the involvement of local labour is not as promising and there is evidence that vocational training graduates do not meet the standards of the industry. As stated by Hamid et al. (2013), the composition of workforce in a construction project is one (local labour) to five (foreign labour) of the total number of workforces in a construction project. The percentage of involvement between the local labour and foreign labour is worrisome, and consequently will affect the productivity of the construction project itself.

Hence, the aim of this study is to have an overview on the participation of local labour in the Malaysian construction industry.

METHODOLOGY

Document Analysis is utilised in this study by focusing on the current landscape of participation of local labour in the construction industry in Malaysia. Nonetheless, other issues related to the participation of local labour in the Malaysian construction industry were also documented. Table 1 below lists two documents chosen for the purpose of document analysis in order to know the current landscape of participation of local labour (i.e., National Employment Returns Report 2016, Productivity Report 2017/2018).

Table 1. List of documents

Documents	Description	Purpose	Source
National Employment Returns Report 2016	This document contains statistical information on the labour market and the workforce from surveys of selected economic establishment covering the whole of Malaysia	To identify: - Distribution of employees by citizenship - Distribution of employees by region - Distribution of employees by sector - Distribution of employees by Job Category	Institute of Labour Market Information and Analysis (ILMIA)
Productivity Report 2017/2018	This document reviews Malaysia's labour productivity performance and comparison with selected countries performance	To identify: - Malaysia Productivity Performance - The Contribution of productivity towards growth	Malaysia Productivity Corporation

DATA AND ANALYSIS

National Employment Returns Report 2016 (NERs)

The NERs gathers information on the labour market and the workforce in Malaysia. The Ministry of Human Resource (MOHR) has carried out a series of employer surveys to profile employers, employees, and their wage and salary levels since 2002. Thus, the latest in the series is the 2016 Survey of National Employment Returns (NER) as its fifth edition consists of surveys conducted in 2007, 2009, 2011 and 2013. The survey is significant to MOHR as the information from the NERs is able to produce a complete and current labour market database that can be utilised by all segments of the society, particularly by the Government sector, the private sector, people looking for work, researchers, and others.

There are five objectives of the NER survey which are: (a) to collect information on the workforce with the objective to update the labour market information database; (b) to outline the workforce structure, (i.e. local and foreign, professional, semi-professional and other categories of employees); (c) to identify the characteristics of employees, especially wages, education levels, TVET, and skills by industry, economic corridors/states; (d) to produce data for analysis of the 2016 workforce as well as trends over time; and (e) to provide projections of the labour market for policy purposes. However, the document analysis only involves the labour force participation of the construction industry in Malaysia.

Profile of Employees
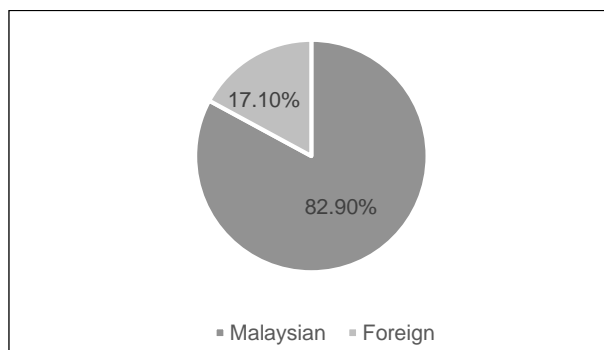
Figure 1. Distribution of Employees by Citizenship, 2016

Based on NER 2016 Survey (Figure 1), the distribution of employees by citizenship consists of 82.9 percent Malaysian employees and 17.1 percent foreign employees.

Furthermore, the Peninsular of Malaysia (comprising of 11 states and the Federal Territories of Kuala Lumpur and Putrajaya) has the largest concentration of employees among the three regions which are Peninsular of Malaysia, Sabah and Federal Territory of Labuan and Sarawak. Table 2 shows that Peninsular Malaysia has the largest number of Malaysian employees accounting about 81.7 percent, followed by Sarawak (12.7 percent) and lastly Sabah and the Federal Territory of Labuan (5.6 percent).

Table 2. Distribution of Employees by Region, 2016

Region	Malaysians		Foreigners		Total Employees	
	No.	Percent (%)	No.	Percent (%)	No.	Percent (%)
Peninsular Malaysia	4,125,744	81.7	830,193	79.6	4,955,938	81.4
Sabah and WP. Labuan	281,203	5.6	95,181	9.1	376,384	6.2
Sarawak	640,206	12.7	117,682	11.3	757,888	12.4
Total	5,047,153	100	1,043,057	100	6,090,210	100

Table 3 outlines the distribution of employees by nationality and by sector. Among local employees, the Construction sector is recorded as the third largest among other sectors at 6.3 percent with the ratio foreign to local labour force at 22 to 100.

Table 3. Distribution of Employees by Nationality and by Sector

Sector	Malaysian		Foreign		Total Employees		Foreign/Local ratio (Local=100)
	No.	Percent	No.	Percent	No.	Percent	
Agriculture	120,382	2.4%	236,585	22.75%	356,967	5.9%	197
Manufacturing	867,309	17.2%	418,252	40.1%	1,285,561	21.1%	48
Construction	311,725	6.2%	69,052	6.6%	380,777	6.3%	22
Mining	16,757	0.3%	1,554	0.1%	18,311	0.3%	9
Services	3,730,921	73.9%	317,614	30.5%	4,048,535	66.5%	9
Other Industry	60	0.0%	-	-	60	0.0%	0
Total	5,047,153	100.0%	1,043,057	100.0%	6,090,210	100.0%	21

In Figure 2, employees in the Service and Sales category form the largest group among the Malaysian employees which is 23.1 percent, followed by Clerical Support Worker category at 18.4 percent. However, there is a monopoly of foreign employees in the Elementary Occupations at 47.7 percent involving physical work included in the construction industry and other sectors.
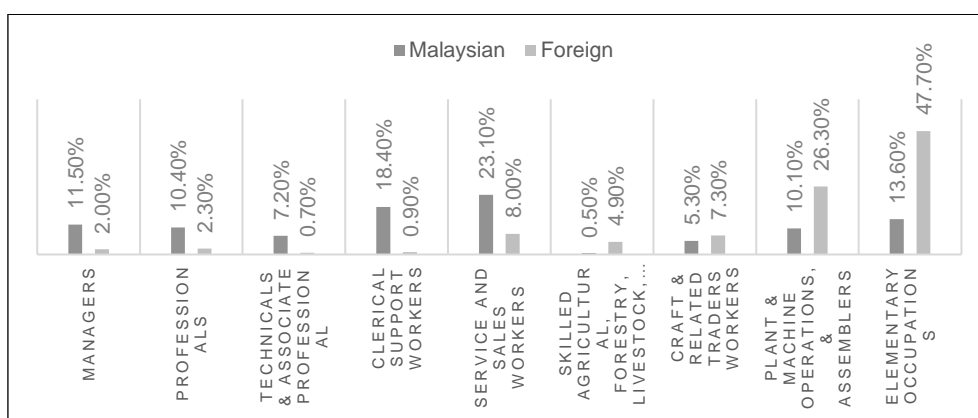
Figure 2. Distribution of Malaysian and Foreign Employees by Job Category, 2016

Table 4 shows that the labour-intensive industries have a higher share of the lower occupational categories. Construction sectors which involve labour force in the Elementary Occupations shares 19.4 percent after Clerical Support Workers which shares about 28.6 percent. However, for the Elementary Occupations, the Construction sector is in 7th place among 20 other sectors.

With respect to the NER 2016 results, the workforce in the survey consists of 82.9 percent Malaysian employees, and 17.1 percent foreign employees. However, Malaysian employees are employed in the Service and Manufacturing sectors and both comprise the largest sectoral share at 73.9 percent and 17.2 percent respectively and followed by the Construction sector which is only 6.2 percent from the total share of other sectors. Foreign employees are also focused in the two same sectors in Manufacturing and Services accounting for 40.1 percent and 30.5 percent respectively while the Construction sector accounting for 6.6 percent from all of the foreign workers.

The ratio of foreign to local employees is most significant in the Agriculture sector where there are 197 foreign employees for every 100 local employees while the Construction sector shows that there are 22 foreign employees for every 100 local employees. However, the majority of Malaysian employees is found in the Service and Sales occupational category, whereas foreign employees are concentrated in the Elementary Occupations which involved physical labour in the Construction sector.

Table 4. Distribution of Employees by Sector and Job Category

Sector	Distribution of workers (per cent)									
	Manager	Professionals	Technician & Associate Professionals	Clerical Support Workers	Service & Sales Workers	Skilled Agricultural, Forestry & Fishery Workers	Craft & Related Trade Workers	Plant & Machine Operator & Assemblers	Elementary Occupations	Total
Agriculture, forestry & fishing	3.2%	0.7%	0.8%	5.7%	1.0%	15.5%	1.4%	5.0%	66.6%	100.0%
Mining & quarrying	10.7%	8.3%	5.7%	12.8%	4.0%	0.7%	8.3%	26.5%	23.1%	100.0%
Manufacturing	7.4	6.6	8.8	7.1	1.9	0.2	8.4	41.9	17.8	100.0%
Electricity, gas, steam & air conditioning supply	2.2	8.9	12.5	46.0	21.0	-	1.8	4.4	3.4	100.0
Water supply, sewerage, waste management & remediation activities	5.2	10.0	16.9	20.0	2.6	-	6.3	23.3	15.7	100.0
Construction	11.4	6.7	7.8	28.6	2.3	0.5	15.9	7.2	19.4	100.0
Wholesale & retail trade, repair of motor vehicle & motorcycles	10.4	5.6	2.5	15.7	45.1	0.4	3.5	4.2	12.5	100.0
Transportation storage	9.7	12.3	4.5	23.2	7.4	0.1	4.0	19.9	19.1	100.0
Accommodation & food service activities	10.6	7.1	1.5	15.2	17.4	0.2	9.5	4.0	34.6	100.0
Information &communication	20.7	30.1	20.8	15.7	8.6	-	0.8	2.0	1.3	100.0
Financial & insurance/ Takaful activities	17.1	23.6	17.8	22.4	11.8	-	0.1	0.4	6.6	100.0
Real estate activities	19.9	10.6	9.3	19.8	10.1	0.3	6.3	3.0	20.6	100.0
Professional, scientific & technical activities	11.2	20.2	10.4	34.4	2.6	2.3	2.9	3.6	12.5	100.0
Administrative & support service activities	7.2	16.6	3.4	11.7	15.2	-	5.6	7.1	33.2	100.0
Public administration & defence, compulsory social security	6.0	5.2	10.8	41.0	15.1	4.3	3.9	2.4	11.3	100.0
Education	14.0	50.1	5.8	14.1	7.5	0.1	1.7	1.5	5.4	100.0
Human health & social work activities	8.4	19.6	24.8	16.9	17.9	0.3	1.4	0.8	10.0	100.0
Arts, entertainment & recreation	10.5	5.5	8.1	13.5	15.1	0.5	9.9	15.3	21.6	100.0
Other service activities	12.1	14.3	4.9	14.8	13.7	0.7	9.5	13.0	16.9	100.0
Households as employer	8.8	-	-	11.8	-	-	17.6	8.8	52.9	100.0
Total	9.9	9.0	6.1	15.4	20.5	1.2	5.6	12.9	19.4	100.0

Productivity Report 2017/2018

In the 2015/2016 Productivity Report, the aim of the document is to show Malaysia's future productivity growth which is highly dependent on the workforce potential to innovate and apply advanced knowledge and technologies. In the 2016/2017 Productivity Report, the focus of the document is on the importance of transforming the mindset of people towards better collaboration to achieve better productivity. However, in the 2017/2018 Productivity Report, Malaysia has made a clear path towards transforming into an advanced economy and inclusive nation, with a rigid economic growth record.

Thus, the objective of this report is to review Malaysia's labour productivity performance and its comparison with selected countries. Plus, this report will put forward the labour productivity performance by the main economic sectors and the respective policies and efforts which were undertaken comprehensively to boost productivity at the national, sectoral and enterprise levels are also outlined. Nonetheless, for the purpose of this research, the document analysis will only be focusing on labour productivity performance and concentrated on the construction sector in Malaysia.

Malaysia's Labour Productivity Performance

The improvement of Malaysia's labour productivity in 2017 have contributed to higher growth in the country's Gross Domestic Product (GDP) to 5.9 percent from 2016 which is only 4.2 percent. As measured by real added value per person employed, Malaysia's labour productivity has improved by 3.8 percent in 2017 as compared to 2016 which is only 3.5 percent as shown in Table 5. This productivity growth performance exceeded Malaysia's target of 3.7 percent in 2017.

Table 5. Growth and Contribution of Labour Productivity and Employment to GDP, 2016 & 2017

	Growth (%)		Contribution (%)	
	2016	**2017**	**2016**	**2017**
Labour Productivity	3.5	3.8	83.3	65.5
Employment	0.7	2.0	16.7	34.5
GDP	4.2	5.9	100	100

As shown in Table 5, in spite the fact that the contribution of Labour Productivity in 2017 decreased by 17.8 percent from 2016, there is an increase in the Employment at 34.5 percent which contributes towards the total Gross Domestic Product (GDP).

Figure 3 shows the employment growth by skill level. There is an increase in the low-skilled level from -6.2 percent in 2016 to 0.6 percent in 2017. Medium-skilled also shows an improvement where there is an increment from -0.1 percent in 2016 to 1.9 percent in 2017. However, there is a decrement in rate for high-skilled level from 7.8 percent in 2016 to 2.9 percent in 2017. As the total employment distribution by skill level, medium-skilled level has the distribution of about 59.6 percent (8.6 million employment) followed by high-skilled level with 27.5 percent (4 million employment) and lastly low-skilled level with only 12.8 percent (1.9 million employment).
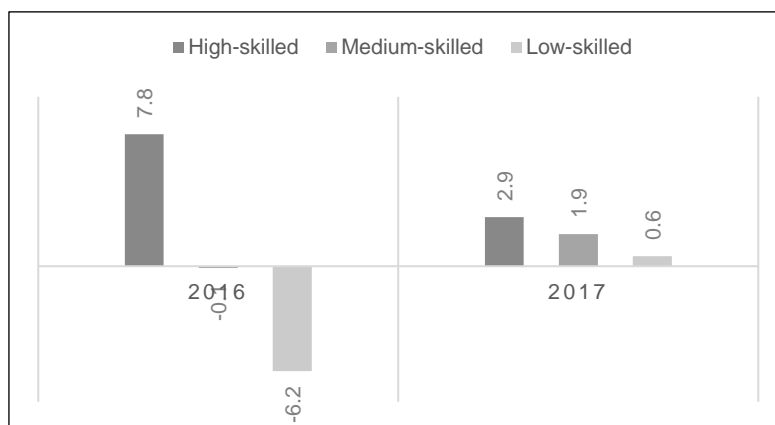
Figure 3. Employment Growth by Skill Level

Sectoral Labour Productivity Performance

Table 6 shows that in 2017, there is economic growth in labour productivity for all main economic sectors. The largest contribution was accounted by the service sector with a total to GDP at 54.5 percent and registered 5.0 percent to Productivity growth. The service sector recorded comprehensive growth in the Added Value contribution at 54.5 percent, while the Employment contribution was at 60.6 percent. The second largest contribution towards GDP was the manufacturing sector which recorded 4.3 percent for Productivity growth, while Added Value and Employment growth were at 6.0 percent and 1.7 percent respectively.

Table 6. Labour Productivity of Main Economic Sectors

Sector	Labour Productivity		11 MP Target	Added Value Contribution	Employment Contribution
	2016 (RM)	2017 (RM)			
Agriculture	51,289 (-4.9%)	51,988 (1.4%)	3.6%	8.2%	12.0%
Mining	1,133,372 (15.1%)	1,210,832 (6.8%)	1.1%	8.4%	0.6%
Manufacturing	106,307 (3.6%)	110,858 (4.3%)	2.6%	23.0%	16.8%
Construction	39,298 (10.0%)	40,242 (2.4%)	9.6%	4.6%	9.2%
Services	69,534 (4.2%)	73,030 (5.0%)	4.1%	54.5%	60.6%

Meanwhile, the Construction sector recorded Labour Productivity growth of 2.4 percent in 2017, with Added Value contribution and Employment contribution at 4.6 percent and 9.2 percent respectively. However, in Table 7, in the period of 2011 to 2017, the productivity growth of the Construction sector was driven by Multifactor Productivity (MFP). This is due to intensive demand by the construction sector resulting from mega construction projects nationwide.

Table 7. Capital Intensity, MFP and Labour Productivity Growth of the Main Economic Sectors, 2011 – 2017

	Labour Productivity (%)	MFP (%)	Capital Intensity (%)
Agriculture	0.3	-3.0	3.3
Mining	-9.0	-6.8	-2.2
Manufacturing	3.4	1.3	2.2
Construction	5.9	5.1	0.8
Services	3.0	2.6	0.4

SUMMARY

This study presents the document analysis of two types of reports. The objective is to know the current landscape of participation of local labour in the construction industry in Malaysia. Based on the results, there is a relationship between the landscape of participation of local labour in construction and the output of productivity of the industry itself. As an example, the service sector had 60.6 percent employment contribution and had the highest productivity compared to other sectors. Meanwhile, the construction sector only has 9.2 percent employment contribution and the lowest value-added contribution for labour productivity at 4.6 percent among other key economic sectors.

Table 8. Summary on Document Analysis

Variable	National Employment Returns Report 2016 (NERs)	Productivity Report 2017/2018
1	Construction sector recorded 3rd largest share among other sectors for nationality distribution with ratio foreign to local force 22 to 100	Decreasing of labour productivity contribution towards GDP from 2016 to 2017
2	The monopoly of foreign in elementary occupations	Construction sector recorded 2nd lowest growth for labour productivity and 2nd lowest employment contribution towards labour productivity for construction itself
3	Construction sectors recorded 7th highest contribution for elementary occupations towards job category among other 20th sectors	Construction sector productivity growth driven by Multifactor Productivity (MFP)

However, the construction industry productivity has been driven by Multi-Factor Productivity (MFP) due to the implementation of mega projects recurrently. Looking at the extent of participation of the labour, the productivity itself is not in a good position which indicates that there are areas that need to be enhanced in order to boost the labour productivity in line with other key economic sectors.

CONCLUSION

From the study, NERs reported that the construction sector has the 2nd lowest productivity level among other sectors which shows that the Malaysian construction industry is not on the right track towards the Construction Industry Transformation Program (CITP) for 2016 – 2020 which addressing on productivity as one of their strategic thrust. As per stated in NERs document, the monopoly of foreign labour in the elementary occupation could be one of the impacts towards the productivity as per mentioned by Abdul-Rahman et. al., (2012). Furthermore, it has been proven in the National Employment Returns Report that the construction sector recorded as the 3rd largest share of nationality distribution (ratio between local labour to foreign labour) which is the 7th highest contribution for elementary occupations among 20 other sectors. This is shown in Table 9, where the increase in number of foreign labours in Construction workers from 2015 to 2016.

Table 9. Registered Construction Personnel by Category of Worker

Category of Worker	2015		2016	
	Local	Foreign	Local	Foreign
Construction worker	295,560	135,997	304,167	148,025
Skilled construction worker	50,855	1,675	91,637	1,939
Manager and site assistant manager	51,410	1,462	58,646	1,052
Construction supervisor	50,933	272	116,579	1,566
Administrative personnel	126,716	1,662	42,814	138
Total	575,474	141,068	613,843	153,720

(Source: CIDB, Malaysia)

Furthermore, the result of the study shows the interrelation of the variables where, the increase of foreign labour in the construction industry decreases the contribution of productivity growth towards the total GDP in the construction sector which acts as one of the main economic sector in Malaysia. As recorded in the Productivity Report 2017/2018, the construction sector is still far from the 11th Malaysia Plan, where the target growth is 9.6 percent. However, the construction sector only recorded 2.4 percent growth in 2017 compared to 2016 which is at 10 percent. Despite improving the unemployment rate as per stated in Table 10, there needs to be serious consideration and attention in order to improve the landscape of participation of local labour in the construction industry in Malaysia.

Table 10. Labour Force Participation Rate in Malaysia

Period (Jan)	Labour Force ('000)	Employed ('000)	Unemployed ('000)	Labour Force Participation Rate (%)	Unemployment rate (%)
2016	14,652.0	14,150.5	501.5	67.7	3.4
2017	14,880.9	14,366.8	514.1	67.7	3.5
2018	15,187.0	14,670.5	516.5	68.2	3.4

(Source: Department of Statistics Malaysia / Ministry of Finance)

RECOMMENDATION

This research, in conceptual terms, is limited to documents analysis which has provided valuable evidence for scholars and practitioners. For future study, meaningful results can be obtained if general and specific issues on the participation of local labour in the Malaysian construction industry can be identified and more detailed statistical analysis could be made.

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ENABLERS AND BARRIERS TO ADOPT ZERO WASTE CONCEPT IN THE CONSTRUCTION INDUSTRY

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Abstract
Rapid development in the construction sector leads to an enormous amount of Construction and Demolition Waste (C&D Waste) generation in the construction industry. Basically, C&D Waste is a combination of concrete, brick, timber, steel, cement, polythene, aluminium, cardboard, and plastic. In order to eliminate the C&D Waste, the "Zero Waste" (ZW) concept has emerged as a solution. ZW means the elimination of waste at the source and throughout the lifetime of the construction activity. However, limited studies are available on ZW management in the construction industry. Therefore, the paper aims to identify enablers and barriers to adopt the ZW concept in the construction industry. This paper critically reviews the secondary data on waste management studies conducted in the construction industry and findings from eight case studies. Along with the qualitative approach, under case studies, semi-structured interviews were conducted. Thus, through the study, conducting meetings to laborers, assigning supervisors and managers to monitor laborers and procurement coordination were identified as the key enablers to adopt zero waste while poor supervision, lack of skilled laborers, lack of awareness, lack of attitude and lack of housekeeping were identified as the barriers to adopt zero waste concept in the construction industry.

Keywords: *Barriers, Construction and Demolition Waste, Enablers, Zero Waste.*

INTRODUCTION

Throughout the world, one of the main solid waste generations is through C&D waste (Elgizawy, Haggar, & Nassar, 2016). In almost every city and country, waste management is one of the most challenging area (Zaman, 2014). With the resource consumption growth, waste generation get increased leading for issues in the management of waste (Song, Li, & Zeng, 2015). Further, since the early nineteenth century, attention is being paid to solve waste problems (Zaman, 2014). The construction sector contributes 30% of wastes to landfills (Crawford, Mathur, & Gerritsen, 2017). Moreover, as a result of the construction waste landfilling, environmental problems and health problems take place (Elgizawy et al., 2016). Further, Crawford et al. (2017) have stated that with the landfilling of C&D waste, environmental issues such as groundwater and soil contamination, land degradation, the release of methane to the atmosphere and destruction of habitats take place. Hence, considering the long-term impacts towards the society and environment there is a need to control the waste generation (Osmani, Glass, & Price, 2008). In addition to that, with the increasing public concern to manage C&D waste, practices such as boosting resource exploitation efficiency, the circular economy is being practiced (Mahpour, 2018). Therefore, by implementing C&D waste management techniques, economic and environmental benefits can be gained (Yazdanbakhsh, 2018).

To handle the issue of waste management, ZW concept has emerged as an innovative method within which waste is considered as a resource (Zaman, 2014). ZW is a whole system approach that focuses on the elimination of waste at source and also in all the points of the supply chain (Curran & Williams, 2012). Moreover, considering the benefits through waste minimization, environmental issues, and benefits of cost-saving that arise through C&D waste, more focus is given towards the waste minimization practices over the past years

(Osmani, 2012). According to Zaman (2014), natural resource optimum usage and reduction in environmental issues can be achieved by implementing the concept of ZW. Hence, the implementation of the concept of ZW is identified as an ideal solution to manage C&D waste. Therefore, through this paper, identification of key enablers and barriers to adopt ZW concept in the construction is considered.

LITERATURE REVIEW

Construction and Demolition Waste Management

C&D waste gets generated through both construction and demolition processes (Crawford et al., 2017). Similarly, C&D waste gets generated through raw material extraction, material manufacturing, through process of construction, disposal and demolition (Elgizawy et al., 2016). Globally, 35% of C&D waste is disposed to landfills without any treatment (Menegaki & Damigos, 2018). Further, as per Yates (2013), C&D waste comprise in 50% of hazardous and 25% of municipal waste. According to Kofoworola and Gheewala (2009), C&D waste id defined as the waste generated from construction, renovation and structural demolition of the buildings. In addition to that, C&D waste is also defined as a waste of valuable natural resources (Wang, Li, & Tam, 2014).

C&D waste is comprised of concrete, wood, steel, copper, aluminium, bricks and mortar, plastic, PVC pipes, plastic films for packaging, wall coverings, glass, ceramic tiles, mineral wool insulation, drywall/gypsum m board, gravel, sand, and soil, paper, cardboard, marble, and granite (Elgizawy et al., 2016; Yazdanbakhsh, 2018). Furthermore, C&D waste landfilling has resulted in depletion of natural resources and difficulties in conservation of material and energy (Elgizawy et al., 2016). Further, C&D waste has created adverse impacts in economy, social life, environment, and in the health of the public (Yuan, 2017). In the construction industry to minimize the waste generation, prefabricated component adaption, onsite waste sorting and use of waste management plans can be done (Yuan, 2017). Moreover, Ling and Nguyen (2013) have stated that with the minimization of C&D waste, environmental stress created in the population can be reduced. Similarly, sustainability in the construction industry can be gained through the designing of deconstruction and disassembly of structures during the design stage (Yates, 2013). Thus, to handle the critical waste problem, ZW concept is considered as an idealistic concept (Zaman, 2015).

Zero Waste Management

With the current waste management, issues such as lack of resource conservation, pollution control and recovery in the integrated waste management approach has led to an innovative waste management concept called "Zero Waste" (Zaman, 2014). Hence, the ZW concept consist of waste prevention, recovery of resources, advanced recycling and behavioural changes (Cole et al., 2014). Moreover, through ZW concept, waste materials are converted into useful resources (Ksiazek et al., 2016; Pietzsch, Ribeiro, & Medeiros, 2017). Similarly, through the redesigning the resource life cycle with the ZW concept, C&D waste issue can be solved in an effective way by reusing all the products (Song et al., 2015). Furthermore, as per Curran and Williams (2012), through the implementation of ZW concept, traditional thoughts of waste management are being challenged. Thus, it is believed that rather than moving in a linear system, ZW strategy needs to move in the cyclical system according to cradle to cradle approach for the effective use of materials (Elgizawy et al., 2016).

With the adoption of ZW concept, financial, economic, stakeholder and community benefits can be achieved (Pietzsch et al., 2017). According to Zaman (2014), under ZW management criteria, to avoid threats such as consumption issues and human behaviour issues, waste management principles and designing of products are being considered. In addition to that, the author has also stated that with the ZW concept all the waste gets recovered, recycled or get nourished from a natural procedure without doing any harm to the natural environment. Thus, the implementation of the ZW concept helped to protect the natural resource as well as the environment through the adverse impacts of poor waste management.

Enablers for Zero Waste

To implement ZW concept effectively in the construction industry various enablers can be encountered. To manage the C&D waste, enablers such as understanding and awareness, construction project manufacturing, policies and legislations, product and material recovery, economics and operation and designing of buildings were identified (Adams, Osmani, Thorpe, & Thornback, 2017). In addition to that, Pietzsch et al. (2017) have said that to accomplish the ZW concept in the construction industry, operationalizing, planning and governance can be used. Further, Pietzsch et al. (2017) have explained that financial incentives, rates of regulations, green innovation, consumption and behavioural changes, logistic system modification are considered as planning and governance enablers while infrastructure improvements and product redesigning are considered as operationalizing enablers. Similarly, in order to adopt ZW concept to the construction industry, the government has to take the lead by providing adequate C&D waste management regulations, providing waste recycling policies for the factories those who recycle waste, the release of waste in scheduled time intervals and charging a fee for the disposal of waste (Yuan, 2017).

Barriers for Zero Waste

For effective C&D waste management hinders are created through, inadequate public education, lack of policies, poor public attitude, lack of framework for legal matters, lack of training and payments for workers involved in waste management activities and through landfilling of waste (Ezeah & Roberts, 2012). Furthermore, lack of waste processing facilities, poor communication, and coordination among parties involved, poor awareness and behaviour from project stakeholders, lack of awareness of environmental implications of waste disposal, cultural resistance to implement C&D waste diversion, and poor project processes and activities are also considered as the barriers that creates difficulties in achieving ZW in the construction industry (Menegaki & Damigos, 2018).

More importantly, to reduce C&D waste, primary barriers that have been identified are, poor urban designing and planning, C&D waste disposal costs are low, and inadequate design standards for designing of building (Ling & Nguyen, 2013). Further, for the reuse of C&D waste barriers such as inadequate knowledge on reuse, lack of standards for the reuse of C&D waste, inadequate guidance on C&D waste sorting and collection and lack of proper markets for reused C&D waste were identified (Huang et al., 2018). In addition to that, authors have identified, barriers that affect for recycling of C&D waste are as an ineffective management system, immature recycling technology, underdeveloped market for recycled C&D waste products and immature recycling market operation. In the same way, the varying commitment

to senior management and politicians, and absence of training programs to explain the concept of ZW are identified as the barriers for the successful implementation of ZW concept in the construction industry (Cole et al., 2014).

RESEARCH METHOD

To identify the gaps of the existing knowledge a review of prior literature is essential (Webster & Watson, 2002). Thus, initially a comprehensive literature review was carried out to identify the existing knowledge by refereeing to journals, conference proceedings, books, reports and articles. With the literature findings, C&D waste in the construction industry, ZW, enablers, and barriers to adopt ZW in the construction industry were identified. To check the enablers and barriers to implement ZW concept in the Sri Lankan construction industry, qualitative approach with case studies were used. Selected eight cases were in the building construction category of Construction Industry Development Authority (CIDA) - CS2 grade and semi-structured interviews were conducted to collect data related to enablers and barriers to implement ZW concept in the Sri Lankan construction industry. Respondents were selected based on the involvement to waste management within the construction site of the selected cases and case studies details are shown in Table 1 and Table 2 provides the profile of the interviewees.

Table 1. Case studies detail

Criteria	Case A	Case B	Case C	Case D	Case E	Case F	Case G	Case H
Cost of the project (Rs.Billion)	4	0.28	1.2	0.76	1.89	7	0.4	3.08
Duration of the project (Months)	36	18	18	18	24	26	18	20

Table 2. Profile of the interviewees

Profession	Code	Interviewees	Experience
Project Manager	PM	PM-C	26 years
		PM-E	18 years
Planning Engineer	PE	PE-A	7 years
		PE-B	5 years
		PE-F	13 years
		PE-H	4 ½ years
Site Engineer	SE	SE-C	4 years
		SE-D	6 years
		SE-F	3 years
		SE-G	5 ½ years
		SE-H	3 ½ years
Safety Officer	SO	SO-A	7 years
		SO-B	5 years
		SO-C	8 years
		SO-D	4 ½ years
		SO-E	4 years
		SO-F	12 years
		SO-G	2 ½ years
		SO-H	8 years
Mason	MA	MA-E	1 ½ years
Store Keeper	SK	SK-B	1 year
Labourer	LA	LA-A	10 months
		LA-C	1 year
		LA-D	1 ½ years
		LA-F	1 ½ years
		LA-G	8 months
		LA-F	1 year

CASE STUDY FINDINGS

Enablers in Construction and Demolition Waste Management

In order to identify the enablers and barriers to adopt ZW concept to the Sri Lankan construction industry, eight case studies were selected. Respondents were asked to give their perception on enablers used to manage C&D waste in the construction sites and findings are shown in the Table 3.

Table 3. Enablers to implement ZW in the construction industry

Enablers	Case A	Case B	Case C	Case D	Case E	Case F	Case G	Case H
Conducting meetings to labourers	√	√	√	√	√	√	√	√
Assigning supervisors and managers to monitor labourers	√	√	√	√	√	√	√	√
Procurement coordination		√	√	√	√	√		√
Employee commitment and attitude							√	√
Allocation of labourers to housekeeping		√						
Maintaining standards (ISO 9001, ISO 14001)			√					
Organisational policies			√					
Appreciation and rewarding the labourers						√		
Waste management targets						√		
Pleasant environment	√							
Charging fine system	√							
Skilled employees							√	

When it comes to all eight cases, respondents have identified conducting meetings to laborers, management monitoring and supervisor monitoring as the main enablers to manage C&D waste in their sites. Furthermore, other than Case A and Case G, all the other respondents have identified, coordination in procurement is also another major enabler in C&D waste management. Safety Officer (SO-B) and Store Keeper (SK-B) of Case B, stated that proper involvement of managers and supervisors through the instruction on correct ways to sort and reuse the waste materials help to eliminate waste. In addition to that, respondent SK-B stated that management use their daily meetings to convey the waste management message to the laborers. Further, SK-B stated that two laborers are allocated for waste management within their site.

Project Manager of Case C (PM-C) stated that, in the project, the project profit margin can be decided based upon waste management. If proper waste management takes place within the site, most of the materials that are being thrown away as waste can be used for an alternative purpose where cost savings can be achieved through that. Furthermore, respondents also stated that if the materials are planned from the initial planning stage, then if an instance where excess materials are available in the site, then those materials can be used to another purpose as they have pre-planned the places to use the excess materials. Moreover, PM-C also stated that engineers, store assistants, and technical officers are being sent for training where they get comprehensive ideas on material usage without creating waste. Furthermore, he stated that with the involvement of the management and supervisors, laborers are provided with knowledge on material usages and their alternative uses. Further, through quality control policies and through standards like ISO 9001, and ISO 14001 material wastage is being controlled on the site. In addition to that, PM-C also stated that use of machinery

reduces the material wastages in transportation of materials to upper stories of the site. Similarly, SO-C and SE-C said that, during the construction of buildings, attention is being paid for the environment and it helps to regulate the C&D waste generation.

For the control of waste in Case D, according to the Site Engineer (SE-D), attention is being paid to material reconciliation. Through material reconciliation, the maximum use of materials takes place within the sites. Further, for the daily meetings, contractors and direct laborers are involved in the Case D. Respondent PM-E stated that in their site laborers are asked to collect the unused nails and depending on the number of nails that laborers collect, money value is given to the laborers for the collected amount of nail waste. This has encouraged laborers to collect the nails and it also helps to enhance the safety of the site. Furthermore, when issuing the materials for laborers, issued materials are being documented. By checking the material issue details within the Case E, they check for the excess use of materials by the laborers. In addition to that, PM-E said that through training and awareness and with proper waste management practices, profit can be increased. Nevertheless, through the allocation of supervisors to monitor the activities of the laborers within the Case E, supervisors will look into material usage of the laborers and asked them to use the material in a maximum way. As an example, if there is too much block waste on a specific floor, then the supervisor will look into this matter and asked them to use the material in a maximum way.

Respondent PE-F stated that, in their site waste management is encouraged through the appreciation of work. That means when cardboard waste gets generated during the interior designing stage, within the site, it is planned to give the cardboards to recyclers. So, what they have planned on their site is to give half of the amount that is received from the recycler to the employees who collect those cardboard waste. As per the respondent PE-F, this method encourages waste management within the site. Moreover, respondent SO-F stated that waste management targets are given to the waste management team in the site. If the waste management team achieves more than the given target, then the employees are given an incentive. Apart from that, according to SO-F, through the induction also employees are encouraged to do waste management. Further, in the induction, employees are being educated regarding waste management in the site.

According to the respondent SE-G, for proper waste management within the site, labour attitude, management guidance and daily meetings to raise awareness in laborers are necessary. Further, SO-G stated that, if the employees are skilled enough, then they will try to manage the wastages by using the maximum benefits of the materials. Moreover, he also stated that for each floor they have allocated separate supervisors so that they will look into wastages and make sure to reduce waste generation. Furthermore, respondent SE-H explained that waste needs to be planned at the initial stage of the construction. If concrete is taken as an example, at the initial stage it cannot be ordered accurately. So, while in the construction stage, if there is any excess amount of concrete, from the initial stage it should be planned where to use the excess materials. Thus, it helps to reduce C&D waste. Moreover, in Case H, respondent PE-H stated that for every 10 laborers one supervisor is allocated and through a thorough inspection, waste is managed within the site.

Barriers in Construction and Demolition Waste Management

In the process of adopting ZW in the construction industry, there are different barriers. In order to identify the barriers, interviewees were asked "what are the factors that demotivate waste management in your site?" and the identified barriers are shown in the Table 4.

Table 4. Barriers to implement ZW in the construction industry

Barriers	Case A	Case B	Case C	Case D	Case E	Case F	Case G	Case H
Poor supervision	√	√	√	√	√	√	√	√
Lack of skilled labourers	√	√	√	√	√	√	√	√
Lack of awareness	√			√	√	√	√	
Labour attitude		√			√	√		
Lack of housekeeping			√			√	√	√
Lack of facilities	√		√			√		
Transportation issues		√		√				
Lack of staff commitment				√		√		
Lack of government support	√							
Issues in external parties	√							
Lack of preplanning				√				
Lack of onsite sorting						√		

In all eight cases, the most common barriers that were identified by all the respondents were poor supervision and lack of skilled laborers. Other than those barriers, lack of awareness, lack of housekeeping, lack of facilities and lack of attitude were also identified as barriers in more than 2 cases. Respondent PM-C stated that, if more focus is given to waste management, then it will lead to issues in the progress of the site. As an example, PM-C elaborated that, if the plywood is reused then there is a long process. Due to the reluctance and laziness of the laborers, this long process creates issues in reusing. In addition to that, PM-C also highlighted that lack of labour force to waste management and poor housekeeping create issues in proper C&D waste management. Respondent SE-D said that in construction sites everyone focusses on profit". At the initial stage of the construction, less attention is paid for waste management. So, in the process of construction, if a waste gets generated, there is no alternative method to be used as there are no pre-planned alternative options that have planned in the initial stage. Moreover, SE-D stated that there is a lack of budget allocation for waste transportation from the site.

Respondent SO-E explained that employers and employee perspectives on waste management also make a direct impact on waste management within the sites. Further, Safety Officer of Case E highlighted that lack of employee awareness on waste management leads to poor waste management practices within the sites. In addition to that, respondent PE-F stated that lack of waste management team to manage waste within the site is one of the key barriers they face in the process of waste management. Further, he added stating that, no one is considering waste management as their responsibility and they do not focus much on waste separation. Moreover, respondent PE-F also said that due to the lack of staff commitment and lack of housekeeping procedures also waste management does not take place in a proper way. Nevertheless, the lack of proper sorting and speed of the project also leads to poor C&D waste management within the construction sites. Furthermore, SO-F explained that, when the speed of the project is high, it is difficult to balance the construction activities and waste management within the site as they are in the goal of reaching the deadlines.

CONCLUSIONS

C&D waste creates adverse impacts on social, environment and health of the people. Thus, to mitigate the C&D waste issue, different strategies are being followed. The ZW concept is one of the strategies that can be used to eliminate waste from the construction industry. ZW can be defined as the process in which waste is considered as a resource and with the implementation of the concept, waste elimination takes place. Though ZW is identified as a strategy, ZW management in the industry is a challenging issue to be addressed. Hence, this paper has discussed the enablers, and barriers to implement ZW concept in the construction industry. The study revealed that conducting meetings with laborers, assigning supervisors and managers to monitor laborers are the main enablers while poor supervision and lack of skilled laborers as the main barriers to implement ZW in the construction industry. Therefore, the aim of the paper was achieved with the identification of enablers and barriers to adopt ZW concept in the construction industry.

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A STUDY ON THE GREEN CLEANING BENEFITS FOR MALAYSIAN PUBLIC SCHOOL

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Abstract
Operation and maintenance (O&M) phase for any types of building or business comprises of various significant activities including cleaning. Several researchers related to school building's O&M have clearly identified that the cleaning activities contributed the most significant impact to the school's healthy and safe environment, thus encourage a better performance and productivity of staffs and students. However, the current practice of conventional cleaning in school; the usage of cleaning chemicals which contain an extreme levels of volatile organic compound (VOCs) and also poor equipment (poorly filtered vacuum) leads to a harmful impact especially on the aspect of social, economic and environment. For example, health and performance issues of students, staffs and also the janitors. Therefore, Malaysian built environment industry has highly encouraged the building managers to make changes to more effective and efficient cleaning so called green cleaning practices. A study has been carried out by identifying the critical benefits which can be achieved by the green cleaning implementation in Malaysian public school. A thorough literature has been conducted and twelve (12) benefits were recognized. The researcher was then conducted a pilot test and survey involving 71 Malaysian cleaning service providers, those registered with Malaysian Association of Cleaning Contractors (MACC). In order to identify the ranking of the green cleaning benefits, the analysis technique involved are the Frequency Calculation and Criticality Index Calculation. Hence, according to the methods of analysis outcome, it shows that the benefit of "improve indoor air quality (IAQ)" and "provide safe and healthy environment to occupants and janitors" identified as the most critical benefits that the Malaysian public school can be gained through the implementation of green cleaning. The outcome of this survey can provide input especially to the O&M stage in the built environment industry, which can encourage practitioners to make a move to green cleaning practice instead of conventional cleaning.

Keywords: *Green Cleaning; Benefits; Malaysian Public School*

INTRODUCTION

Sustainability is known as a present method by the built environment practitioners, which comprises of an advanced revolution especially on environmental, economic and social aspect (Atifi, 2012). The Brundtland Commission has defined the sustainable development as "the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs" (Berry, 2010).

Malaysia had introduced a rating system specifically for environmental aspect of building called as Green Building Index (GBI). The GBI has been recognized by PAM (Pertubuhan Arkitek Malaysia / Malaysian Institute of Architects) and ACEM (the Association of Consulting Engineers Malaysia). Next, this GBI also is specially created for any new or existing construction/building in Malaysia which mainly to assess their sustainable design of the building and its performance. The assessment of the building's design and performance has been carried out based on the six (6) main criteria; (i) Energy Efficiency, (ii) Indoor

Environment Quality, (iii) Sustainable Site Planning & Management, (iv) Materials & Resources, (v) Water Efficiency, and (vi) Innovation. The recognition of the GBI has contributed to the Malaysian construction industry's which aiming in assisting the industrial players especially in construction industry towards sustainable development. The most crucial role of GBI and sustainable development approach is also ensuring the existing and new buildings will be renovated, operated, and maintained in the best green practice which also known as green operation and maintenance approach (Zainol et al., 2015).

OPERATION AND MAINTENANCE IN SCHOOL

Every type of building including school requires operation and maintenance (O&M) which is well-defined as an activity needed to preserve an asset and facilities so that it remains to provide acceptable services and achieves its expected life (BETCO, 2008). Students, teachers and staffs are heavily occupied the school building after the home. The school is an essential place where students and staffs are spending their time for teaching and learning process. Hence, the building and environment itself supposed to be accessible, enjoyable and safe for them to stay in and for other teaching and learning related activities (Corbet-Shramo et al., 2011). In order to hold their look and functionality for a long period of time, the building and facilities need to be professionally managed and maintained. The maintenance of the school buildings and facilities is not only significant for environmental and social, but also shows it's important to the economic aspect as well. Providing a professional and proper O&M activity for the school building leads to an efficient use of energy resources. A rational and efficient use of energy resources hence leads to energy saving, which means that will save the school's operational cost (Corbet-Shramo et al., 2011).

The O&M comprises a broad spectrum of services such as air-conditioning, sanitary/plumbing, cleaning, mechanical and electrical, lighting etc. (Zainol et al., 2015). Janitorial or cleaning can be categorized as the most significant and active building maintenance services during O&M stage. Cleaning services has been carried out few times a day every day. Several researches have proved that the cleaning services being the major contributor to operation and maintenance expenditure, and also gives a vital impact to the indoor environmental quality (IEQ) (Berry, 2010; BETCO, 2008; and Zainol et al., 2015).

According to Kates et al. (2005); Kile et al. (2005) and Kohls (2010), almost 55% of the nation's school's environment are facing problems especially on the indoor environmental quality (IEQ) due to;

   a) poor installation of amenities
   b) poor building materials and design
   c) poor ventilation system
   d) poor cleaning services

The school building encompasses a large building area, high number of occupants (students, staffs, and teachers), and numerous furniture. Hence, it requires proper and professional cleaning services (BETCO, 2008; Green Clean Program Resource Guide, 2010; and Healthy School Network. Guide to Green Cleaning, 2016).

Although the availability of many researches regarding school, however there is still lack

of research and information on how the school buildings are supposed to be managed, maintained, and operated. Several researchers have found that most of cleaning services in school are practicing traditional cleaning services by using harmful cleaning detergent, non-ergonomic equipment, and unclear procedures. This traditional practice of cleaning may give a bad impact especially on IEQ (e.g. indoor pollution) to school environment (Environmental Working Group and Regional Asthma Management and Prevention, 2016). By practicing traditional cleaning practices, products and equipment may also give a bad impact to occupants' health due to been exposing to chemicals (Environmental Working Group and Regional Asthma Management and Prevention, 2016). Hence, it is needed for all types of building especially school to have an efficient and proper cleaning services in order to prevent any health issues and indoor pollution. *Table 1* below are mentioning on the effects of practicing traditional cleaning services which seriously leads to the issues of occupants' health and the environment, thus becoming a strong and valid reason to take into consideration on the measures to prevent those issues.

Table 1. Bad impacts of traditional cleaning

Health Issues	Environment issues
(i) Exacerbations of asthma, and other breathing problems	(i) Water pollution
(ii) Harmful to the nervous system, reproductive organs, kidney and liver	(ii) Increased waste
(iii) Eye irritation and headaches	(iii) Cleaning products made from scarce, non-renewable resources
(iv) Hormone disruption	
(v) Cancer	
(vi) Poor design of cleaning equipment can cause injuries to janitor	

(Sources: Zainol et al., 2016)

GREEN CLEANING IN SCHOOL

United State EPA's Schools Chemical Cleanout Campaign (SC3) is encouraging every schools to implement green cleaning practices which aim to provide clean and safe classrooms and environment to the building occupants. According to their annual report 2016, schools' janitors are using various of cleaning chemicals which sometimes be harmful to occupant's health (eye, nose, and throat irritation, asthma, headache, and etc.) and to the environment (BETCO, 2008; and More et al., 2011). A growing body of scientific knowledge has proven that children may suffer disproportionately from environmental health risks and safety risks. However, the issues of health and environment can be solved by establishing and implementing a green cleaning program in school. By consuming green cleaning products and practicing green cleaning practices can be less harmful to human health and the environment compared to other conventional cleaning products and practices that have been used by many schools today.

Healthy School Campaign (HSG) which is a non-profit organization in Chicago committed to ensure that all students have access to a healthy and safe school environments where they can socialize, learn and succeed. In HSG annual report 2017, they have created the five (5) simple steps (as in Figure 1) that anyone can apply to start or enhance a green cleaning program at school.
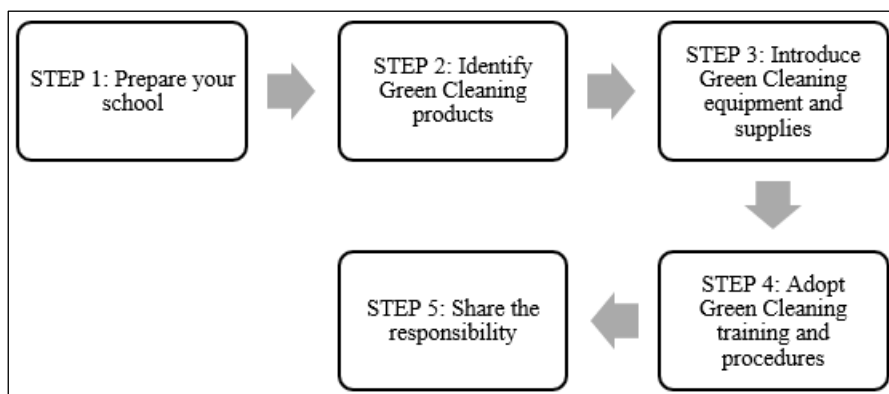
(Sources: Clean, G. (n.d.). A Green Cleaning Program Starts Here)
Figure 1. The five (5) Steps to Green Cleaning in Schools

The most important thing parents should consider in choosing school for their children is pertaining to the environment of school. The environment provided must be in healthy and safe condition for them to stay all day. Hence, a proper and professional school maintenance and cleaning services is required in order to provide a safe and healthy environment to the students, teachers, and staffs. Despite, several researchers have stated that the building maintenance aspects specifically 'cleaning services', are always been ignored (Nazaroff and Weschler, 2004). Aforementioned in Table 1, the execution of traditional and poor cleaning services has negative impacts mainly on the environment (indoor air quality), social (safety and health) and economic (operation cost/expenditure) aspects (Nazaroff and Weschler, 2004). These negative impacts also have been proved by several researchers that the traditional cleaning procedures and products may lead to variety of occupant's health problems and indoor pollution (Zainol et al., 2015; Rumchev et al., 2004; and Samari et al., 2013). This happened due to the consumption of toxic and non-biodegradable cleaning product which full of chemical and volatile organic compound (VOC). Next, this harmful cleaning product will pose physical and emotional discomfort to the students, staffs, and teachers. Thus, this may lead to reducing staff's productivity and distracting the process of teaching and learning in school (Corbet-Shramo et al., 2011).

Green cleaning is much required for every school building. Several researchers and cleaning service providers had proposed the green cleaning programme to the Malaysian Government (Zainol et al., 2015 and Young et al., 2010). However, until today there is not any enforcement by the Malaysian Government on the green cleaning programme, especially pertaining to the establishment of green cleaning policies or guidelines/standards (BETCO, 2008; and Young et al., 2010). Besides, the Malaysian green building rating system (GBI), has also never mentioned any specific component or requirement to implement the green cleaning. The GBI had only mentioned on the usage of environmentally friendly cleaning product though the green cleaning programme is beyond just a product. Zainol (2016) and Young et al. (2010) had stated that the green cleaning programme encompasses few components which include training components, equipment, cleaning procedures, communication channel and so on. Thus, this research has been carried out to explore and investigate on the green cleaning practice specifically for Malaysian public school. The aim of this research is determining the significant benefits of green cleaning implementation for Malaysian public school.

THE STUDY

Below (Figure 2) is the processed occupied in achieving this research.
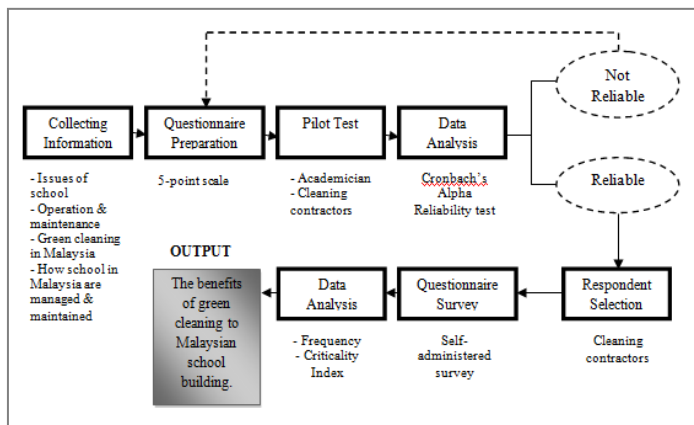
Figure 2. Research Flow

Collecting Information

All the information has been gathered from primary data (personal communication) and secondary data (journals, conference papers, news, books, articles etc.) specifically on the issues of Malaysian public-school environment and how the building are managed and maintained. The personal communication has been conducted intentionally in obtaining opinions and ideas from the practitioners (cleaning service provider) regarding the awareness and how much extent the green cleaning has been implemented in Malaysia. The outcome from the interview sessions, the practitioners have mentioned on the challenges and issues that thwarting the implementation of green cleaning in Malaysia, basically the challenges are pertaining to the cost and awareness among the cleaning service provider. However, most of them agreed on the benefits that can be achieved from a comprehensive green cleaning practice particularly for Malaysian public school.

Questionnaire Preparation

A technique of questionnaire in this study aims to gather a valuable data in particular area and its will be analysed and tested statistically. A set of questionnaires has been constructed which consisting closed ended questions with 5 Likert scale. Then, the respondents participated in this study need to choose and tick the answer in the appropriate column provided. The questions prepared in this study involving two (2) separated sections:

  i.   Section A: Respondent's Background
  ii. Section B: Benefits of Green Cleaning for Malaysian public school

The 5-point scale in Likert scale questionnaire is commonly used in several researches which to allow the respondents to convey their opinion (agree or disagree) with the particular statement. The Likert scale assumes that the strength/intensity of an attitude is linear on a range from strongly disagree to strongly agree and makes the assumption that attitudes can be measured.

Reliability test were then being carried out by using Cronbach's Alpha Reliability Test to test the internal consistency of the group of questions.

Respondent Selection

The respondent involved in this research is only the cleaning service provider according to the role they perform and experiences they had in cleaning services in Malaysian public school. Based on the information received from Malaysia Association of Cleaning Contractors (MACC) website, estimated around 208 cleaning service providers have officially registered and listed under MACC. Out of 208 cleaning service providers, only 103 cleaning service providers experienced in providing cleaning services for Malaysian public school. Therefore, all of 103 registered cleaning service providers have been approached and only 71 of them agreed to participate.

Questionnaire Survey

The designed questionnaire has been distributed to all 103 registered cleaning service providers through walk in and email to their respective managers. Hence, after three weeks of distribution, the researcher received 71 respond/feedback from the respondents.

Data Analysis

A pilot study was carried which involved 30 selected respondents (15 academicians and 15 practitioners of school cleaning services). The collected data were analysed using Cronbach's Alpha Reliability Test. Aforementioned, this test is frequently been used and its familiarity among social science studies to calculate the reliability of their items (Gliem & Gliem, 2003). As stated in Table 2, the final values of Cronbach's Alpha for this research is 0.780, thus it shows that the questionnaire is reliable to be handled in this research. Besides, agreeing by Litwin (1995), when the final values of Cronbach's Alpha is more than 0.7, it shows that the questionnaire developed in this study is internally consistent and reliable to be carried out.

Next, the reliable instrument was then distributed to the related respondents (cleaning service providers). Aforementioned, out of 103 questionnaires that have been disseminated, only 71 of them were positively answered and returned. The collected data were then analysed by using the statistical methods; frequency and Criticality Index. Criticality index formula (as in Figure 3) was used to determine the ranking and criticality of the factors.

$$\text{Criticality Index} = \frac{5n_1 + 4n_2 + 3n_3 + 2n_4 + n_5}{5(n_1 + n_2 + n_3 + n_4 + n_5)}$$

where,

n_1 = number of respondents who answered 'strongly agree'

n_2 = number of respondents who answered 'agree'

n_3 = number of respondents who answered 'neutral'

n_4 = number of respondents who answered 'disagree'

n_5 = number of respondents who answered 'strongly disagree'

Figure 3. Criticality Index formula

As per data collected and analysed, the research has revealed the twelve (12) green cleaning benefits for Malaysian public school. All the twelve (12) benefits that can be gained are relating to three (3) main aspects; i) Economic, ii) Social, and iii) Environment. As per Table 2 below, the result shows the ranking of the green cleaning benefits for Malaysian public school.

Table 2. The green cleaning benefits to Malaysian public school according to the ranking

Benefits	Cronbach's Alpha if Item Deleted	Criticality Index	Ranking
Social benefits			
Provide safe and healthy environment to occupants and janitors.	0.798	0.9211	2
Improve occupants' and janitors performance.	0.833	0.7831	9
Enhance school image.	0.773	0.6676	12
Reduce absenteeism and sick leave.	0.771	0.8507	8
Environmental benefits			
Improve indoor air quality (IAQ).	0.911	0.9521	1
Reduce waste.	0.741	0.8676	7
Reduce environmental pollution from chemical use .	0.721	0.8761	5
Reduce the excessive use of natural resources (i.e. energy, water, chemical etc.).	0.812	0.8704	6
Economic benefits			
Reduce operating cost due to reduction of energy consumption, water and cleaning product usage.	0.699	0.9099	3
Increase the value of building and rental income.	0.742	0.6930	11
Reduce cost to purchase cleaning product due to efficient usage.	0.723	0.8568	4
Reduce medical expenses due to higher rates of injury and illness.	0.845	0.7606	10
Cronbach's Alpha: 0.780			

Rank 1: Environmental benefits

Improve Indoor Air Quality (IAQ)

According to Young et al. (2010) and BETCO (2008), harmless cleaning product, materials and equipment of green cleaning can expressively improve the IAQ. Good IAQ may produce result in healthier, happier, and more productive occupants by reducing the risk and healthcare cost. BETCO (2008) has mentioned that the good IAQ can actually improve 5-7% of occupants' productivity. Staffs who lived in poor IAQ condition will always be absent from work, less productive, and lose more work hours (Ghodrati et al., 2012).

Rank 2: Social benefits

Provide safe and healthy environment to occupants and janitors

Green cleaning is adopting an environmentally preferable cleaning products, materials and equipment that significantly may help in improving occupants' health in school building. Young et al (2010) has stated that this kind of product contains zero or a lesser amount of chemical substance that critically reducing the health risk; e.g. asthma, eye irritation etc. Moreover, the equipment used for green cleaning activities is taking into account the ergonomic factors. Thus, may help to prevent and reduce any potential injuries; neck, shoulder, low back and wrist (Corbett-Shramo, Wagner and Esbensen, 2011).

Rank 3: Economic benefits

Reduce operating cost due to reduction of energy consumption, water and cleaning product usage

Traditional cleaning activities consume higher quantity of water, energy and chemical. However, by practicing 'Day Shift Cleaning' strategy and consumption of products and proper equipment in green cleaning programme, the usage can be saved up to 40%-50% (BETCO, 2008; Cox et al., 2009; Kohls, 2010; Mollenkamps, 2009; Young et al., 2010;). Hence, according to Kohls (2010) the cost of school's operation especially in maintenance aspect can actually be reduced and prolonging the building/amenities lifespan.

Rank 4: Economic benefits

Reduce cost to purchase cleaning product due to efficient usage

The green cleaning products are commonly sold in concentrated form that will save the space of product storage. Besides, it's also can reduce the purchase frequency and delivery cost (Young et al., 2010; Cox et al., 2009).

Rank 5: Environmental benefits

Reduce environmental pollution from chemical use

Extreme usage of cleaning chemical during school O&M stage may polluted and damaged the school environment; e.g. air, land and water pollution (Corbett-Shramo et al., 2011; Ontario Ministry of Education, 2010). This happened due to most of the traditional cleaning products are made from non-renewable natural resources; e.g. petroleum (Corbett-Shramo et al., 2011; Ontario Ministry of Education, 2010). Therefore, by using "environmentally preferable" or "green" cleaning products for cleaning service in school can diminish those bad effects (Fischer, 2010).

CONCLUSION

This paper has clearly mentioned on the needs of green cleaning practices and also its benefits to Malaysian public school. Obviously, this green cleaning programme had better to be among the standard practice for every types of building, especially for schools' operation and maintenance. Several researchers and cleaning service providers have also emphasized on its significance/benefits especially on the three sustainable aspects; economic, social, and environment. Though, in Malaysia, yet there is not any regulations or specific standard have been established to implement green cleaning especially for public school. Thus, it is imperative and critical to look at this sustainable maintenance approach, by exploring and investigating the appropriate green cleaning components and requirements, persons to be involved in this programme, and how it should be conducted (processes and procedures). Therefore, the persons whose involved in school operation and maintenance should cooperate especially on the establishment of school green cleaning policy. The school maintenance team should hire or collaborate with green teams (GBI facilitator) for them to get more valuable information on the sustainability programme, hence created a more successful green cleaning

policy and programme. A healthier and safer environment in school leads to a superior working and learning environment, hence offer a very positive impacts on students' achievement and performance, and staffs productivity.

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LEADERSHIP-RELEVANT BOURDIEU CAPITALS OF DESIGN CONSULTANT FIRMS' MANAGERS IN THE MALAYSIAN CONSTRUCTION INDUSTRY

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Abstract
The creative products of Malaysian design firms are critical for sustained competitiveness in the increasing globalized and local construction market. These products are derived from the collaborative efforts of the design leaders and their subordinates. Owner-managers of design firms are aware of the role of their leadership in increasing the productivity of their creativity workers. Knowledge of effective leadership traits has initially guided leadership development and sustainability. Later theories such as charismatic theories and leader-member exchange theories have a common theoretical paradigm of leader-follower relations. A novel approach to this leadership theoretical paradigm is replacing relevant leaders' traits with Bourdieu capitals that effectively influence their followers. This paper reports the findings of interviews with subordinates in Malaysian architecture, civil engineering and landscape architecture consultant firms regarding the influence of the superior's Bourdieu capitals upon their creativity. Qualitative thematic coding analysis of the interview transcripts generated the relevant Bourdieu capital categories and theme. The leader's human, emotional, political, cultural and social capitals were found to influence the subordinate's creativity motivation. The data indicate a common theme of followers' creativity motivation through learning from leader's superior human capital. The learning is aided by the leader's emotional capital. The findings imply that four generated capitals are components of two Bourdieu initial capitals (social and cultural) and that the generated political capital is conceptually aligned with symbolic violence. Bourdieu capitals offer an innovative perspective in studying and possibly quantifying leaders' influence upon their followers.

Keywords: *Leadership; Creativity; Bourdieu Capitals; Design Consultants; Malaysia.*

INTRODUCTION

Many nations including Malaysia increasingly embrace and support free trade in international services despite recent developments towards protectionism. The liberalization of professional services trade is relatively small yet will grow in the future (Roy, 2016). Malaysian architecture, engineering design and other construction related consulting services firms will face increasing competition locally and internationally because Malaysia has committed to bilateral and regional free trade agreements (MATRADE, 2017; MoWM and CIDB, 2017). These businesses can only compete successfully if they provide higher quality creative designs and product deliverables to the globalised clientele.

Creativity is integral to the design process. It can generate novelty and usefulness yet does not necessarily guarantee an effective design (Mulet et al., 2017; Runco and Jaeger, 2012; Sawyer, 2012; Valgeirsdottir and Onarheim, 2017). A design firm is partly dependent upon the creativity of its designers to remain competitive. The principal and senior designers of architecture and civil engineering consultant firms generally lead and collaborate with a team of less experienced subordinate designers to generate designs suited for the clients. Hence, competitive designs are easier to generate with highly creative subordinate designers. The

leader's behaviour is critical in enhancing the subordinates' creativity (Dong et al., 2017; Sisik et al., 2017; Wang and Rode, 2010; Politis, 2005).

PAST RESEARCHES

Research approaches on leadership in promoting creativity among followers in organizations include the influence of superiors' behaviours and traits upon the subordinates' behaviours. An emerging research approach is the impact of a leader's tangible and intangible resources on his followers' behaviours. These resources are money, social network diversity, personal qualities, and experiential knowledge. Such resources are labelled as capitals (Bourdieu, 1986). A leader possessing high amount of capitals is seen as highly credible both within and outside his organization (Venkataramani et al., 2016).

Bourdieu (1986) sees capitals as relevant to socio-cultural frameworks called "fields of practice". Each field of practice possesses a unique doxa (rules of the 'game') and habitus (psychological schemas of thoughts, actions and dispositions). An individual simultaneously resides in many fields such a field of communal relationships, a field of familial relationships, and a field of professional work etc. Individuals in a field use their capitals in a continuously struggle for positions or status. A person's set of capitals is sustained, accumulated or diminished because of his life actions. The usefulness of a capital varies in fields of practices. For example, social capital may be more beneficial to actors in the political field as compared with those in the creative and manufacturing fields (Bourdieu, 1986, 1984).

Past researches (e.g. Santos-Rodrigues et al., 2010 and Liu et al., 2015) on the influence of Bourdieu's capitals mainly focused on one or two capitals instead of a combination of Bourdieu capitals. Social capital was found to exert a clear influence on innovation and creativity in education and manufacturing (Landry et al., 2000; Perez-Luno et al., 2011; and Gu et al., 2014). Leadership researches in education (Spillane et al., 2003), sports (West and Allin, 2000), and community researches (Zackarakis and Flora, 2005) had used Bourdieu capitals. Other fields with leadership researches using Bourdieu capitals are business (Levy et al., 2015), ethnic studies (Keskiner and Crul, 2017) and politics (Bennister et al., 2014). Bourdieu capital-relevant variables utilised in construction industry researches are leaders' emotional, intellectual and managerial competences (Meng et al., 2015), psychological capital (Toor and Ofori, 2010) and technical competence (Minh et al., 2017). No leadership studies based on Bourdieu capitals has been carried out upon the creative practitioners in the construction industry.

Leadership in the construction industry is relatively under-researched. This is despite leaders in construction industry having lesser non-technical skills such as leadership relative to their technical skills (Wan Muda et al., 2016). Most researches focused on two aspects to explain leadership effectiveness in the construction industry; namely the leaders' behaviours and styles, and the leadership in the context of the project. Among the researches on leaders' behaviours and styles are Zheng et al. (2019), Jung et al. (2014) and Rowlinson et al. (1995). Examples of researches regarding project leadership are Laarson et al. (2015), Dainty et al. (2005) and Odusami et al. (2003).

Project team leadership is more attractive to researchers as it is seen as the type of leadership relevant for successful project outcomes. The construction industry has a

fragmented approach to product delivery. A grouping of consulting firms and construction contractor firms collaborate to deliver the product in the construction project. The leader of the project team is traditionally the architecture or the civil engineering consultant.

The principals of consulting firms depend on a team of their firm's subordinates to deliver design services and products. The provision of good design services and products by consultant firms contributes to the overall project success. Yet, there are few researches on leadership of the subordinates in consulting firms. Past architecture firm leadership studies are from Ireland (Fleming, 2012), Turkey (Kasapoglu, 2014), South Africa (Wenlock, 2014), United Kingdom (Galloway & Haniff, 2015) and Australia (Zacher & Rosing, 2015). Kissi et al. (2012) investigated leadership in United Kingdom civil engineering consulting firms. There is no past research regarding leadership in design consulting firms of the Malaysian construction industry.

METHODOLOGY

This research forms the exploratory qualitative phase of a larger study about the influence of the superior's Bourdieu's capitals on subordinates' creativity in design consultant firms from the Malaysian construction industry. This research's findings guided the design of the survey questionnaire for the subsequent phase of the larger study.

Five design subordinates in architecture design consultant firms, six design subordinates from civil engineering design consultant firms and six design subordinates in landscape design consultant firms throughout Malaysia constitute the purposive sample interviewed by telephone. The sample was confined to design subordinates with minimum of five years working experience in their respective professions. They were chosen based upon snowball sampling and consulting firm directories of the respective professional bodies in Malaysia. Eight respondents were male. Theoretical saturation was reached after the seventeenth respondent and the interviews were stopped. Although the sample is multi-disciplinary and seems inappropriate, the respondents inhabit the same 'field' (construction industry) with its unique doxa. They also share a common habitus as Malaysians (Bourdieu, 1986).

The fourth author conducted and transcribed audio-recorded interviews with the respondents. They were asked to opine on the given statements about their leaders' characteristics that could motivate them to be more creative. The first author used Qualitative Thematic Coding to analyse the interview transcripts. It involved the reiterative content analysis of the transcripts, audio recordings and written interview notes. The analysis generated meaning units which are groups of transcript verbatim excerpts of similar meanings. The meaning units are then consolidated in categories of Bourdieu capitals. The Bourdieu theory of field is the analytical base to uncover the meaning units and categories. The next stage of the analysis involved identifying a common theme in these meaning units and categories, and also from the reanalysis of the transcripts, audio recordings and written interview notes. Twenty-one relevant meaning units, five Bourdieu capital categories and a theme were generated. The second and third authors reviewed the analysis results. Their comments were acted upon to increase the findings' robustness.

FINDINGS

The following sections report the capitals and theme generated from the analysis, and the discussion of the findings. Table 1 provides the definitions of the capitals and their respective meaning units. It also shows the distribution of the meaning units among the respondent.

Category Findings

The content analysis of the interview transcripts generated nineteen meaning units reflecting the characteristics and behaviours of the leaders that influence the respondents to be more creative. Five capital categories were identified from the consolidation of the meaning units. These are Social, Human, Cultural, Emotional and Political Capitals. The following sections are about these five capitals. Each section provides the definition of a capital. It then explains the meaning units relevant with the capital.

Cultural Capital

This category refers to the subordinate's perception that the leader's possessions, style and image reflect the leader's status in society and provide benefits. This category consists of three meaning units.

The first meaning unit *Marketing to Client* refers to the manner the leader's cultural capital is perceived to help obtain new work commissions. The leader uses cultural capital (his image and possessions) to market to potential clients and jobs; enhancing the firm's survivability. The subordinates become assured of job security and are motivated to design well. Respondents A2, A3, A4, A5 and E3 said that the leader's distinctive and expensive possessions such as his car and dressing are useful for procuring jobs. These possessions make potential clients perceive that the principal is successful and capable of delivering the design services. These perceptions help persuade potential clients to award the commissions to the firm. Thus, the leader's cultural capital indirectly causes the subordinates to be motivated to be creative due to the perceived assurances of job security. Respondent E1 had cited that the leader's cultural capital can enhance the firm survivability and consequently create his feelings of job security. However, he disagreed that it could impact on his creativity.

The next meaning unit is *Subordinate Helps Marketing*. Respondents A3 and A4 said that when their leaders dress appropriately for marketing purposes, they felt obligated to support their leaders' marketing efforts by dressing likewise at the office.

The last meaning unit is *Leader's Charisma*. The leader has charisma due to his projection of success through his possessions, style and image. Respondent A5 noted that the leader's expensive and distinctive possessions create an aura of success. This aura creates charisma that makes subordinates' desire to be close to and be associated with the leader because of the desire to emulate their leader's success.

Table 1. Capital categories, respective meaning units and distribution among respondents

Category	Meaning Unit	A1	A2	A3	A4	A5	E1	E2	E3	E4	E5	E6	L1	L2	L3	L4	L5	L6
Cultural Capital	Marketing to Client		X	X	X	X	X		X									
	Subordinate Helps Marketing			X	X													
	Leader's Charisma					X												
Political Capital	Reward and Punishment Power		X	X		X			X	X	X	X						
	Self-Imposed Acquiescence	X		X	X											X		
	Trust Induced Influence			X													X	
Social Capital	Socially Sourced Knowledge					X		X	X	X		X	X	X	X			
	Social Sourced Work Capabilities		X	X						X				X				
	Job Security								X									
Human Capital	Learning from Leader's Experience and Knowledge	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Subordinate's Confidence of Leader's Knowledge	X	X	X	X	X	X	X									X	X
	Reciprocal/Collaborative Learning	X				X	X	X	X	X	X			X	X	X		
	Nurtured Learning					X	X		X		X			X	X	X	X	
	Role Modelling					X	X		X		X						X	
	Leader's Accredited Knowledge	X				X	X	X				X						
	Leader's Reputation	X		X	X													
	Leader's De-Motivating Influence	X			X								X					
	Leader's Respectfulness to Subordinate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Emotional Capital	Leader Possessing Likeable and Inspiring Traits		X	X	X		X		X	X		X	X		X	X	X	X
	Leader's Compassion to Subordinate			X	X				X	X					X		X	
	Leader is Supportive and Nurturing towards Subordinate	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X

"Because (it is) down to one word – Image. Because……the leader driving a luxurious car, branded clothes, but that of course, people will like, respect the leader. Because if he wears that clothes, drive that car, people will like Wow. It will give the leader's appearance to the people that they will see him as being very successful….. It will give positive things. So, in your statement about suitable spare time hobbies, such things will give the leader a very positive image. When the leader has a positive image, he has this very strong aura, it will affect people nearby him. Because people want to be with the leader. So, definitely, the leader is influencing people. So, definitely, their creativity will be influenced by the leader."

Architect Respondent A5

Political Capital

This is related to the subordinate perception that the leader has the power to influence his subordinate's behaviour with respect to creativity. There are also three meaning units specific to leadership capital.

In the *Reward and Punishment Power* meaning unit, the leader has the power to either reward or punish the subordinate. Respondents A2, A3, A5, E3, E4, E5 and E6 said that the pay and other intangible 'rewards' contributes to the leader influence over them. Respondent E3 highlighted empowerment and less pressured working atmosphere as influential rewards that the leader gives to the subordinates.

"Rewards are definitely necessary. The reward is not just pay, it includes our 'freedom' at work. My boss is agreeable with the way we work so long as the job get done, OK? That is a type of reward. He has made me feel 'comfortable' working here…We get no excessive pressure working here."

Engineer Respondent E3

The second meaning unit is *Self-Imposed Acquiescence* that refers to the subordinate acquiescing to meet the leader's demands and requests due to his good relationship with the leader (respondents A1, A3, A4, and L4). A good superior-subordinate relationship can result in the subordinate purposely curtailing his creativity to keep the superior happy. This can end up frustrating the subordinate. This is the case with the architect respondent A4. When he joined the firm, he investigated the professional background of his leader. He found that the leader has a reputation for being very creative in the industry. The subordinates tried to design in the tropical modernist style because the leader likes to design in that style. However, respondent A4 sometimes become unhappy not being able to design in other styles.

Trust Induced Influence meaning unit refers to the leader being able to influence the subordinate because the subordinate trusts him (respondents A3 and L5). The mutual trust between the leader and subordinate in their work interaction can cause the subordinate to be motivated to be more creative without asking for more pay. Architect respondent A3 said that he liked if his leader had a give-and-take attitude with designs. The leader should consider the subordinate's need to be 'creatively accepted' while not neglecting to satisfy the leader's creative desires. Thus, the subordinate will be motivated to work harder, more "honestly' and be more creative.

Social Capital

The category Social Capital refers to the subordinate's perception of his leader's durable social network that motivates the subordinate to be more creative. Three meaning units were relevant to this category.

Respondents E2, E3, E4, E6, L1, L2 and L3 cited the *Socially Sourced Knowledge* meaning unit. This refers to the leader's knowledge that is obtained via his social network. Knowledge is an important component of being creative. Hence, they appreciated the leader's sharing with them new knowledge gained from networking with relevant persons outside the firm such as other consultants, local authority personnel, national government's Public Work Department officials etc. The shared information or knowledge may not be directly related to their expertise but was still appreciated. The leader also shares some of his social network with his subordinate so that the subordinate can easily access the persons to directly obtain ideas and knowledge. This helps to build up the subordinate's own social capital.

The next meaning unit is *Socially Sourced Work Abilities*. The leader's social network can help a subordinate facing a design problem. The leader helps solve his subordinate's problem by referring to his social network such as other consultants, government officials etc. for problem solving ideas which he then passes to the subordinate (respondents A2, A3, E4, and L2). Thus, this meaning unit refers to the leader's ability to help them complete design work through using his social network.

"...In my work, I often encounter problems that are not related to my profession. For example, process engineering problems or electrical engineering problems, I have to work with them to solve the problem. If we do not understand or know something, we have to refer to others. If my boss has friends outside from these professions who can help, I can get help through my boss."

Engineer Respondent E4

The meaning unit *Job Security* refers to the subordinate's belief in the leader's ability to gain work through his social network thus enhancing the subordinates' job security. Respondent E3 mentioned he were motivated to try to be more creative because he believed that leader could gain new work through his social network. The new jobs secured his employment in the firm. Thus, he felt it worthwhile to try to be as creative as possible in his job.

Human Capital

Human capital refers to the subordinate's perception of experiential knowledge and institutionalized recognition of skills and experiences of his or her leader. Eight meaning units were relevant to this category.

The first meaning unit is *Learning from Leader's Experience and Knowledge*. It refers to the further development of subordinate's human capital through learning from his leader's knowledge and experience. All the respondents' narratives had this meaning unit. According to respondents A5, E1, E2 and E4, the leader must have better academic and professional accreditation than the subordinate. In addition, the leader must have superior experiential

knowledge. This makes the subordinate more confident of the value of learning from the leader's human capital.

Respondents E1, E2, E3, E4, E5, E6, A1, A4, A5, L2, L3 and L4 highly valued learning the leader's experiential knowledge. Respondent A1 said that having higher degrees is not important for architecture creativity. Respondent E1 strongly valued learning from the leader's experience. Yet, he narrated that a leader needs a strong theoretical background in structures to design well. Thus, his human capital is perceived as credible by his subordinate. It implies that Respondent E1 wanted assurance that his leader's experiential knowledge is reliable to learn from. Respondent E1's 18 years of working experience suggests that he holds the view that long working experience does not equate with the possession of correct or useful experiential knowledge. Respondent L3 recognizes that his design lacked the 'practical knowledge' aspect. He appreciated learning and using the experiential knowledge of his leader as it makes his design better. In respondent L2's case, his leader (the principal) oversees the design process. He reviews and discusses the design with the subordinate assigned to the task. The leader's knowledge is transferred to the subordinate during the reviews and discussion. He tends to assign the designing to the subordinate who is more skilled, thus ensuring that the design desired by the client is obtained. This motivates the subordinate to design to his best in every task assigned.

The second meaning unit *Subordinate's Confidence of Leader's Knowledge* refers to the subordinate driven to designing more creatively due to having confidence in leader's human capital to learn from. Respondents A1, A2, A3, A4, A5, E1, E2, and L5 cited this meaning unit. Respondent E2 was more motivated to be more creative when he is confident of his leader's experiential knowledge. Respondent A1 cited that the motivation to produce creative and practical designs arose from his desire to learn from his leader's comments about his design. He implied that if his initial designs were neither practical nor creative enough, the leader will reprimand him rather than commenting constructively on the designs.

The next meaning unit is *Reciprocal/Collaborative Learning*. The leader and subordinate learn from each other's knowledge and skills. Respondents A1, E1, E3, E4, E5, L2 and L4 cited that the learning was two-way process. The subordinate learns from the leader's human capital and the leader also learns from his subordinate designs. This reciprocal learning is more evident when the subordinate has his own experiential design knowledge. Thus, the discussion-based learning is more beneficial to both parties (respondents E1, E3, E4, and L4).

The *Nurtured Learning* meaning unit refers to the leader guiding and nurturing the subordinate's human capital development. Respondents A5, E1, E2, E3, E5, L2, L3, L4 and L5 cited the importance of the leader nurturing the subordinate when enhancing the subordinate's human capital. These respondents view the leader as someone who will share, guide, teach, inspire and support the human capital development of his subordinates. This nurturing leads to more effective learning by the subordinate. Respondent A5 narrated that he viewed a good leader as the superior who is willing to willing to share his knowledge with and provide inspiration to the subordinates to be creative. The sharing of knowledge is unplanned and is not necessarily during the design process.

"Our relationship is not limited to the office. Sometimes he will ask to accompany him to the meetings so that we have varied work exposures. Sometimes during the car journey with him, he will discuss work…and give design insights through his 20 years of experience in landscape design."

<div align="right">Landscape Architect Respondent L3</div>

Role modelling meaning unit refers to the subordinate being driven to emulate the leader's creativity and knowledge. Respondents A5, E3, E5 and L5 pointed out that their creativity and improved knowledge reflect their leader's creativity and knowledge. As subordinates, their creative works had to align with or modelled along the leader's creative wants. Respondent L5 made a conscious effort to identify his superior (the firm's principal) design preferences. He has his superior's preferences in his designs so that the design would be accepted without too many revisions.

Leader's Accredited Knowledge is the sixth meaning unit. It is about the leader having academic and professional accreditation of his knowledge and practice (respondents A1, A5, E1, E2, and E6).   Respondent E2 felt more confident of the expertise, knowledge and experience of her leader because he is an engineer with a Professional Engineer accreditation from the Board of Engineers Malaysia. Yet respondent A1 felt that he is not impressed with higher academic qualification such PhDs because he felt that the leader's experiential knowledge was more valuable to him. However, respondent E1 felt that academic qualifications indicate accredited knowledge because engineering design is based on theoretical engineering knowledge. Hence, a leader with average engineering theoretical knowledge accreditation is not as credible as one who is accredited with high level engineering theoretical knowledge. Respondent E6 also placed his confidence in his leader who is a Professional Engineer accreditation because his leader was helping him to become a Professional Engineer. Respondent E2 also shared the same perceptions.

"Experience is important and things like that. In engineering, there is the Ir (accredited professional engineer) title. A person with such a title is bound to have lots of experience. We can refer to such a person at work to help in our work. Then, we can also make him our mentor because you need a professional engineer as a mentor if you want to apply for the Ir (Ingenieur) title."

<div align="right">Engineer Respondent E2</div>

The next meaning unit is about the *Leader's Reputation*. Respondents A1, A3 and A4 cited this meaning unit. A good reputation validates the leader's knowledge and skill in the field. Respondent A4 said that a leader's reputation in industry creates subordinates' confidence in his/her human capital while respondent A3 said that such reputation results in potential clients being assured of his/her expertise and thus commissioning the jobs to the firm. Respondent A1 said that the leader's reputation can motivate subordinates to design more creatively for fear of bringing down their leader's reputation, thus impacting on winning future jobs.

The meaning unit *Leader's De-motivation Influence* refers to the subordinate being demotivated to become creative due to the design being overly dependent on input from the leader's superior human capital. Respondents A1, A4, L1, L3 and L5 narratives contained this meaning unit. Leaders can dominate the design input such that the subordinates were

sometimes demotivated to be more creative. They felt that it is easier to just follow the leader's design directions rather than coming up with creative ideas that would be sidelined in favour of the leader's alternative designs (respondents L3 and L5). The leader's prerogative over the final design has demotivation effects. Respondent L5 felt 'dishonest' to his own design creativity through incorporating his superior's preferences in his designs. Respondent L1 is demotivated to be creative for some aspects of the design because he knows that the leader has his preferences for these aspects.

Emotional Capital

Emotional capital is about the subordinate's perception of the leader's emotional resources in the form of emotional support, expenditure of time, attention, care and concern available to his/her subordinates. Four meaning units comprise this category.

All respondents cited the first meaning unit labelled *Leader's Respectfulness to Subordinate*. This meaning unit was the 'theme' in every interview. The respondents want to be treated by the leaders with respect. A leader should also be respectful of his subordinate's design abilities. Such respect creates closer leader-subordinates relationship. It encourages the subordinate to be open to discussion with his leader and thus facilitate knowledge transfer (respondents A3, A4, E4, E6, L4 and L5). Respondent E3 said that he was comfortable working with the present leader such that he has been with the leader for fifteen years. His present leader treated him with respect as a fellow professional.

The next meaning unit is the *Leader Possessing Likeable and Inspiring Traits*. Such traits facilitate a closer leader-subordinate relationship (A2, A3, A4, E1, E3, E6, L1, L3, and L6). Respondent A2 and A4 noted that when the leader possessed likeable traits, the subordinates are influenced to have such traits. Thus, it creates a less stressful and improved collegiality at the firm, and makes the subordinates willingly give their best in their designs.

The next meaning unit is *Leader's Compassion to Subordinate* that refers to the leader being empathetic to his subordinates (respondents A4, E3, E4, L3 and L5). Respondent L3 narrated that leader who shows compassion by permitting him to attend to urgent family obligations even during peak times. However, the respondent realizes that he still has commit to finishing his task on time. It creates the feeling that the leader cares for the off-work welfare of the subordinate. Respondent E4 narrated that he felt his leader was compassionate to his subordinates because the leader planned the assignments to each subordinate to avoid overburdening them.

The fourth meaning unit is the *Leader is Supportive and Nurturing towards Subordinate*. All the respondents (except respondents A2, A4, E2 and L1) cited this meaning unit. These respondents generally described the meaning unit as the leader consistently advising and helping the subordinate to improve their design skills and knowledge. Respondent L3 narrated that his leader gave him a certain degree of freedom to design and would often comment constructively on the design. The leader also encourages him to improve on his older designs. These approaches help the respondent to upgrade his creativity. Respondent E3 said that the leader supported his career development by encouraging and helping him to attend training courses and take the professional examinations.

Thematic Findings

A theme is an underlying topic or matter found among all the respondents whether through their categories, meaning units, excerpts and transcripts. All the respondents cited *Learning from Leader's Experience and Knowledge* meaning unit (Human Capital Category) and the *Leader Respectfulness to Subordinate* meaning unit (Emotional Capital Category) as shown in Table 1. Thus, one theme emerged from the subsequent interpretative analysis of the transcripts, excerpts, meaning units and categories. The theme is *Creativity is encouraged through learning from leader's superior human capital. The learning is aided by the leader's emotional capital.*

Design subordinates are driven to be more creative when they have confidence in and are learning from the leaders' human capital especially the experiential knowledge. The meaning unit *Learning from the Leader's Experience and Knowledge* was present in the transcripts of all the respondents. A leader's reputation in the industry and relevant accredited qualifications contributes to his subordinate's confidence about the superiority of the leader's human capital. Yet, architect respondent A1 said that higher degrees do not equate with architectural creativity. Engineer respondent E1 prioritized learning from the leader's experience. However, he reported that a strong structural design theoretical background is needed to design satisfactorily. It implies that respondent E1 wanted to ensure that the experiential and accredited knowledge received from the leader is sound. It was found that the leader's accredited knowledge can be more important for subordinates who work in Malaysian provincial cities such as Kota Kinabalu in the state of Sabah where experiential learning opportunities for subordinates are less.

"Definitely. I agree with that (Statement: Work subordinates are more likely to be influenced by a manager to be creative because the manager has work skills, knowledge and experiences that the subordinates want to learn from). *Because he is your superior. In terms of qualification, experience and everything, he is better than you. So, of course you will be influenced by him. Whoever enters a firm or company, he or she may have certain experiences that affect how he or she designs. In a 'fresh' project, we come to learn. If we gain experience, we can use it to apply for a better new job or a better position, but nevertheless, there will be some (persons in the new firm) who are "higher" than you in term of experience and knowledge….In Malaysia, I can see that especially in Sabah, East Malaysia where I work now, a lot of, 100 percent (of subordinates) are influenced by their superiors."*

Architect Respondent A5.

The leader's emotional capital makes the subordinate confident that he will be able to attain the superior human capital from the leader. The leader's positive emotional capital namely being likable, compassionate, and respectful toward the subordinate's abilities and designs, is believed to show the leader's generosity, willingness and supportiveness in helping the subordinate learn further either through work interactions, mentoring or nurturing methods.

"Although a subordinate is still 'learning', he has his own ideas. So, the manager, however senior he is, should respect these new ideas. He should not show his 'power' and reject the ideas just because he has been designing longer…At the start, the subordinate has

to obey his manager but slowly and surely, he must show and prove his creativity to his manager. His designs must be workable, so he has to work hard."

<div align="right">Architect Respondent A3</div>

"*When the basic design comes from the boss, the boss will accept any discussion with the staff. He will ask me the reason for designing a certain way. So, we give our reasons. When we input our best ideas into the design, we can discuss with the boss…If we feel our ideas on the detailing is better, he will have a look and give his consent for inclusion into the design. For him to give consent, we have to give reasons and show some sketches of alternative designs first.*"

<div align="right">Landscape Architect Respondent L1</div>

DISCUSSION

This section consists of two discourses about firstly, Bourdieu Capital Categories and secondly, the thematic finding of leaders' Bourdieu capitals impact on design subordinates.

Bourdieu Capital Categories

Bourdieu (1986) specified three types of capitals, namely economic, social and cultural capitals. Economic capital refers to the amount of monetary possessions of the leader. Respondents' narratives did not evoke meaning units that constitute economic capital. The meaning units that constitute the generated factor labelled social capital, concurs with Bourdieu's concept of social capital.

The human and emotional capital categories in this research seem to be different manifestations of Bourdieu's cultural capital. According to Bourdieu (1986), there are three types of cultural capital. The first type is embodied cultural capital which refers to long lasting dispositions of the mind and behaviours that are nurtured. This definition would encompass the study's emotional capital.

The second type of cultural capital is institutionalized cultural capital which is defined as accredited knowledge and skills objectified through academic qualifications and formalized titles. This would be partially similar with human capital of this study. However, Bourdieu's institutionalized cultural capital excludes tacit experiential knowledge critical to professional practice.

The third type of Bourdieu's cultural capital is objectified cultural capital. This refers to the person's possession of material objects and media that stylistically reflect his status in the community. One generated Bourdieu capital category of this study is conceptually similar with objectified cultural capital. It was labelled as cultural capital in this study's findings.

Another generated factor is political capital which is not part of the original triad of Bourdieu capitals. However, Bourdieu (1986) posits that the social and cultural capitals are transformed into symbolic capital that the person uses to impose 'symbolic violence' on others to sustain or improve his status in the field. This symbolic violence consists of actions to create psychological drivers in others to act in ways beneficial to the actor and in most cases sustaining the dominance of the actor over the other. The political capital category

aligns conceptually except that Symbolic Capital is derived culturally and does not include the sources of formal power (Peiro and Melia, 2003) derived from one's station in the organizational hierarchy.

The leader's social capital indirectly contributes to enhancing the human capital of the subordinate. It provides the subordinate an indirect access to the new knowledge and ideas obtained by his/her leader through his/her social network. The leader effectively becomes a middleman between the knowledge source and the subordinate. The knowledge is transferred during the discussion, mentoring or design review between the leader and the subordinate. Sometimes, the subordinate refers to the knowledge source directly. In addition, it seems that subordinates were more motivated to be creative when they sensed that they have job security in the firm. These job security feelings emerge because they perceive that the leader's social capital helps obtain new work commissions for the firm. They also perceive that the leader's cultural capital contributes to the marketing effort in obtaining new work commissions. This further enhances their feelings of job security. These perceptions matched Marr et al. (1996) who posited that consultant firms' commissions are customer led and thus involve building relationships with potential clients. Several respondents cited social capital and cultural capital thus suggesting the situational presence of both capitals.

Thematic Findings

The results show that the leader's emotional capital and superior human capital influence the design subordinates' creativity. Firstly, this is possibly because the design consultants are in the knowledge economy business. The human capitals of these consultants are used to create designs for the clients and are consequently important for the sustainability of their businesses.

Designs do not originate solely from the leader's human capital but are collaboratively produced. The firm's designs result from team effort of subordinates who design to satisfy the main design concepts of the leader. Thus, the quality of the finalized design is dependent on the human capital and creativity of the subordinates. If the leader enhances his subordinates' human capital, he may improve their creativity and his firm's competitiveness.

The subordinate is aware that the firm's designs are a team effort. His job security is enhanced if he has the needed human capital that contributes positively to good designs and future work commissions. Thus, he is driven to enhance his human capital.

The leader's display of respect for the subordinate's design abilities and output can also enhance this collaboration. The subordinate consequently does not fear that his creative works being sidelined by the leader. He becomes less afraid to be more creative.

The second possible cause is related to the preponderance of small design consultant firms in the construction industry. These firms are financially incapable of regularly sponsoring their employees' training to enhance their skills and knowledge, and consequently their design creativity (Moohammad et al., 2014). Thus, the employees are probably highly dependent upon their leaders to provide the enhancement free of financial costs.

Leadership is commonly defined as the ability of an individual to influence, motivate and enable others to contribute towards the effectiveness and success of their affiliated organization (George and Jones, 2012). The common goals of the subordinates in this study were found to include their enhanced human capital. The leader can influence his subordinates' creativity through the possible learning of his/or superior human capital. In other words, the leader's human capital contributes to his/her leadership capital. This implies that the transfer of human capital is both transformative and transactional to both parties.

The use of three different professions in the analysis may decrease the validity of the findings. Each profession has its own doxa and habitus. Engineering and architecture consultants are licensed in Malaysia while landscape architecture consultants depend on their professional society's accreditation for credibility. Thus, the sample of members from three professions may be unsuitable. However, a person simultaneously resides in many 'fields of practice'. (Bourdieu, 1986). Respondents from each profession dwell concurrently in their respective 'fields' and the construction industry 'field' This is supported by the relative similarity of the interviewees' responses and the early achievement of theoretical saturation (at the seventeenth interviewee). It suggests the responses also reflect the doxa and habitus of the construction design 'field of practice'.

The design subordinates from interior architecture and town planning design consulting firms were not sampled in this research. Their exclusion may be justifiable because architects in Malaysia are allowed to do some functions of the town planner and interior design architects. Secondly, these two professions generally play secondary design roles in the construction projects. Their exclusion may contribute to a potential deficiency of findings. Landscape architects also play secondary design roles in construction projects. Yet their job scopes are exclusive because the architects and engineers lack competence to design landscapes.

CONCLUSION

The category coding generated five categories capitals namely Social, Human, Cultural, Emotional and Political Capitals from the meaning units in the interview transcripts. These capitals partially diverge from the Bourdieu's (1986) triad of capitals, namely economic, social and cultural capital. Economic capital was absent in the responses. The generated Social Capital concurs with Bourdieu's original concept of social capital. Bourdieu had divided cultural capital into three types. The generated Human Capital concurs with institutionalized cultural capital. The generated Emotional Capital is similar to embodied cultural capital. The generated Cultural Capital reflects the objectified cultural capital. The generated Political Capital is not part of Bourdieu's triad of capitals. However, it is conceptually aligned with the Symbolic Capital. Bourdieu posits Symbolic Capital being used when the leader engages in symbolic violence upon the subordinates.

The thematic qualitative coding of the interviews generated the theme *Creativity is encouraged through learning from leader's superior human capital. The learning is aided by the leader's emotional capital.* The theme implies that Bourdieu capitals are instrumental for influencing subordinates' creativity within the socio-cultural and economic contexts of design consultant firms in the Malaysian construction industry. Bourdieu capitals offer an innovative perspective in studying and possibly quantifying leaders' influence upon their followers.

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INFLUENCING FACTORS OF LIGHT STEEL PANEL (LSP) SYSTEM IMPLEMENTATION FOR AFFORDABLE HOUSING PROJECT IN MALAYSIA

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Abstract
The high demand-supply gap of affordable housing has been a major issue in Malaysia and has increased housing prices. Accelerating the total number of affordable housing supply will be the main objective to overcome the issue. However, construction sector faces difficulties to achieve the target number of supplies by utilizing current Industrialized Building System (IBS). It is due to the current IBS system utilization still cannot fulfil the affordable housing needs especially for middle-income group. Housing needs for middle-income is not bound to the affordability of the house itself but also related to improving quality of life such as sufficient size, worthy aesthetic feature, and sustainability. Therefore, some changes need to be made to the framework of current IBS system by taking into account the affordable housing needs. The framework must develop in a holistic way to ensure the system can be used as an alternative for the current construction method of an affordable housing project in Malaysia. The objective of this study is to identify the factors will influence developers to accept the new housing system implementation. This research conducted an interview with eight project managers with more than three years working experience in developer's firm. Based on the findings, majority of developers have been introduced by many types of IBS system. In conclusion, the lower construction price, short construction time and quality housing (less defect problem) is the main factors for the new system acceptance.

Keywords: *Affordable; Housing Project; Light Steel Panel System.*

INTRODUCTION

The high demand-supply gap of affordable housing has been a major issue in Malaysia and has increased housing prices. Thus, construction industries face pressure to fulfil the demands of affordable housing. Developers need to supply affordable housing which currently rates under RM300,000 with the lower fixed price ranging from RM25,000 to RM42,000 (Ramli et al., 2016; Abdullahi and Aziz, 2011). The price is proportionately low while the cost incurred by developers includes building and infrastructure costs are increased. The housing cost is remaining higher if the conventional construction method is still widely used in the construction of affordable housing. In other point is the operations of conventional housing method are labour intensive, tedious and require a lot of on-site coordination.

However, conventional construction methods are still widely used in the construction of affordable housing in Malaysia while it is high cost and unable to respond to this huge demand in a short time with standard quality (Nawi et al., 2014). More worrying yet the construction industry has entered another unprecedented crisis of rising in construction cost and housing price (Mansur et al., 2016). The hiking trend of construction cost make worried to many of stakeholders in the construction industries. High in material cost for residential construction by using conventional methods further narrow profit margins obtained by the contractor. Other problem facing by the contractors is inability to complete project in specified time plans. Whereas, the most significance delay factors in housing construction are weather condition and shortages in skilled laborers (Ramli et al., 2019). Dependencies on natural

resources and labours orientation will increase the demand on the resources such as labour, material and equipment may cause scarce, and this will hamper to the project execution (United Nations, 2008).

Although Industrialized Building System (IBS) as one of the forms of off-site manufacturing (OSM) technique was introduced by the Malaysian Government in 1966, until now just a few developers and contractor had used the method because of high cost, high risk and high level in setting up the programs (Fathi, 2012). Developer also faces to the leakage problem in jointing which further be the risk to other complications, these are includes dampness, corrosion and scratch (Mydin et al., 2014). Meanwhile, construction industry has been flooded with many types of IBS system such as interlocking brick, lightweight block, lightweight foam and many more. However, these types of IBS material still cannot reduce the affordable housing price below the affordability of middle-class home buyer (Shadiya, 2014). Therefore, this study will establish the framework for improving the residential construction system in an affordable housing project by utilization of the LSP system as one of the types of IBS methods. Importantly, the establishment of the new system must take into account the developer's expectation regarding the appropriateness of system implementation in the affordable housing industry.

The LSP can be built quickly and economically due to the installation method carried out in pre-manufactured which has saved construction time and labour (Mashhadifarahani, 2015). The installation process starts by connecting the wall framing components in a factory. The panel components then brought to the site and the labour starts joining panels using clips and self-drilling screws. These erection steps implemented with the simple procedure and will shorten the project duration. LSP systems found extensive usage, due to that this system is widely used for the construction of commercial and residential buildings with a low and moderate rise in the United States, Canada, Australia, Japan, and many other countries (Mehdizadeh and Ravanshadniya, 2017). Thus, the housing needs in those countries force the stakeholder to utilize the fast and simple construction method like the LSP system.

LITERATURE REVIEW

Through the Construction Industry Transformation Plan (CITP) 2016-2020, the construction industry will be focusing on the usage of the Industrialized Building System (IBS). In order to maximize the utilization of IBS in the affordable housing sector, Malaysia needs to do a lot of effort not only for research and development related system automation itself but also in term of customer needs and requirements. As well as the successful implementation of prefabricated housing in Japan which based on product services oriented on building utilization phase, to build up the companies' customer relations and customer inclusion capabilities (Linner and Bock, 2012). Hence, this action can enhance IBS housing construction system and can help fulfil the affordable housing needs.

Affordable Housing Needs

Two main issues commonly faced by middle-income earners to own the houses are substandard houses and financially stressful. In 2014, according to McKinsey in about 330 million urban households were living in substandard housing or were financially stress by housing costs (McKinsey Global Institute, 2014). This is predicted to rise to nearly 440

million households, or 1.6 billion people, by 2025 – and 2.5 billion people by 2050 (Menon et al., 2019). The measurement range of median affordability between less develop and more developed countries is too far. Based on median affordability (median price-to-income ratio), cities in less developed countries are found to be significantly less affordable (28% less affordable) than cities in more developed countries (Kallergis et al., 2018). This figure also includes Malaysia as a developing country, represent the current scenario faced among the majority of middle-income earners to own an affordable house.

The research finding by Bujang et al. (2017) prove that most of the *Bumiputera* as middle income earner cannot afford to buy a house even though they have monthly income salary for at least RM5,000. However, for those already owned a house only afford to buy a house at a price's level between RM200,001 to RM250,000 only. Whereas, the house prices offered are much higher than the capacity of middle-income earners (Shadiya, 2014). The middle-income earners currently face a huge dilemma in planning future life to own the quality house. According to Stone (2006), affordable housing will give meaning for the owner if three essential questions can be answered: affordable for whom; on what standard of affordability and for how long? Hence, it is revealed that affordable housing has a close relationship with housing needs. Therefore, the challenge of affordability requires not just a short-term plan but also long-term strategies for setting up the appropriate construction method.

Affordable Housing Construction Method

In order to meet current housing need, especially for the low and middle income, the government and the private sector has played their role in social responsibility in the agenda to build the shelter for people. However, by utilizing the current construction method the developers face difficulties to develop affordable housing under the fixed budget rate. Housing construction project conducted using conventional methods is a technique that has been widely used in the field of residential construction for centuries of years. The method can be defined as fabricating components for the building on site involve the process of installation timber or plywood formwork and steel reinforcement (Haron et al., 2005). The cast-in-situ process is mainly conducted by labour and the overall process is done on-site work.

By using the conventional methods, contractors have difficulty to ensure the construction work carried out in accordance with the specified time because of problems related to building quality, the uncertainty of site condition, skilled labour shortage, and bad weather condition. One of the alternatives which can be used to replace this method is by using Industrialized Building System (IBS) where most of the components of a building will be made off-site and manufactured in a factory and brought into the site to be assembled (Blismas, 2007). Current IBS technology includes precast concrete, interlocking brick, steel framing, lightweight block system, and timber framing system supposedly are not only helping contractors and owners get their buildings faster and more economically but they also help reduce construction waste and produce high energy efficiency buildings which result in a long-term benefit to projects (CIDB, 2003). CIDB (2003) has categorized the types of IBS systems in the housing construction market as shown in Table 1.

Table 1. Types of IBS and Structure Elements in Housing Construction Market (CIDB, 2003)

System	Structure Elements	Structure Elements
Precast concrete system	Column Beam	Wall Slab
Reusable formwork system	Column Beam	Wall Slab
Steel Framing Systems	Column Beam	Rood Truss
Prefabricated timber framing systems	Column Beam	Rood Truss
Blockwork systems	Column Beam	Wall

(Source: CIDB, 2003)

In an effort to encourage the utilization of the IBS system, Malaysia has allowed the various type of IBS systems to enter the housing construction market. Such in the U.S, the panel system is the most commonly used in construction, 43% of all prefabricated homes in the United States use the light panel system (Smith, 2010). Thus, Malaysia also can improvise the local IBS panel system to a lightweight pattern. The futuristic design of affordable housing can be build using lightweight panel material, which accordingly there are various types of panel material in the market. The panels are planer elements that can be used to build structural walls, floors, and roofs, load-bearing or non-load bearing enclosures, and interior partitions. On the other hand, the panel system must be equipped with good comfort and safety features to suitably fit for a residential home.

Lightweight Panel Housing in Malaysia

Presently, the Construction Industry Development Board has encouraged the construction firm to invest in manufacture building components in a controlled environment (CIDB, 2016). It is due to the two main targets; better quality and faster completion time. Various types of IBS systems have promoted by CIDB include precast concrete, lightweight panel system, lightweight block wall, and roof trusses. However, the utilization of lightweight panels less popular among other IBS systems. The lightweight panel system commonly utilized in housing construction is wood panel and steel panel system. Thus, the panel system is regularly utilized in a medium and large-scale housing project. There are many advantages of the panel system over to the other structures including higher in factory production quality and simpler, reliable and rapid connections system (Mashhadifarahani, 2015). Lightweight panel system allowed high degrees of prefabrication, which major part of houses was installed at the manufacturing firm under control production (Eren, 2013). As a result, speed constructions work and precise steel material has further given a greater economic performance (Andrade et al., 2016).

Besides that, the panel system commits a simple construction method, in which the installation technique is basically as wooden framing system will give a lot of advantage to the local builder to understand the installation method (Hacker and Gorges, 1998). Panelised also fulfils the green building specification of which there are less scrap and waste from the construction process and high recycle-ability (Andrade et al., 2016). Although the panel system has presented many advantages to the construction industry, there are a lot of disadvantages in regard to the system. Firstly, Lightweight panel is a new system of IBS so there are very less theoretical analysis and nor relevant experimental data of the structure exist as a guide for local designer and architecture to develop the systematic lightweight steel specification (Li et al., 2014). Second, the panelised housing construction system is very new to the people in terms of structure and has low confidence in its security, stability, comfort and etc. Based on the pro and contra as mention above, there are buildable factors of the lightweight panel to be utilized in the affordable housing construction industry. Therefore, the

research focus on factors influence the utilization of lightweight steel panel (LSP) system for an affordable housing project in Malaysia.

Light Steel Panel (LPS) System

Light Steel Panel (LSP) system was made from galvanized sheet steel which readily transformed into shapes used for framing is has been utilized in the housing for about 70 years (Lawson and Ogden, 2008). LSP consist of several components includes C-shaped channel, roxul stone wool (insulator), an insulated metal panel and an angle finish (Figure 1). The structural system is made from sheet steel that has been coated with an anti-corrosion material and known as light gauge galvanized steel or cold-formed steel into C-shaped components. C- Shaped, refer figure 1 has own design specifications that enable facing materials to be screwed and attached quickly.
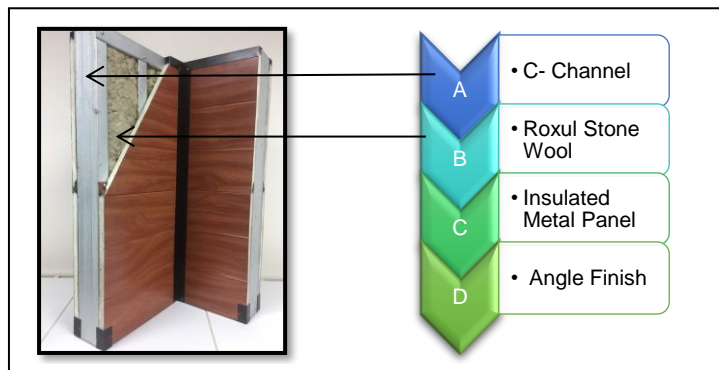
Figure 1. LSP Panel System

Specification of cold-formed steel for wall structures are base on, substitute 3-5/8 inches x 33 mils (20-ga) studs for 2 inches x 4 inches wood studs, and substitute 6 inches x 33 mils (20-ga) studs for 2 inches x 6 inches wood studs (Hacker & Gorges, 1998). The insulated panel screwed to the structural steel as interior and exterior walls. In order to increase the wall performance of LSP the insulation material installed in the cavity wall. Therefore, roxul stone wool as a core of the wall panel has increased the conductivity, fire resistance and soundproof of the wall system. This will further increase the quality of the product and can be utilized by the client not even to the office or commercial buildings but it also relevant for a residential house. LSP panel wall will be delivered to the job site for the joining process, the finishes for angle part is using several materials such as aluminium, fiberglass and board cement.

Influencing Factors

Implementation of the LSP system for affordable housing is influenced by several factors includes the regulation requirement, sustainable issues, market opportunities, economic assessment, and industrial capability. Firstly, development of process and practices of new LSP system must prefer to local building code and authority's approval. Research and discussion about process and practices of new innovation among stakeholder is crucial to increase the systems' flexibility in housing developments (Erofeev, 2019). The process and practices of the system implementation must be parallel with building code from local housing authority. Surf et al, 2014 also emphasized on the important of integration between building

code of new IBS system with current construction method used in construction industry. This is to ensure the new LSP system can easily adopted by construction industry.

Secondly, sustainable housing system should have strong engagement with authorities from any approval up to promotion activity for the system utilization, such as high promotion action has been taken in China since there is a positive growth of steel in the construction industry (Cheng et al., 2011). Achieving economies of scale in the housing construction project by following the sustainability standard in wide-ranging criteria including economic, environmental and social aspects is the main target of LSP implementation (Corman et al., 2016). On top of that, it is applicable in the future for IBS products with green index standards are more referable in housing construction. Thirdly, the authorities must promote to the public about the factors and impacts of human activities on the environment once stimulate market demand for environmentally friendly products (Andrade et al., 2016). Importantly, government must take several initiatives such as conducting a program to promote every IBS product registered under the body of regulation. This is to educate people about the advantages and significant of greens products to people and the environment.

Fourth, all the metal stud of LSP panel come in precise measurement allowed easy maintenance without great material loss, contribute to fewer expenses and faster constructions time, hence to obtain a greater economic performance in the life-cycle costs indicators (Andrade et al., 2016). Indeed, cost benefit analysis of green affordable housing (Yeganeh et al., 2019) will help to encourage utilization of LSP system in affordable housing construction. This advantage of lightweight steel housing must be taken as a benchmark for the stakeholders in decision making to use a simple and safe method in the construction industry.

Table 2. Influencing Factors of LSP System Utilization in Affordable Housing Construction

Main Factor	References	Influencing Factors
Regulation Requirement	Erofeev, 2019; Surf et al., 2014	Procedures and practices in housing design and development; Building code for sustainable housing construction
Sustainability	Maimun et al., 2018; Corman et al., 2016; Cheng et al., 2011	Affordable housing demand & site selection; Economic, environment and sustainability of housing construction; Steel housing as green and affordable system
Time-Cost-Quality	Yap et al., 2019; Andrade et al., 2016; Yeganeh et al., 2019	Desired quality of housing; life-cycle cost indicator in housing construction; Green affordable housing – cost benefit analysis
Market Opportunities	Andrade et al., 2016; Noguchi, 2003	Environment friendly product stimulated by environment pollution; Quality-oriented production approach on the delivery of prefabricated homes
Social Culture	Osman et al., 2017; Steinhardt and Manley (2016)	Affordable housing supply based on housing need; Historical stigma to prefabricated housing
Industry Capability	Wakely 2018; Lang, 2019; Lang 2018;	Government-supported housing for developer; Collaborative in social sustainability; Role of local authorities in collaborative housing project

The selection criteria of influencing factors of LSP utilization in affordable housing have been listed in the Table 2. Thus, all the five criteria including regulation requirement, sustainability, time-cost-quality orientation, market opportunities and social culture can be as a benchmark in the development of LSP housing construction framework. However, the five criteria mention above should supported by strong industry capability. In that case, based on

the main goal to fulfil affordable housing demand, government must provide robust support to the stakeholder such as developer (Wakely, 2018) for encouragement of LSP system implementation in affordable housing project. It is also essential to encourage cooperation between stakeholders in housing project (Lang, 2018) to provide an ample supply chain for smooth implementation of LSP system.

RESEARCH METHOD AND PROCEDURE

The value and appropriateness of qualitative studies within management technology and engineering have become recognized amongst the researchers (Fellow and Liu, 2003). In fact, the qualitative method can explore the natural reflects the reality of what happened in the real setting. This will allow the researcher to get a clear explanation in detail and obtain rich data in terms of tacit knowledge, perception and human experience, which this is cannot be measured in a quantitative approach. The authors imposed a careful selection process of the participants which has share high degree of knowledge and direct practice in the area of affordable housing construction to construct some validity and robustness of the method.

In particular, the authors have ensured that the participants are aware of the aims, objectives, and methodology of the study. The research conducted a study in utilizing semi-structured interviews to examine the influencing factors of the LSP system implementation in an affordable housing project. An in-depth interview is conducted with the project manager with more than three years of working experience in the developer's subsidiary which develops an affordable housing project. The current construction practices for affordable housing projects were the focus of this research; therefore, the research was only restricted to construction practices for affordable housing only does not involve other types of housing.

The interview technique in collecting qualitative data is by face-to-face interview approach. This technique will allow the researcher to get real data for the research. The answers given by individuals more subjective base on knowledge and experience own by them. Response from respondents is recorded using recording tape and time duration in the interview session were varied commonly from twenty minutes to forty-five minutes depends on circumstances. Since the data is collected only involve 8 respondents the simples' tool as the content analysis was used for analysing the data. The recorded interview which converted into a form of text is coded or broken down, into manageable categories on a variety of levels--word, word sense, phrase, sentence, or theme and then examined using one of content analysis' basic methods; relational analysis. Through the analysis proses, the influencing factors of implementation of the LSP system for affordable housing have revealed. Therefore, the developer's feedback is important to enhance housing construction practices for affordable housing based on the client's expectation.

RESULT AND DISCUSSION

Respondents for this research are focused on the project manager which has more than three years of working experience in developers' firm which has conducted an affordable housing project. They gain experience based on the main project management principles to organize, lead, plan and control the whole project implementation process. The project manager handles the entire project includes preparation of site plan, project financing plan, manages the design and construction teams including architects, general contractors,

engineers, construction managers and other consultants to ensure adherence to project budget and schedule, cost containment and quality control.

Table 3 shows the position, experiences years and value of affordable housing offers by the organization. From the schedule, we know that all of the respondents in a position as a construction project manager. Experience more than three years is crucial and will give a clear picture of the subject matters. The selection of the project manager was vital to this research due to their experience involvement in planning, implement and controls the affordable housing construction project. This because project managers in developers firm have wide experience in dealing with a contractor as an implementer and also buyers as end-user of the IBS system. Thus, the successful implementation of the IBS system in Malaysia specified based on client- driven (CIDB, 2006).

Table 3. Respondent's Detail

Respondent (R)	Position	Experiences	Housing Value (RM)
R1	Project Manager	8 years	350,000 & below
R2	Project Manager	5 years	150,000 & below
R3	Project Manager	4 years	150,000 & below
R4	Project Manager	10 years	350,000 & below
R5	Project Manager	5 years	200,000 & below
R6	Project Manager	15 years	200,000 & below
R7	Project Manager	4 years	350,000 & below
R8	Project Manager	20 years	350,000 & below

Influencing Factors

During the current period, the construction system in Malaysia based on brick or concrete has well developed due to the support of institutions, growth of actor-networks, and investments in machinery, human resources and technology development. Through the development of the prefabricated houses, building material has allowed the entry of the various types of new innovative IBS systems. In order to improve the current housing construction method in Malaysia, the government plays an extensive promotional afford for the utilization of an innovative IBS system that aims to speed up the delivery time and build enough affordable and quality houses. Therefore, this section discusses about the factors will influence the utilization of LSP in affordable housing construction project based on developers view. The influencing factors focused on this research are consisting of construction regulation, sustainable development, market opportunities, economic assessment and industry capability.

Construction regulation

Based on the finding, the three important licenses for the LSP system before entering the housing construction market are; Construction Industry Development Board (CIDB) for IBS specification approval; Uniform Building by Law (UBBL) for fire safety provision; and SIRIM QAS International Sdn. Bhd. for durability test. It is in order to secure and prevent buyers from getting a low standard of housing condition at least after five years own the house. CIDB is one of the bodies responsible for monitoring the new entry of material product or system utilization in the construction industry. The majority of developers claimed new innovation of LSP should be approved by CIDB. CIDB is the government body which provides an instrument for IBS standard requirements, certification, verification, testing, and monitoring the implementation of government IBS project (Haron et al., 2014). Respondent

R1 has stated the way CIDB to check the quality of the LSP system;

"…As I know, CIDB itself have their own building code for IBS. So, it can refer to CIDB itself because CIDB will calculate the Green Building Index (GBI) for the house building. From that, they will count whether our building is IBS or not. If I am not mistaken, the higher rating we get so we get the higher score." Respondent R1.

In addition, responsible CIDB is undoubted because currently all promotional activity for any type of IBS system in Malaysia conducted by this body. Not even that, the body also oblige in controlling and monitoring especially in term of quality and system installation for registered IBS system. Hence, the quality specification of LSP housing must comply with the Quality Assessment System in Construction (QLASSIC). QLASSIC is a system or method to measure and evaluate the workmanship quality of a building construction work based on the Construction Industry Standard (CIDB, 2013). In another point of view, fire test certificates are important to approve the residential house building innovates by using the LSP system is safety for occupant life. Respondent R5 has pointed out about this matter;

"…. the 'Bomba' require to check the fire rate and then we want to look the housing layout plan. They (manufacturer) must have their own browser, to look at the layout, or if they have proposed the size of gypsum panel. If refer to 'Bomba' the size is in 230mm, then we want to know the thickness they proposed to us." Respondent R5.

Admittedly, the certificate of new material approval such as wall fire tests can be requested from SIRIM (Soon et al., 2014). Meanwhile, the design for the house can refer to the building standard under the Uniform Building By-Law 1984 and Fire Service Act 1998. Fulfilment of specification of LSH to the fire test requirement will be allowed the material to be used in the housing project without a doubt. The summary of exploratory findings for the regulation requirement was shown in Table 4.

Table 4. Regulation Requirement

Factors	Certificate of Regulation	Respondent (R)
Regulation Requirement	Construction Industry Development Board (CIDB)	R1, R2, R3, R4. R5, R6, R7, R8
	Uniform Building by Law (UBBL)	R1, R4, R5, R7, R8
	Guarantee of Durability (SIRIM)	R1, R2, R3, R4. R5, R7, R8

Sustainable Development

In the meantime, developers put hope in the housing industry to come out whit better housing method in prefabricated types. According to respondent R1 to R8, the system provided for housing development should dry, clean and have smart elements. Then, the housing project will perform under scheduled without messy places and wastages in any way. Some developers have used more than one type of prefabricated housing system and feel there are still need a lot of improvements. Respondent R3 and R4 have different point about dry, clean and smart construction work;

"…actually, the advantageous of IBS is like I said just now, it is dry construction which means the constructions are clean and smart and do not produce waste from cement, woods, and etc..." Respondent R3.

"…problem that I always meet when use precast is about jointing. Another one is about the site not really clean. There are still having wastages on the site. For current IBS, if the panel did not arrange properly on site, so the place still looks messy." Respondent R4.

Thus, Sustainable housing development in Malaysia still in an early stage. Less knowledge or wrong understanding about the green building concept is making hard for the new IBS system to enter the housing market. Respondent R2, agreed utilization of IBS system especially penalized or hybrid can less environmental defect caused by wastage from construction project (CIDB, 2003). In addition, the new LSP system must cover all aspects of sustainable development includes design, tendering, site planning, organization material selection, recycling and waste minimization (Langston and Ding, 2011).

Importantly, the adoption of IBS in Malaysia construction industry requires building players to revitalize of new mindset of awareness, change management and business engineering (Musa et al., 2015). It supported the application of Industrialized Building System (IBS), design standard, predesign, pre-approval, this action could reduce the time and cost of construction. In order to further encourage contractors to involve in the prefabricated building manufacturing field, CIDB has introduced Construction Industry Transformation Programmed (CITP) to transform the construction sector. This programmed is held together with industrialist including government agencies, private companies, and academic authorities who able to ensure the Malaysian construction industry on par with other developed countries (Halim et al., 2017). The summary of exploratory findings for the regulation requirement was shown in Table 5.

Table 5. Sustainable Housing Development

Factors	Sustainable in Housing Construction	Respondent (R)
Sustainable Development	Early Phase Adoption	R1, R2, R4, R7, R8
	Fewer workers	R1, R2, R3, R4, R5, R7
	Less wastage	R1, R2, R3, R4, R5, R7, R8
	Smart building	R2, R4, R6, R7

Market Opportunities

The important action to be taken is determining the competitive advantageous of the LSP system in order to win the IBS market competition. For further action, respondent R4 and R8 suggest convincing the consultant, contractor, and developer to introduce the LSP system. Respondent R8 specify his suggestion as follow:

".... Of course, yes. It depends on how we are creating the market. One way is we can convince consultants, contractor, and developers. The more important is the government must encourage and support us to use the IBS housing material." Respondent 8.

It is crucially important to take engagement with the architect and engineers to develop the best specification of the LSP system for affordable housing. While respondent R2 refer to the supplier of LSH material which completes with their own architect and engineer. Respondent R2 stated as follow:

"..if we choose the IBS manufacturer which complete with architect and engineer. The engineer can give approval to the structures. Then, they used easy prefabrication." Respondent 2.

The government should be an important body to promote and support the utilization of new IBS systems such as LSP in housing construction. In general, all respondents agreed that the Construction Industry Development Board (CIDB) is the main body responsible to promoting and control the utilization of the IBS system in housing construction. The government needs to be the main actors to promote the public about the factors and impacts of human activities on the environment once stimulate market demand for environmentally friendly products (Andrade et al., 2016). In another point of view, the government can promote the competitive advantages of house-made by the LSP system in regard to buyers can gain many advantages include can have a cool and comfortable house, less maintenance with no crack risk and can reduce monthly energy bills.

The house develops by cold form steel structure with metal or aluminium material for the exterior wall will reduce the licking problem. This problem has been the top amongst buyers, which often sceptical to the IBS system due to the leakage and crack problem (Jabar et al., 2018). LSP system with not based on concrete materials will lessen the defect issue face by the developer while handover the house to the customer. As currently face by them is future maintenance of the building's needs when there were defects of IBS buildings during handover. Hence, it is very significant to select the appropriate building systems, components, and materials that require minimum maintenance (Lin et al., 2008) to form the prefabricated IBS- Housing. Indeed, support by related agencies is crucial to give a mandate to housing industries players to utilize the LSH material without prejudice. The summary of exploratory findings for Market Opportunities was shown in Table 6.

Table 6. Market Opportunities

Factors	Market Acceptation	Respondent (R)
Market Opportunities	CIDB promotion	R1, R2, R3, R4, R5, R7
	Competitive advantages	R1, R2, R3, R4, R6, R7
	Collaboration among stakeholder	R1, R2, R4, R8

Economic Assessment

Any type of IBS system proposed by a contractor to the developer has opportunities to be implemented. Demand will be higher for the IBS system which offers by a contractor at a lower price. Respondent R2, R3, R4, R7, and R8 indicate everything they refer to the lowest price offer by the contractor. This gave them chances to have a good margin and can pay the price, so many people can afford the house. Respondent 2 stated;

"…. At the end of the day, what we are accepting is about the cost. For example, one unit single- story house is about RM150,000. The cost to build the house with land is also RM150,000, which means the cost same as the sales price. So, we are not lost. But we are bare another cost, such as the cost for road constructions around the house, water tank, infrastructure, and architect. Thus, the overall cost for the house up to RM200,000." Respondent R2.

It is very clear, lowering the construction cost is be the main mission for developers in developing affordable houses (Corman et al., 2016). The aim of profit, cost-efficiency, and quality are important drivers in the evolution of any sector, including building and construction. Thus, a higher turnover rate margin will be achieved by the reduction of construction time. Even the housing price still the same, the developer still can have

advantages from early house submission to purchaser. While, the contractor still can save more costs from the reduction of site cost, less staff and less use of heavy machinery. However, the LSP systems implementation should reach the time and cost reduction target without compromise the quality of housing. This responsible can started from the design and architectural housing layout plan. Based and layout plan materials panning will be performed based on discussion between engineer and quantity surveyor. It is due to allocate the optimal quality of affordable housing at the standard of affordable material price and the easiness of installation.

Currently, the majority IBS system in Malaysia is mainly based on concrete product specifications such as precast concrete, cement board, form, interlocking brick and many more. All the materials enter in IBS construction market with standard specifications. In general, standardization is the first step towards affordable IBS products (CIDB, 2010). In terms of LSP material, the overall component sent to the construction site must provide in a standard size. All the structures' element includes groundworks were using slab concrete, while the structure using Cold form steel, wall panel using metal (exterior wall) and cement board (interior wall). LSP system can move from a concrete based toward the combination's material. In fact, in IBS Road Map 2011-2015 it was stated that IBS was not just for concrete based. In another point of view, IBS is not subjected to mass production only but also delivers a unique product through a systematic approach (Gardiner, 2008). This is agreed by one of respondent R5 as below;

"…. I also feel sceptical once the people talk about the utilization of the cement board. But, when I enter the house (made from steel frame as structure & cement board for the wall), it has a good aquatic's wall. Also, we do not hear any sound because it is use a sandwich. They put wool or sponge to fill in the empty space between the interior and exterior walls. They use USG boreal that is a cement board. One more thing the cost is less if they use the sandwich. I think the system is no problem." Respondent R5.

Combinatorial concepts are relevant to allocate the reasonable cost of the house building. Any type of materials can use to replace the concrete material for housing as long as the end product quality fulfils the fire resistance and acoustical standard for housing. According to Rahim et al. (2012), a few potential lightweight wall structures and ceiling materials with plug- in assembling can be further researched. Indeed, it will be supported by the technological development of IBS and the introduction of new support and infill appropriate for affordable housing, such as development and distribution of structural forms and R&D of other interior finishing methods and design. The summary of exploratory findings for Economical Assessment was shown in Table 7.

Table 7. Economical Assessment

Factors	Assessment Tools	Respondent (R)
Economic Assessment	Cost Assessment	R1, R2, R3, R4, R7, R8
	Quality Assessment	R1, R2, R3, R5, R6
	Time Assessment	R1, R2, R3, R4, R5, R,7, R8

Industry Capability

The success factor of housing construction implementation is determined by the efficiencies of building material management. Good material management is closely related

to an adequate supply of materials resources. Inadequate materials housing supply generally caused to the project delay. Thus, it is very important to ensure to choose the material with easy supply and can be replaced by other materials if facing a shortage of stock. Respondent R2 mention about Malaysian capability to produce the product based on steel and aluminium;

"…Is Malaysia the place that can produce raw material such as an aluminium? For example, one of the building built from 100% of the steel structure. The construction activity was very faster." Respondent R2.

Significantly respondent R1 stated to create a flexible design, further the system can implement in the long generation which no risk of loss of stock. However Respondent R3, R4, and R5 have stated that Malaysia has a strong capability to produce prefabricated products because there is existence various type of IBS systems in the housing market. In order to ensure the LSP system will be implemented as a whole respondent R6 stated that the industry must prepare several installer groups. The statements were present as follow;

"...The industry should provide a workshop to do a training for system installation. One more thing the workers must be very expert in installation works and safety. For this system, the workers must know the important joining points. Because, if they make a mistake while joining process, the structure will break." Respondent R6.

From the analysis above, industry capability can be seen from the ability of the LSP system specification in the fulfilments to the needs of the affordable housing market. This step needs high collaboration between designer, architecture, engineer and research team. The product's prototype was needed to be tested and get approval from the regulation's body. Product approval is very important to ensure the product is durable, fire resistance and soundproof. First of all, the government needs to allocate an investment in Research and Development (R&D) to develop the best affordable structural steel housing mechanism. In order to achieve the early target is to lower the housing price until 20% decreases, the government must allocate a lot of investment in R&D and manufacturing firm development.

Secondly, development of LSP manufacturing firms under GLC is crucial in order to supply the LSP housing system under an affordable housing market. The GLC will be the main manufacturer responsible to supply the LSP component. Equally important to keep in touch with designers and engineers to design and create a standard house patterns under affordable cost. At this point, product choices and parameters joint design need to be studied in order to understand the relationship between manufacturing and construction (Tan and Foley, 2002). In this relationship, the contractor act as the main installer for all the LSP system supply. Meanwhile, installation training can be done under CIDB as the main body control and monitoring IBS system in Malaysia. The project can perform faster and economically through proper planning and effective management control.

Thirdly, the establishment of a training centre focusing on LSP installation is significant to ensure erection's work performs smoothly. The training skilled is easier to teach the team installer because the system is less complex, just utilizing the wooden installation basic concept. It is contrary compare with the IBS systems before which more complex and critical if there are mistaken (Ang, 2015). Jabar et al. (2018) also have urged that the unskilled worker and improper IBS manufacturers or contractor leads to the low quality of IBS projects in

Malaysia. As a result of current IBS projects failure in Malaysia, it leads to modular entrepreneur and Malaysians feeling doubtful of the future in MCS. More research focuses on design, materials and installation expertise is very important to the development of new LSP system. Lack of expertise of the building materials and fitting methods and no ideal design or specifications on the systems has led to the low quality of final products (Hamid et al., 2008; Rahman and Omar, 2006). The summary of exploratory findings for Industry Capability was shown in Table 8.

Table 8. Industry Capability

Factors	Build Ability	Respondent (R)
Industry Capability	Material source availability	R1, R2, R3, R4, R7, R8
	Local Manufacturing Firm	R1, R2, R3, R4, R5 R7
	Replacement material	R2, R4
	Future maintenance	R1, R2, R3, R5, R6
	Specialist (skilled installer)	R1, R2, R3, R4, R5, R6, R7, R8

CONCLUSION

This paper gives a clear understanding of the influencing factors of LSP for an affordable housing project in Malaysia. View amongst developers of affordable housing projects about the proposed system is important as guidance to the LSP implementation. Obviously, several developers have been introduced by any type of IBS system include the steel framing concept. In fact, they agree the lower cost, short construction time and quality housing is the main reason for the success of the implementation. The LSP system can be implemented by offering to middle, income earner, the affordable housing price below RM200, 000 with standard housing quality. This can be fulfilled rearrange the housing supply chain by the developers be as the main actors in the manufacturing team while the contractor is focusing on installation work. However strong collaboration between stakeholders is very important to ensure the successful implementation of the LSP system to fulfil affordable housing demands. Therefore, further studies are encouraged to test on contractor's perception towards the influencing factors of LSP system identified from this study.

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KEY STRATEGIES IN EMBARK ON INTERNATIONAL CONSTRUCTION PROJECT: MALAYSIAN CONTRACTORS PERSPECTIVE

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Abstract
The pressures of internationalization have generated a highly competitive market on Malaysian construction industry. However, the competitive and saturated of domestic market has driven many Malaysian contractor to embark on international projects. Without any denial, participation in international projects is a challenging task. It requires Malaysian contractors to develop strategy to enable them to operate successfully abroad. Therefore, the objectives of this research are to identify the key challenges for Malaysian contractors to undertake international construction projects thus identify strategies for Malaysian contractors to undertake international construction projects. To achieve the objectives of this research, quantitative method was adopted by using questionnaires. Questionnaire were distributed to participants from well experienced management team of G6 and G7 companies that have vast involvement in international projects. The findings of this research revealed that skilled worker shortage, high cost of financing of international project and limited experience with similar projects are the top three key challenges encountered by the Malaysian contractors in international construction project. The research identifies risk management and forming joint venture are the key strategies for Malaysian contractor to undertake international projects. In conclusion, this research can assist Malaysian contractor who wish to embark on international projects in supporting the current Construction Industry Transformation Programme (CITP) and the 4th Industrial Revolution in construction industry.

Keywords: *Challenges; Contractor; Internationalization; Malaysia; Strategies*

INTRODUCTION

Construction industry is one of the key drivers for Malaysian economy as it plays a vital role at both local and international levels. There was a trend of internalization for Malaysian contractors to grow their business at international level in order to ensure their viability and long-term survival in international market (Alashwal & Pirzada, 2015). Some more, the local economy experienced downturn at late nineties have caused the market in construction industry and local contractor have no choices but to compete effectively with international rivals. Therefore, in order to survive from the late nineties economic impact in local market, Malaysian contractor started to move into international construction project (Hanid et al., 2008). The international construction operations keep growing, and many contractors' firms are found continuously seeking opportunities in the new markets (Omar et al., 2018). Although international construction project provides opportunities for Malaysian contractor, however, it not only brings opportunities but also certain challenges in the form of competition among all the countries in construction industry (Mat Isa et al., 2014).

According to Loo et al. (2012), when a Malaysian contractor take on an international project, they will face not only complex risk, but also uncertainties and challenges. This challenge is mainly due to lack of international construction experiences and business operating environmental information (Omar et al., 2018; Abu Bakar, 2008). Apart from that,

according to Preece et al. (2015) and Mat Isa et al. (2006), the main barriers for Malaysian contractor to entry international market were insufficient financial resources, insufficient information to access market and high uncertainty from political risk. Therefore, there is a need to deep understanding on the unique strategies to overcome all of the challenges that will be faced by Malaysian contractors in order to compete well in the international market. For that reason, this research attempt to identify the key strategies for Malaysian contractor to embark on international projects.

LITERATURE REVIEW

Internationalization in Construction Industry

The increasing trend of globalization in world economy provides an open gate for today's construction firm to becoming an internationally interdependent marketplace. Hence, with the opportunities given for the international construction firms, the construction companies become more interested to ventures their business into the international market (Jin et al., 2013).

An early definition of internationalization by Welch & Loustarinen (1988) is 'the process of increasing involvement in international operations. Besides that, according to Juan, 2008 and Wong, 2007, internationalization not only resulted in creating competitive advantages, but also sustain firm's survival rate by bringing people, organization and countries closer. Furthermore, internationalization takes place by three different types of approaches such as by creating partnership in new countries, by rising commitment in existing international networks and by integrating organization's network positions in various countries (Chetty & Blankenburg Holm, 2000). Thus, going international can be defined as a market entry process through a construction firm which moves their operation solely from its local construction project to international construction projects.

By taking advantages of international construction project opportunities, this allows Malaysian construction industry to reduce effects of domestic market condition and have better control over its own development (Alashwal et al., 2015). Consequently, most major contractors have decided to change their focus by looking into international construction projects outside Malaysia and it is not only to ensure the viability of their businesses but also for long-term survival (Alashwal et al., 2015). However, risks are always accompanied by opportunities. Despite the opportunities that international projects offer, the contractors faced with various challenges when moving into international markets (Gad, 2012).

Factors Affecting Internalization of Construction Project

The international construction projects could not be separated with globalization. Competition in the international construction industry has increase due to global business. The key factors driving international construction project can be divided to two major factors which are internal factors and external factors (Gunhan et al., 2005). Internal factors defined as the factors that available for an organization used to support their business to global and not only in domestic region. Besides that, external factors are factors outside an organization that can encourage the presence of international construction.

Previous studies of Gunhan & Arditi (2005) also states that the general factors leading to a more accelerated internationalization. The factors including stagnant domestic markets that generated a new market opportunity. The larger markets demand and new opportunities allow the construction projects able to spread uncertainties and risks through diversification into new market. In addition, the factors of quick spread of innovations such as technological developments. Apart from that, a competitive use of resources for example more elaborate use of resources and capabilities of people about foreign cultures and markets is also enhance internationalization.

Besides that, according to Awil & Abdul Aziz (2012), the motivating factors for internationalization are long-term profitability, market stability, natural progress due to size, globalisation, top management vision, specialist expertise technology and government incentives. By pursuing the integration of technologically superior services, the construction companies able to compete in the international projects.

In addition, recent study by Omar et al. (2018), indicate that to find opportunities abroad was the main predictor on Malaysian contractor firms to go international. The firms chose to go abroad for a long-term opportunity for survival and longevity offered in international markets. Other important factors are because of the economic crisis, depreciation of ringgit, global drops in oil and gas prices and stagnant and saturated domestic market.

Malaysian Contractor Involvement in International Construction Project

Previous studies from Mustaffa et al. (2012) shows that international projects undertaken by Malaysian contractor have greatly increased from 25 projects in year 2000 up to 652 projects in year 2010. However, over the past five years, Malaysian contractors have re-positioned themselves in international market. Therefore, a database from international projects is used to examine the current position of Malaysian contractor in undertaking projects outside of Malaysia. The data was based on content analysis from Construction Industry Development Board's (CIDB) database which started such compilation in the year 2000.

Without any denial, Malaysian government through CIDB has taken initiative to encourage Malaysian contractors to export of Malaysian construction and consulting serviced into abroad. Malaysian companies have made their presence mainly in Middle East, South Asia, Asian and Africa region. According to CIDB (2016) there are totals of 112 Malaysian contractors that have been awarded international project outside of Malaysia and across 57 countries worldwide since year 2000.

Besides that, up to May 2016, as reported by CIDB International Project Database, Table 1 below also shows the total number of projects and project values that undertaken by Malaysian contractor involved in international project outside of Malaysia. There are divided into completed projects, current projects and miscellaneous projects where Malaysian contractor exported their construction services internationally. Meanwhile, the database in Table 1 shows that current involvement of Malaysian contractor since year 1982 until April 2016, the total number had reached a project values worth RM 113 billion and 781 of total projects number. It also represented the success involvement of Malaysian contractors in undertaking international construction project.

Table 1. Statistic total number of projects and project values in international project undertaken by Malaysian contractor

Project status	Total project (nos)	Project Value (MYR)
Completed	702	83,498,860,710.38
Current	51	23,180,133,981.35
Miscellaneous	28	7,176,820,000.00
Total	781	113,855,814,691.73

Challenges Faced by Malaysian Contractor in Embarking International Construction

All construction projects face varies of technical and financial challenges, but international projects confront another special set of issues since diverse participants from differing background and cultures who work together in unfamiliar locations (Will & Levitt, 2011). Table 2 shows the challenges that might be occurred when Malaysian contractor embarking international project.

Table 2. Challenges in embarking international construction projects

Author, Year	Challenges
Jatarona et al. (2016)	Poor site management
	Inadequate contractor experiences
Alashwal et al. (2015)	Construction-related challenges (e.g.: Inadequate of raw material, equipment and tool shortage)
	Organizational-related challenges (e.g.: Incorrect planning, Labour shortage, Training)
	Environment-related challenges (e.g.: Unknown condition)
	Political-related challenges (e.g: Government policies)
	Legal-related challenges (e.g.: Lack of local construction law)
Mat Isa et al. (2013)	Weak financing capacity
	Lack of familiarity of local system, style and knowledge
	Language barrier
	Lack of coordination (e.g.: Dispute)
Loo et al. (2012)	Financial (e.g.: Interest rate)
	Economic (e.g.: Price fluctuation, exchange rate, inflation)
Fernández et al. (2011)	Different construction code (e.g.: Raw material production)
	Local requirement (e.g.: Seismic load)
	Different negotiation style
Abu Bakar (2008)	Change in law and contract
	Financial risk (e.g.: Currency, Bank loan)
Ling et al. (2006)	Natural challenges (e.g.: Weather and geological system)
	Contractual challenges (e.g.: Building procurement, Safety measures)
	Political challenges (e.g.: War)
	Cultural challenges (e.g.: Different in religion, Culture)

Existing Strategies in International Construction Projects

Construction is like a battlefield and problem solving is one of the crucial tools to conquer this battle. Therefore, a thorough assessment of specific factors on the country or market environment, firm's capabilities and project characteristics must be done prior to their decisions to enter the competitive and high-risk global market. Table 3 shows strategies in embarking international projects from previous related research.

Table 3. Strategies in embarking international projects

Author, Year	Main Strategies	Strategies
Preece et al. (2015)	Site Management	Efficient site management team to gain trust Long term and strong management Good technical project staff Effective Safety and Health Management
Mat Isa et al. (2014), Ma et al. (2014), Stewart et al. (2011) and Abu Bakar (2008)	Market Entry Strategy	Effective market selection decision Good control system to monitor performance Construction joint venture with local firm Initiate an International Joint Venture Choosing an experience and familiar partner
Kerur et al. (2012)	Risk Management and Control	Effective risk reduction Good risk mitigation plan
Minja et al. (2012)	Joint Venture & Partner Selection	Ability, experience, skills, financial ability, willingness, spoken language, track record, JV experiences, mutual understanding
Chen et al. (2011)	Market entry decision	Strategic alliance, local agent, licensing, joint venture branch office, BOT
Cheah et al. (2014)	Financial & Contractual Management	Effective financial resource allocation Insurance Policies

RESEARCH METHODOLOGY

Research methodology is a method to carry out a study and describes the specific procedures or techniques used to identify, select and analyse information that applied in the research. This research adopts a quantitative approach for collecting data from targeted respondents by using questionnaires. This approach was used to identify the challenges and strategies from the perspective of Malaysian contractor in regard to internationalization. Furthermore, the data collected from questionnaire survey were analyse quantitatively with the help of Statistical Package for the Social Science (SPSS) software.

The respondents of this research were the Malaysian main contractors that undertaken international construction project at outside of Malaysia and registered as G6 and G7 contractor under CIDB. The targeted respondents were top and senior management level employees in the organization such as project manager, site manager and senior manager. Thus, the targeted population was a list of 112 Malaysian contractor companies awarded to CIDB international construction projects. An acceptable sample size of 86 respondents were then chosen from the targeted population (Krejcie & Morgans, 1970).

This data collection was carried out by distributing questionnaire survey to the respondents. The questionnaire was design into four section as the following:

Part A: Correspondent and company information,
Part B: International construction project information,
Part C: The challenges of embarking international construction project,
Part D: The strategies in embarking international construction project.

The measurement of items in Part C and D is using a five-point Likert Scales so that the respondents able to indicate the degree of influences and level of their agreement according to their experience (Kothari, 2004). Descriptive analysis was then used to analyze the data and describe the phenomenon being studied so that it is easier to understand. SPSS software was used to help during data analysis.

RESULT AND DISCUSSION

Response Rate

A total of 100 sets of questionnaires were sent out by email to the selected company to be responded and 49 sets of questionnaires were received back for this research. However, only 40 questionnaires were qualified as valid data and another 9 questionnaires were excluded from the research due to invalid and incomplete data. Thus, the response rate has a percentage of 47%.

Reliability Test Analysis

Reliability analysis can be defined as testing of consistency by using Cronbach's coefficient (Bhatnagar et al., 2014). In this research, the overall Cronbach's Alpha consists of 82 items and achieved 0.754, which is considered as acceptable by referring to Table 4.

Table 4. Cronbach's Alpha internal consistency table

Cronbach's Alpha	Internal Consistency
< 0.6	Poor
0.6 < 0.7	Questionable
0.7 < 0.8	Acceptable
0.8 < 0.9	Good
0.9	Excellent

Respondent and company background

Respondent and their company background were analysed in this research including respondent's designation and years of working experience in construction industry, the duration of company operate in international construction project and also the company international project information.

The findings in Figure 1 shows that majority respondent who answered the questionnaire for this research is from Grade 7 contractor organization with 60% as compared to Grade 6 contractor (40%).
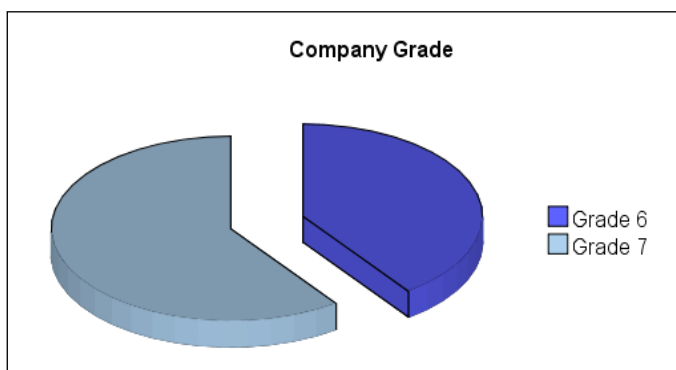
Figure 1. Contractor CIDB registration grade

For the job position as revealed in Figure 2 below, 11 from 40 respondent are senior manager (27.5%), 8 of them are others position for example project executive and contract

administration manager and assistant project manager. Besides that, 7 of them are site manager (17.5%). Thus, most of the respondent are senior manager which represent 27.5 % of 40 respondents.
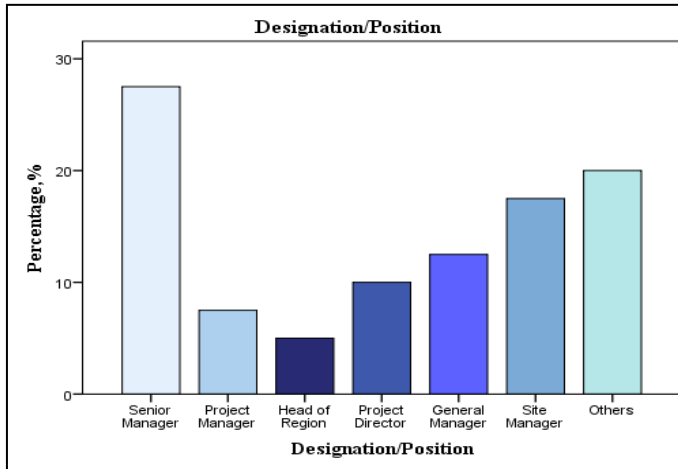
Figure 2. Respondent's designation

Furthermore, based on company international operation experiences, 45% of the respondent company having 1 to 5 years of international operation experiences. It is followed by 5 to 10 years (35%) and 10-15 years (20%) international operation experiences respectively as shown in Figure 3 below.
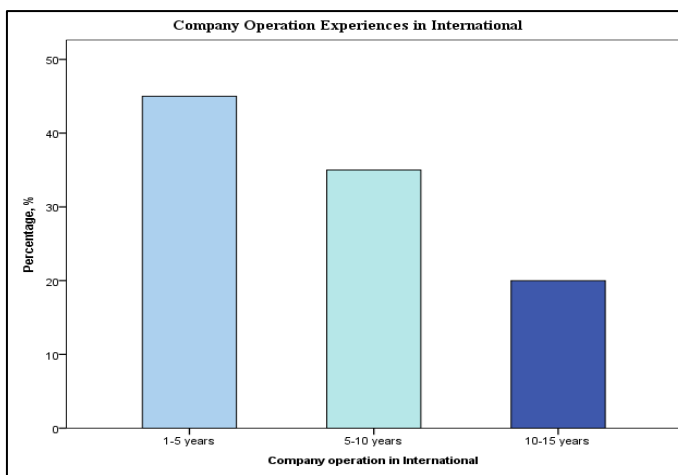
Figure 3. Years of experience in internationalization

Figure 4 indicates the highest proportion of the contractor organizations international contracting activities is located in ASEAN region with 37.5% from 40 respondents, followed by Middle East and South Asia Continent with percentage of 27.5% and 12.5% respectively. Likewise, it is notable that Africa and other countries both contribute with 10% and the remaining percent fit in Europe region.
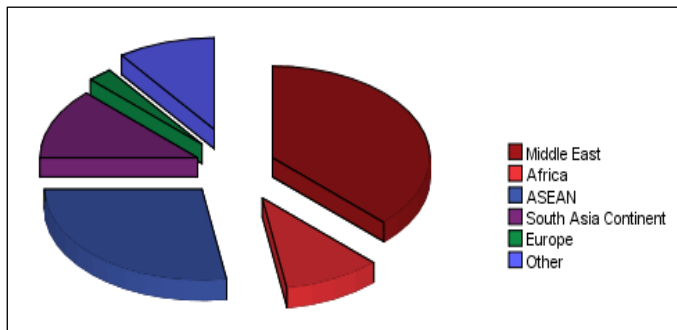
Figure 4. Region of company operate internationally

Figure 5 below shows the nature of international projects undertaken by the respondent's companies. Based on the data, the highest proportion of the international project type involved by respondent companies is heavy or highway with 32.5%, followed by commercial building at 27.5%, industrial and oil and gas at 12.5% respectively, mechanical and electrical project at 10% and the remaining percent fit in both residential building and other types of projects.
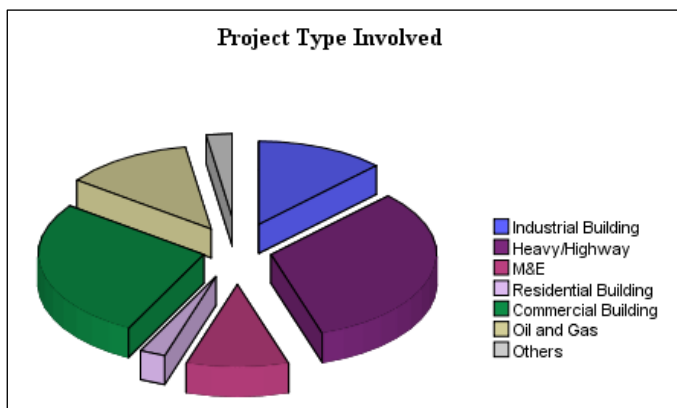
Figure 5. Type of international project

Key Challenges in Embarking International Construction Project

The findings that will be focus in this paper is from questionnaire survey regarding key category of challenges in embarking international construction projects as shown in Table 5. The data was analysed based on average mean score of each category. Table 5 shows the average mean score of ten categories of challenges that faced by Malaysian contractors when undertaking international projects. The highest average mean score shown in the table is Human Resources challenges with the value of 3.97, followed by Financial and Economic challenges at the second place with the value of 3.88. Construction Related challenges ranked at third place with average mean score value of 3.80. Natural and Environment challenges, Material and Equipment challenges and Cultural challenges ranked at 4th, 5th and 6th which indicated average mean score of 3.72, 3.70 and 3.63 respectively. The lowest rank is Legal and Contractual challenges with average mean score value of 3.27.

Table 5. Category of challenges in undertaking international construction projects

Rank	Challenges Category	Average Mean
1	Human resources Challenges	3.97
2	Financial and Economic Challenges	3.88
3	Construction Related Challenges	3.80
4	Natural and Environment Challenges	3.72
5	Material and Equipment Challenges	3.70
6	Cultural Challenges	3.63
7	Safety and Health Challenges	3.61
8	Political Challenges	3.59
9	Managerial Challenges	3.45
10	Legal and Contractual Challenges	3.27

Key Strategies for Malaysian Contractors to Embark in International Construction Project

Four categories of strategies for Malaysian contractors to embark in international projects is shown in Table 5. The most recommended strategies with the highest average mean score shown in the table is strategy related to control and risk management with the value of 4.37, followed by strategy for entry mode at the second place with the value of 4.28. The third and fourth key strategies suggested by Malaysian contractor are strategy related to site management and strategy related to financial and contractual management with mean score of 4.27 and 4.00 accordingly.

Table 6. Strategies for Malaysian contractors to undertake international projects

Rank	Strategies Category	Average Mean
1	Strategy related to risk control	4.37
2	Strategy for entry mode	4.28
3	Strategy related to site management	4.27
4	Strategy related to financial and contractual management	4.00

Majority of respondents agree that the strategy for Malaysian contractors to embark international projects is by controlling the risk of internationalization namely by transfer or share the risk to client. According to Walewski et al. (2012), most of the international construction contractors have their own adequate contractual strategies with respect to project delivery risk and contractual issues. The strategies to manage these risks are risk transfer and risk sharing, subcontractors are often the typical recipients of risk transfer and it is the strategy used to protect main contractor (Kerur & Mashall, 2012).

Additionally, the research finding shows that entry mode strategy is the second key strategies for internationalization by forming joint venture and partnership with local partner firm. The method of forming joint venture with local contractor could provide useful information to Malaysian contractor such in choosing familiar partner, reliable subcontractor appointments and way to obtain credit terms from local and familiar suppliers. This finding was supported by the analysis of market entry selection carried out in this study as shown in Figure 6 below. Figure 6 shows the percentage of market entry selection decision. Joint Venture is the most favour strategy (31.9%) followed by Build Operate Transfer (BOT) and Licensing with 19.1% and 18.1% respectively. Meanwhile, Strategy Alliance is the least favourable strategies of market entry selection decision.
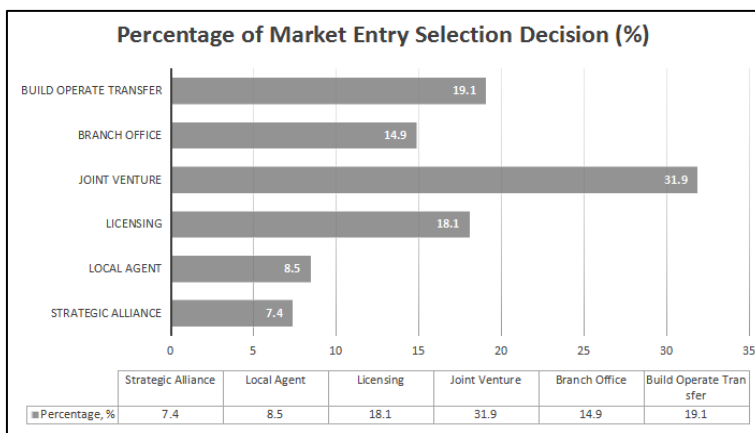
Figure 6. Percentage of Market Entry Selection Decision

As shown in Figure 6, forming of joint venture can overcome the challenges of internationalization faced by Malaysian contractors such as weak financial capability, lack of management skills and lack of equipment. In order to minimize the risk of joint venture, some of the critical joint venture factors and partner selection should be address and identified before making any joint venture agreement (Abu Bakar, 2008; Safa, 2018). Previous research revealed that financial capability was the most important factor for joint venture selection. Financial stability is essential for a prospective partner that can minimize financial risk caused by delays in payments, currency fluctuation, inflation and delays caused by government approval (Minja et al., 2012). This finding was supported by the analysis of percentage of joint venture selection factor carried out in this research shown in Figure 7. The results show that financial capability obtained the highest percentage which is 19.3 %, followed by the second and third highest which are firm ability (17.7%) and firm experiences (17.2%). Meanwhile, political stability obtained a lowest percentage which is 5.7 %.
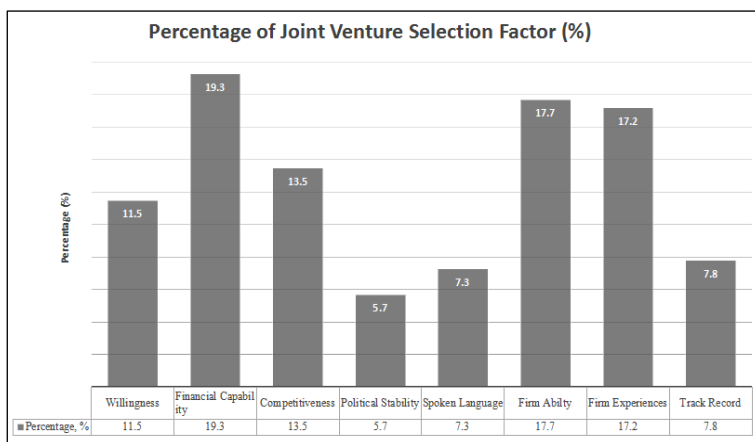
Figure 7. Joint Venture Selection Factor

CONCLUSION

The increasing trend of globalization in world economy provides an open gate for today's construction firm to becoming an internationally interdependent marketplace. Hence, with the

opportunities given for the international construction firms, the construction companies become more interested to ventures their business into the international market. However, there was a challenge need to be faced by Malaysian Contractor in venturing in international project. From this study, it was identified that the key category of challenges for Malaysian contractor in embarking in international construction project are Human Resources challenges, Financial and Economic challenges and Construction Related challenges. In addition, a few key strategies were also identified in this research including risk control and implementing effective entry mode strategies such as forming Joint Venture with local contractor firm. The findings of this research could be implemented in supporting the current internationalization strategic thrust in Construction Industry Transformation Programme 2016-2020 (CITP) initiative in increasing productivity in construction industry.

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CONCEPTUAL MODEL FOR MINIMIZATION OF TRANSACTION COSTS IN BUILDING ENERGY EFFICIENCY (BEE) FOR AFFORDABLE HOUSING DELIVERY

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Abstract
Energy efficiency is fundamental to enhancing homes affordability. There are several unique challenges to affordable housing that owner-developers need to address in order for energy efficiency to make significant economic sense. Issues such as Transaction Costs (TCs) plays a significant role in achieving building energy efficiency (BEE) for affordable housing delivery. It is evident that split incentives, information asymmetry, institutional transition, opportunistic behavior, and ill-informed users incur different levels of TCs and affect stakeholder's willingness to take part in BEE for affordable housing. A better understanding of the nature and structure of TCs is indispensable to enhance the market-drive and investment for BEE affordable housing. Uncertainty, specific investment, frequency and bounded rationality are seen as the key dimensions of TCs. The research focuses on how to minimize TCs involve in BEE affordable housing delivery. It was found in the literature that, the level of TCs for building energy efficiency was estimated at 20.5% of total project costs. A conceptual competency-driven benefits realization model is proposed for minimizing TCs taking into consideration the peculiarities of the current housing projects delivery. This research aims to establish the significance of leveraging on BEE project team-competency and commitment organized within a strategic Benefits Realization Management framework to optimize client 's benefits in terms of minimizing TCs. The focus is on the aspect of developer's competencies and their project team commitment with respect to minimizing TCs that is structured within a Benefits Realization Management (BRM) practice. This model is proposed as a pro-active enabler tool for the purpose of achieving Value for Money in BEE affordable housing projects. This paper is part of a series of publications.

Keywords: *Transaction Costs; Building Energy Efficiency; Affordable Housing; Benefits Realization.*

INTRODUCTION

Construction industry could contribute significantly to the sustainability of future development. Buildings account for 40% of global energy consumption and nearly one-third of global CO_2 emissions (Levine, Urge-Vorsatz, Blok, Geng, Harvey, 2007). New houses that are not energy efficient are continually being built every day, and the existing inefficient housing stocks will remain standing in the next 50 years (WBCSD, 2009). In Nigeria, the energy usage of buildings is growing rapidly due to rural-urban migration and as more people move into modern homes and acquire amenities and appliances such as heating, cooling, and refrigeration. Energy demand in the Nigerian housing sector is expected to grow rapidly in parallel with economic and population growth. Attractive opportunities exist to reduce housing energy demand and use at lower costs and higher returns than in other sectors. When compared to developing countries in general, they lack the incentive and technical knowhow to pursue goal of greater sustainability agenda (Ugwu & Haupt, 2007). There is the need for the developing countries to advance their level of awareness and contribute immensely to the Building Energy Efficiency (BEE) development battle so as to redefine the fight against climate change and address the global environmental concerns (Qian, 2011). It is evident that up to 50% of total energy is utilized by buildings, which include the materials development,

construction and building lifecycle operation (NNBEEC, 2017). In Nigeria, the case is similar, as buildings consume about 75% of electricity, basically for air-conditioning due to the tropic climate characterized by sunny and hot weather. This is seen as the fundamental point and source of Nigeria's greenhouse gas emissions.

There is several research corroborating to the collective benefits of propagating green building. Though, when compared to the conventional buildings approach, green buildings projects are often seen to have a higher initial cost at both the design and construction stages. Certainly, uncertainties exist in the process and route of delivering green buildings, which involves a extraordinary contingency sum to be apportioned in the project budget. Without a clearly define costs and benefits, the perceived higher initial costs and TCs along with their attendant extra risks, further discourage prospective developers and stakeholders from embarking on green building projects. The clients project managers play a vital role in integrating sustainability to deliver a sustainable facility or building at both the design and construction stages whilst keeping in mind the project target of cost and time requirements of the client or project (Ofori, & Toor, 2008a; Ofori, & Toor, 2008b; Delnavaz, 2012).

It also evident that only the developers with financial capability can survive and leverage on the benefits realization actively in the sector. The key players have little or no incentive to risk into green building business. The barrier to the building energy efficient market entry is higher when compared with conventional building approach, this is due to new information search, *expertise*, lack of technical knowhow of new technology, and financial risk involved. But if there is an establish asymmetric information with regards to the standards quality or obligatory requirements that are not forced on the market, the developers' opportunistic behaviour might take centre stage and they may continue to produce conventional buildings (Akerlof, 1970).

The actions aimed at minimizing TCs are seen as being oriented towards Benefits Realization. The attempt here is to provide a basis to realize benefits for the client by focusing on key existing developers' capabilities, viewed as corporate social responsibility within construction industry, focusing on the soft human factors component. Taking BEE affordable housing delivery scheme as being best suited to test this principle of targeting benefits maximization for the client, an analysis of developer's team-commitment and team-competence is undertaken to evaluate their significance in minimizing Transaction Costs (TCs). TCs have been variously described as being social waste of wealth (Koskela, 2000; Wenan & Mengjum, 2010).

Research Theoretical Framework

Affordable housing developers' team-commitment and team-competency are two critical aspects of developer organizational capability that significantly influence on organizational performance. The affordable housing developer commitment and competency measures will be developed using Delphi technique. These focused measures were being collated from extant literature under the broad category of organizational commitment and competency and articulated as a theoretical framework (refer to Figure 1). Further detailed discussion on the Delphi technique will be provided in the subsequent publication. The responses of the experts through the rounds of Delphi will facilitate the final consensus view of the BEE affordable housing experts which will constitute the final research questionnaire measurement constructs.

The epistemological basis for this work is embedded within Lean Production Theory (Koskela, 2000), wherein knowledge or action in production is to be premised on principles related to minimizing waste and maximizing value (Gomez & Raji, 2017). In this paper BEE affordable housing performance is addressed in terms of minimizing TCs in order to maximize benefits for BEE affordable housing clients in the construction industry.
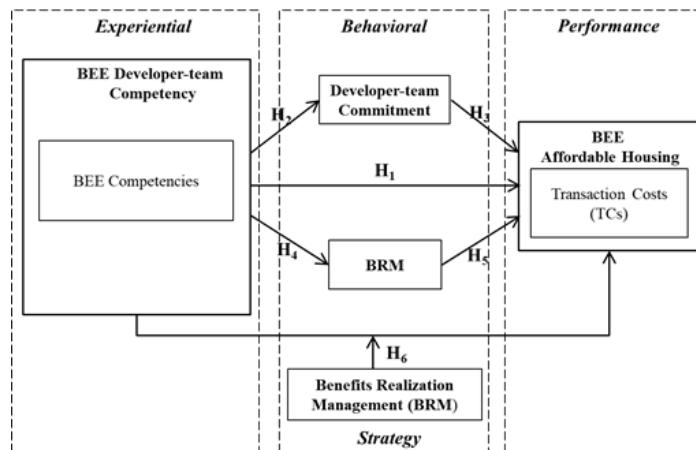
Figure 1. Theoretical framework

The ultimate deduction is that BEE affordable housing clients rely on the attitude and behaviour of the developer team to act in the client's best interest. Hence, in the absence of such behaviour or commitment from the developers' team, the BEE affordable housing clients' benefits would be afflicted by uncertainties, consequently lowering the performance level and increasing TCs. The conceptualization of the theoretical framework (refer to Figure 1) is based on Boyatzis's (2008) *Theory of Action and Job Performance*. According to Boyatzis (2008) theory of performance is the basis for the concept of competency. As maximum performance is believed to occur when individual capability or talent is consistent with the needs of the job demands and the organizational environment. The framework was further developed using Williamson's (1981) analysis of the key contributors of TCs, namely: the economic actors' behavioural assumptions, the lack of competency resulting in bounded rationality (Qian, Lehmann, Khalid & Chan, 2014) and transaction characteristics such as split incentive, information asymmetry, opportunistic behaviour, ill-informed users and institutional transition (Qian, Chan & Khalid, 2015) of the BEE affordable housing projects. Hence, it is hypothesized that BEE affordable housing TCs can be minimized by emphasising on the different dimensions of developers' team-competency and team-commitment as shown in Figure 1. The main hypothesis of the framework is:

The Main Hypothesis

H^A: BEE affordable housing developers' Team-Competency positively influences TCs
H^B: BEE affordable housing developers' Team-Commitment positively influences TCs
H^C: BEE affordable housing developers' Benefits Realization Strategy positively influences TCs

Competency and Performance

In the past few decades, competencies were often used for the basis of performance appraisal (Cardy & Selvarajan, 2006). The competencies as a measurement tool identify behavioral factors relevant to performance in a job and viewed as how the job is carried out. Many organizations use competency models as a part of their employee development program to appraise behavioral performance indicators together with objectives (Özçelik & Ferman, 2006). Consequently, many scholars (McClelland, 1973, Levenson *et al.,* 2009; Ryan *et al.,* 2009; Yaşar, Ünal, & Zaim, 2013) have claimed that assessment of employees' competencies provide an effective method for predicting job performance.

There is a variety of research that clarifies the relationship between competencies and employees' job (task) performance (McClelland, 1973; Liu *et al.,* 2005; Dainty, 2004; Levenson *et al.*, 2009; Ryan *et al.,* 2009). The findings of Ahadzie *et al.'s* (2009) demonstrates the suitability and potential usefulness of their competency-based model that reflects elements of both performance behaviours and outcomes in predicting the performance. Similarly, there are other research (Ryan *et al.,* 2009) highlighting the validity and utility of competencies in predicting employees' work performance. Qiao & Wang (2009) suggest that team building, communication; coordination, execution and continual learning are critical competencies for the success of middle managers in China.

Although the relationship between individual competencies and organizational performance has been addressed. However, there are less empirical evidences found in this issue (Levenson *et al.,* 2009; Ryan *et al.,* 2009; Gammie & Joyce, 2009). On the other side, despite the increasing tendency in using competency models, there is still some confusion and scepticism about the relation between competencies and performance. These are mainly because of the difficulties in assessment of competencies and the complex and lengthy process required for identifying the appropriate competency performance relationship (Vakola *et al.,* 2007). In addition to that, organizational performance has many dimensions, yet it is not easy to connect individual competencies to organizational performance (Liu *et al.,* 2005; Vakola *et al.,* 2007). In this research, D&B contractor teams-competence will be assessed to establish a causal relationship with minimizing post-contract TCs for achieving optimal benefits realization and thus in a more specific sense addressing a particular aspect of project performance in the construction industry aimed at benefits or value maximization.

Commitment and Performance

There is a universal prediction that commitment is beneficial to a wide range of organizations in terms of improving employee job performance such as (improved quality of work, completing work in time) as well as organizational performance (e.g. more sales, higher profit, and higher return on investment) (Mohyin, 2011). Surprisingly, although there is some evidence of significant positive links between affective commitment and performance, the correlations are often small to moderate (Mathieu & Zajac, 1990). The complexity of the relationship between commitment and performance has also been identified and raised by other scholars (Suliman & Iles, 2000). Steers (1977) as cited in Mohyin (2011), stated that a possible explanation for the absence of strong evidence of a correlation between commitment and performance suggests that highly committed employees tend to perform well only if: 1) The organization stresses high achievement orientations in tandem with good employee

relations; 2) passive commitment (often called loyalty) can be translated into "active" commitment; and 3) employees possess the requisite skills, abilities and fully understand and accept their particular organizational roles (Mohyin, 2011). Without these factors, committed employees may not be able to convert their commitment into performance outcomes.

According Randall (1990), based on a meta-analysis of 35 studies it is found that high levels of organizational commitment are positively, but weakly, associated with work outcomes including performance. The study revealed that the type of outcomes (of commitment) and the methods used explain only 19% of the variance in the commitment and outcome relationships, with conceptualization decisions having the largest impact. Further, Swailes (2002) argues that the persistent research findings, which provide only a small positive correlation between commitment and performance, may be a result of methodological inadequacies rather than a true finding.

However, recognizing this limitation, many researchers still make efforts to further investigate the complex relationship between commitment and performance. A few scholars have been able to show a positive relationship between commitment and job performance when organizational commitment constructs are approached in their multifaceted form. For example, Meyer *et al.* (1984) found that affective commitment correlates positively with job performance, while continuance commitment correlates negatively with job performance. Meanwhile, Becker *et al.* (1996) states that, although overall commitment to organizations appears to be largely unrelated to performance, it is possible that there is a relationship between commitment as a multidimensional phenomenon and performance. Hence, they found that employees' overall commitment to supervisors is significantly and positively related to job performance. Another study involving hotel employees conducted by Gould-Williams (1999) provides evidence that commitment produces desirable employee job performance outcomes such as the willingness to work additional shifts and the willingness to work in whatever capacity is required.

Furthermore, with regards to the relationship between commitment and organizational performance, there are additional findings that reveal the existence of a positive link between the two (Brett *et al.*, 1995; Abdul Rashid *et al.*, 2003). A study using conventional organizational commitment scales and different variations of a specially designed new commitment scale has shown evidence that employee commitment is significantly related to the financial success of the organization (Benkhoff, 1997). In the UK, Patterson *et al.* (1997) demonstrated the relationship between organizational commitment and company performance. They found that organizational commitment explains the variation between companies in relation to change in productivity and profitability (7% and 5% of the variation respectively). This clearly indicates the importance of managing employee commitment to influence the business performance.

From the construction management literature there is strong evidence that affective commitment is the main criterion for construction project success (good performance and high satisfaction) (Leung *et al.*, 2004). This suggests the essential need for construction organizations to foster employee commitment for the successful delivery of services to their clients. Further, in responding to the changes in the external context such as the competitive business environment and the dynamic global market, it is noted by Mohyin (2011) that construction organizations need to make necessary changes to their internal environment such

as the business strategies, financial decisions and HRM practices. In this research, D&B contractors' team commitment is hypothesized to have a positive effect on project performance by minimizing post-contract TCs. Thus, if the relationship is positive, then it will require the commitment of all contractor teams' members to move towards the direction for successful benefits realization in D&B projects. In the next sub-section, the empirical research into commitment in construction is reviewed, as the findings of this research will add to that body of knowledge.

Benefits Realisation Management

The benefits realization approach emerged in the sector of information organizations and engineering during the 1990's. It was triggered by the low success of technology implementation in generating the expected business benefits of organization (Thorp, 1998).

It is found in the literature that the need for managing benefits realization is based on three premises: (i) benefits do not automatically appear when a project is delivered; (ii) benefits rarely happen according to plan; and (iii) realizing benefits is a continuous process of envisioning results, implementing, checking intermediate results and dynamically adjusting the path leading from investment to investment to business results.

However, one fundamental aspect of the benefits realization approach is to increase the predictability of benefits being through visualizing the different possible paths from actions to results and to the generation of benefits, whilst constantly evaluating the flow (Remenyi & Sherwood-Smith, 1998). On the other hand, stakeholder's commitment in a benefits realization approach is essential (Bradley, 2006). Bradley states that success is much more likely when stakeholders are engaged in formulating the vision or at least influencing the shape of the change, and where they can see clear value, either for themselves or for the whole organization. It is also found in the literature as posited by Christoffersen & Emmit (2009) that the importance of engaging different stakeholders to discuss project values has also been explored in construction through the adoption of a value-based approach to design management.

Benefits realization literature emphasizes the understanding of projects as systems in which collectively identifying the inter-relationships between projects and benefits are essentials (Reiss *et al.,* 2006). Benefits mapping clarifies the path to benefits, the dependencies between projects, deliverables and benefits, as well as the distribution of budget and responsibilities. As a consequence, it provides basis for risk management, monitoring and budgetary control (Reiss *et al.,* 2006). Continuous improvement is also emphasized based on cyclic evaluations to enable learning and adaptation (Farbey *et al.,* 1999a). The significance of considering continuous re-evaluation of project means, ends and constraints is also discussed by Ballard (2008) and Howell *et al.* (1993).

Different challenges identified in the benefits realization literature are: (i) the ability of setting the adequate measurements to track benefits realization, since it is difficult to convert a policy vision or a business strategy into detailed and measurable statements (Bradley, 2006); (ii) the fact that some of the benefits may be secondary, non-expected and a result of changes that were made during implementation (Farbey *et al.,* 1999b); and (iii) after the project has been delivered, generally the team is dispersed representing a difficulty to set responsibility

for the accountability of benefits. In view of the literature review, this research presents an initial understanding, and as proposed by Rooke *et al.* (2010), additionally for the need of a new and more effective benefits realization and management process that embodies and operationalize the concepts and issues presented in this chapter. The findings as generated at this stage can be summarized as follows:

- Project and product longevity are also a threat to benefits realization, as perceptions may change over time, this needs to be addressed through expectations management (Bartlett, 2006);
- A full analysis of potential stakeholders and the impact on them is necessary in order to resist the possibility of unintended outcomes (Thorp, 1998)
- Expectations must be managed. Since the process of achieving objectives value judgments is inter-subjective, the supplier as well as the client influence is considered. However, project managers must be careful not to generate unrealistic expectations that will lead to the client being disappointed (Bartlett, 2006; Reiss *et al.,* 2006);
- Stakeholder interests will at different times conflict, presenting difficulties for determination of a value and requiring sensitivity to and proactive management of power relations (Sapountzis *et al.,* 2009);
- The link between strategic aims and project outcomes is vulnerable to breakdown and must be monitored (Thorp, 1998);
- Timelines will be vulnerable to all the influences listed above (Thorp, 1998);
- A full analysis of personnel involved in benefits delivery is necessary, including time of involvement, activity and motivations (Thorp, 1998; Rooke *et al.,* 2009).
- It would be risky to assume that all stakeholders will understand the implications of benefits identification and planning, but Kagioglou *et al.* (2000) highlight that project success relies on the right people having the right information at the tight time.
- Projects can only be regarded as successful if the intended benefits are realized (McCartney, 2000).
- Benefits realization is the transformation from a general investment program appraisal approach which is usually based on *cost*, *quantity* and *time*, to an active planning approach supported by benefits planned, delivered and realized by stakeholders (Glynne, 2007).
- Organizations often have a limited ability to manage change (Truax, 1997).

Sapountzis (2013) identify three major dimensions or strategies in which the issues for considering a benefits realization are based. The strategies are:

- Proactive management and learning;
- Stakeholder engagement;
- Strategy deployment.

BUILDING ENERGY EFFICIENCY AFFORDABLE HOUSING

The planet earth is running out of a finite resources of fossil fuels and at the same time global warming is threatening to change the climate into a destructive force that could change the world (McIIwain & Kermit, 2006). Meanwhile buildings are responsible for over 50% of total energy consumption in Nigeria, part of the solution must involve ensuring the building

to be more efficient. As difficult as the task may be, it will be an incremental change in individual buildings over time that make the difference (NNBEEC, 2018). Thus, each stakeholder involved in building design and construction has a role to play in finding solutions to the crisis our planet is faced with (McIIwain & Kermit, 2006).

Understandably, low-income household energy cost, is four (4) times more than for other American households. Even though energy bills comprise of a significant percentage share of a typical low-income family's budget, it is clear that utility costs are seen as an overlooked component of housing costs. The key task is to comprehend clearly that affordable housing can be made to be energy efficient without afflicting cost over-runs and delays at the construction stage of the projects. It is also evident that the benefits to be realized will have significant effect on housing affordability and tenant's willingness to pay for housing bills and rental costs as well as living in a comfortable home. This paper seeks to demonstrate the benefits of BEE affordable housing and how minimizing building energy efficiency TCs can overcome the developer-owners' misconception that achieving BEE affordable housing is typically expensive and time intense. It is also argued that BEE lowers utility bills, which eventually enhances home affordability.

Barriers to Building Energy Efficiency Affordable Housing

The leading barriers to energy efficiency as identified are energy prices and technology; limited capital access; lack of or inadequate information; incorrect risk assessment; the principal/agent problem; and *transaction costs in energy efficiency*. As posited by Valentova (2010), the barriers are all usually interconnected, and they may even reinforce each other as against being in a standalone form.

Energy prices affect the application of energy efficiency measures in several ways. The real stake of energy costs in total costs and the development of energy prices is seen as key factors in energy price. On the other hand, a barrier that is often cited with regards to energy efficiency measures is the extraordinary upfront costs of energy efficiency investments which affect *limited access to capital*. The small and medium size enterprises (SME) and as well as the lower income group "households" are generally perceived to be predisposed by these barriers. Furthermore, due to the *lack of or inadequate information* to prospective investors, in both organizations and households, the energy saving costs measures are expected to go beyond the individual user's benefits (Howarth & Anderson, 1993), which is seen to be more related to TCs.

Incorrect risk assessment: In general, employing an extremely high discount rate in evaluating the economic efficacy of energy saving measures is hypothesis as a key source of the alleged "*efficiency gap*" (Thompson, 1997; Koopmanss &Willem Te Velde, 2001). Numerous empirical findings have indicated that customers, that is "firms and households" cut the price of energy savings by 10%, therefore considerably reducing their present value (Thompson, 1997; Sanstad & Howarth, 1994; Oikonomou, Rietbergenb & Patelbet, 2007). Howarth & Anderson (1993) found that, the estimate of the price cut rates begins from 20 - 25% but can stretch up to 80%, which is far greater than the returns on other investments could provide. Similarly, Vine *et al.* (2003), establish that the level of the price cut rate or discount rate can stretch up to 50%. Hence, there are several motives for this, but they all reflect the barriers discussed earlier.

The principal-agent problem: The "principle-agent" issue is essentially a split incentives barrier "or the separation of responsibilities for energy expenditures and conservation actions (Jochem & Gruber, 1990)". The owners of the rental unit have the incentives and motivation to invest in building energy efficiency measure. Additionally, the home/building owner will not receive direct benefits of the efficiency measure applied, this is due to the fact that, the end-user or tenant is seen to be paying lesser bills for energy consumption. On the contrary, the end-user or tenant obtains all the relevant benefits from the homeowner energy efficiency investment measure, but then with no or lack of incentive to invest, as there is high uncertainty with regards to the contract delivery timeframe. The end-user or tenant may likely move out to another place before reaping or realizing the full benefits of energy saving costs, which is detrimental to the investment from an economic viewpoint. Schleich & Gruber, (2008) posit that split incentives barrier is seen as highly important for households or tenants than private firms and as well as the public sector. This is also seen to have a longer rental contracts than in the households' situation.

TRANSACTION COSTS IN BUILDING ENERGY EFFICIENCY

Transaction costs are portrayed distinctly because they are likely to comprise all the aforementioned barriers above. The level of TCs is not insignificant, and it is expected to inhibit building energy efficiency measures from clearly being executed. Though, the actual amount or quantity of TCs still remains vague and uncertain, partly due to non-existence of a clear method for evaluation that can be considered in decision making processes. Previous studies have found that, the TCs in building energy efficiency are factual and is projected to be on a significant level. TCs might hinder the practice of energy efficiency measures in a project or may eventually offset the benefits achieved or sustained in energy efficiency improvements scenarios and hence lead to their minimal benefits realization.

Matthews (1986) provides a seemly fit definition of TCs in energy efficiency "*as the costs of arranging a contract ex ante and monitoring and enforcing it ex post, as opposed to production costs*." It can be applied to both efficiency measures investment, and to policy instruments. TCs are borne either by the developers, project managers or by the BEE project beneficiaries. The transaction costs therefore pertain to the costs related to investment, operation and maintenance, verification, and/or administrative costs. Lack or inadequate information and TCs are often interchangeably used in the literature (Schleich & Gruber, 2008). It is evident that energy efficiency TCs can be alienated into four (4) main groups or stages in which TCs can occur; at the planning stage, implementation stage, monitoring stage and the verification stage (refer to Table 1).

Table 1. Sources of TCs (Mundaca & Neij, 2006; Valentová, 2010).

Project value	Nature of transaction costs
Planning	• TCs related to information search • TCs related to customers' search • TCs related to legal fees • Proposal development stage • Identification and evaluation
Implementation	• Contracts negotiation • Project procurement stage • Validation stage
Monitoring & Verification	• Monitoring, quantification and verification of savings mechanism and related greenhouse gas emissions reductions

At the planning stage involves information searching, project identification, proposal development and evaluation. Whilst at the project value implementation stage, the negotiation process is important. The last stage essentially means to monitor and verify energy savings and as well as greenhouse gas emissions reductions.

Bjorkqvist and Wene (1993) in addition highlight the importance of taking into consideration potential active rejection within the calculation. Active rejection is described as option that actors take into consideration before active rejection. The actors also incur TCs. Generally, the understanding of the negative effect of TCs has been supported by several studies as identified in the literature (such as in (Reddy, 1991; Ostertag, 1999; Sanstad & Howarth, 1994; Ostertag, 2012; Gomez & Raji, 2017). though, there is lack or inadequate empirical data in the literature. This is due to the fact actors are often seen to be unwilling to reveal information. additionally, there is a lack of post-evaluations or assessment, which serve as an essential source for TCs estimation. in addition, it is evident that TCs are understandably specific in nature with respect to a case (Mundaca, 2007).

The findings of the previous studies that evaluate the level of TCs in different programs is further discussed below. It is significant to note that, due to the diversity of sectors and methods applied, the findings could not be directly analysed in a comparative form.

Bjorkqvist & Wene (1993) carried-out a study of TCs in households that were involve in Goteborg demand side management program. 51 households that invested in their home heating systems upgrade were analysed. The TCs were not assessed in tangible value or monetary terms, but rather in hours spent by the households. It was found that, the household spent 18 hours on average at the decision-making process. 6 hours was found to be the time spent by (active rejection) or non-investors. Interestingly, the energy supplier who was seen as the key initiator of the demand side management program was found to have provided significant information such as the potential dealer or suppliers of energy efficiency equipment, and options information. In this regard, the "*time*" for searching information certainly saved.

Bjorkqvist & Wene further transform the hours into tangible value or monetary terms, by using labour costs as a proxy. The TCs then was found to represented *28% of the average* investment that is when considering gross income, *or 13%* if net income was considered. The acknowledge that the values may have been underestimated, due to the fact that the it is difficult for the households explicitly recall all time spent on the decision and, because the distribution company is engage at the decision making process, they provide a significant relevant information that is required.

Similarly, Michaelowa & Jotzo (2005) carried out a study to evaluate the TCs of numerous greenhouse gas emissions schemes, specifically the AIJ in Sweden. The key sources of TCs in this scheme were the search information costs, baseline development, approval costs, validation as well as registration and monitoring. A substantial fixed part in the TCs in the greenhouse gas schemes was found. This reflects a certain threshold of CO_2 savings below which the TCs eventually offset the benefits realized in the project. In addition, a similar study established the threshold at 50 000t CO_2 per year for a 20-year project. Michaelowa & Jotzo posits that TCs value should exceed 25% of the proceeds from permit sales in order to make a project more feasible (Michaelowa & Jotzo, 2005). By and large, the

level of TCs was estimated at *20.5% of the overall total project value*. Refer to Table 2 below for the experiential estimates of TCs.

Table 2. Experiential estimates of TCs (Valentová, 2010)

Author	TCs Level	Sector	Remarks
Bjorkqvist et al. (2006)	28% (13%)	Household	Gross (net) income
Michaelowa & Jotzo (2005)	20.5%	CDM	Clean Development Mechanism
Mundaca (2007)	10-20%	Audit scheme	Percentage of the audit costs
Mundaca (2007)	8-12%	Lighting	Energy savings target program
Mundaca (2007)	24-36%	Insulation	Energy savings target program
Sathaye (2005)	9-19%	Not specified	
Easton Consultants (1999)	20-40%	ESCOs	Energy Services Companies

In another development, Mundaca (2007) analysed "*free of charge energy audits*" in Denmark, as well as the "*energy efficiency commitment*" in Great Britain. The findings on the "*free of charge energy audits*" could not be regarded as statistically relevant, this is based on the fact that only five (5) replies were received and considered. On the other hand, a qualitative data analysis employed. The fact is that the energy providers have to carry out an energy audits of their customers. The justification for the program is perceived asymmetric information by the market agents, though, the chances of leveraging on all the energy improvements is minimal. The TCs are mainly related to the searching for potential clients for the audit, conduct the audit, and eventually follow up on the measures, with regards to partners' search, when the client resolves to execute some building energy efficiency measures. In addition, another key source of TCs is the accreditation process, in which energy audit is expected to be conveyed as part of the program. It was found that 10 to 20 % of the direct costs of the energy audit to be the estimated TCs and not the prospective investment costs.

On the other hand, Mundaca (2007) attempt to identify and measure or quantify the TCs that have relationship with energy efficiency program. The established TCs were fundamentally information searches on household that intent to save, customers persuasion or approval of building energy efficiency measures by the relevant authority. In the same vain, contracts negotiations or agreements with a third party in verification and monitoring were found to be key fundamental sources of TCs at the implementation stage. All put together, the TCs level varied in accordance to the building energy efficiency measures employed. Evidently, the TCs in lighting ranged from 8% to 12%, and BEE insulation measures the range from 24 to 36% of the total investment value.

Finally, Sathaye (2005) found an estimated TCs which range between 9% to 19% of the total project value with respect to greenhouse gas emission reduction projects in Asia, North and South America. The TCs were established to be borne essentially from the contract negotiation process amongst parties, feasibility studies, monitoring and evaluation as well as from relevant authorities' approval. In addition, Sathaye further believes that a key aspect defining the level of TCs specifically in greenhouse gas projects is the project size. A few researches have also shown commitment and concentrated on the TCs borne by Energy Service Companies (ESCOs). An estimated TCs of 20% to 40% of the total project value was established by Easton Consultants (1999) in energy efficiency projects executed by ESCOs (refer to Figure 2) below.
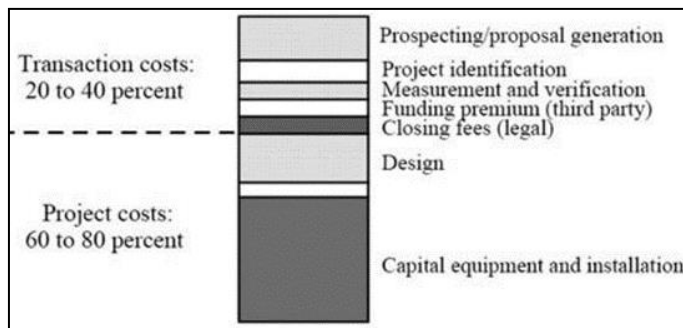
Figure 2. TCs related to ESCO project (1999)

CONCLUSION

In adequate or lack of competency which results in bounded rationality; and transaction characteristics such as split incentive, information asymmetry, developer opportunistic behaviour, ill-informed users and institutional transition can trigger additional TCs in BEE affordable housing delivery. Viewing the problem from an analytical sociotechnical perspective and focusing on developer capability with respect to human action to minimize TCs, two latent constructs were identified from literature as components of developer organizational capability namely: developer team-competency and team-commitment. Hence, it is proposed that, in order to minimize building energy efficiency TCs, developer team-competency and team-commitment needs to be given greater prominence in order for affordable housing projects to leverage on its full benefits with respect to making homes much more affordable to live in, with lower utility bills and high building performance.

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EFFECTIVE SUSTAINABILITY AWARENESS USING PSYCHO-BEHAVIORAL INTERVENTION FRAMEWORK FOR SUSTAINABLE DEVELOPMENT

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Abstract
Today environmental dilemmas are global problem in nature. It requires all efforts and everyone to be environmentally inclined in resolving negative environmental issues and to impede recurring of the new environmental problems. This study addressed the effective method to stimulate pro-environmental behaviour via mediating sustainable development study curriculum awareness using psycho-behavioural intervention. Thus, to instil pro-environmental inclination psychological characteristics towards continuing sustainable agendas. The key objective in this research intended to validate the psycho-behavioural intervention framework effectiveness on the occurring of positive behaviour towards sustainable awareness in students at tertiary education level. A pre-evaluate and post-evaluate design method of control group presented a perception of the range towards which psychological traits can partake an influence of positive behaviour and encouraging sustainable awareness on 220 interior architecture students after undergone training. The main outcome signified that students of interior architecture who attained psycho-behavioural intervention framework obtained better sustainable awareness and psychological traits, and also indicated better positive performance comparatively to the control group when completed the training. Hence, the conclusion is that psycho-behavioural intervention framework able to stimulate positive behaviour and sustainable awareness. This finding is also significant in measuring students study achievement, course aims deliverance and also hidden curriculum traits towards fostering continuing sustainable agendas.

Keywords: *Sustainable Awareness; Green Inclination Intervention Framework; Psychological Traits; Sustainable Development.*

INTRODUCTION

Current Malaysians especially younger generation are well aware of environmental issues and problems whether at local or global level. For the last 20 years, education system has been transforming towards sustainable agendas with efforts and exposures to environmental problems such as rainforest degradation, climate change, global warming and pollutions. Government efforts through formal education system, local authorities' sustainable policies and green incentives has strengthening this discourse in minimizing the environmental problems. Awareness campaign on environmental problems such as 3R (reduce, reuse and recycle), *'sayangi sungai kita'* (love your river), Free Sunday Traffic in Kuala Lumpur and many others sustainable campaign is important in nurturing the pro-environmental psycho-behavioural to the current generation. Environmental problems are also transboundary or global by nature, the yearly environmental problem occurrence of haze and high air pollution index in Malaysia are originally rooted from neighbouring country due to open burning for agriculture land clearance. Hence, a mutual global endeavour from every literate individuals and communities is highly essential in rectifying and minimizing environmental impact and recurrence of the problems.

The effort to culture pro-behaviour and environmentally friendly societies or individuals is via environmental education have been initiated throughout the globe. Through United Nations and its agencies such as UNESCO has sets sustainable goals and objectives as a guiding principle for environmental education. From this top-down approach these goals and objectives were adopted and adapted down to regional level, country, community and finally to each individual based on their culture, custom and context. Environmental education whether formal through learning institution or informal campaign by non-governmental environmental group is important in nurturing and instilling environmental literacy which finally will be translated to pro-environmental psycho-behaviour.

Higher learning institutions play a vital position in affecting the current and forthcoming of sustainable pro-behaviour and way of life of their scholars (Aleixo et al., 2016). This function has also been commended in which the prescribed modules of higher learning institutions are able to substantially induce students' behaviour and manner responses. Pro-environmental behavioural and psychological factors could improve not only present subjective of wellbeing nevertheless also potentials of impending subjective of wellbeing. These indicated that psychological behaviour elements either as consequences or antecedents are both feat as a substantial inducing part in promoting a balanced community and increasing value of living (Kaida & Kaida, 2016). Literacy in environmental problems and ability to comprehend consequences from the results of it is very significant to be instilled at tertiary education level where the students is about to embark the real phase of own life and responsible living.

Typically, in the higher learning institutions, modules of sustainability strategy have always remained applied through class lecture and studio design projects as course assessment. Normally, class instructor delivered the sets of knowledge concerning sustainability design measures in order to give students a required understanding of know-how in order to stimulate their behaviour. This classic method of delivering information through lectures and students self-study through readings is done within the full academic semester approximately about fourteen weeks. The students will absorb the imparted knowledge through lectures and readings by memorizing and surface understanding, likely it will not be implemented at real situations as it is hypotheticals. The assessment in evaluating the delivery of the taught understanding somehow does not actually determine the student's sustainable awareness but instead it just determining the ability of the students to assign the acquired understanding into the creative design tasks. Then, if typical written exercise or examination was used to evaluate the performances, an outcome possibly still lacking intensity to shift towards the habit of sustainable awareness instead it just simply for passing the examination assessment via memorizing. Thus, these kinds of learning method are built not based somewhat thorough theoretic structure, hence produced minor change towards pro environmental behaviour (Green & Levis, 1986).

Many environmental impediments are rooted through human behaviour, and it is able to be delimited through positive eco-friendly behaviour fostering (Nordlund & Garvill, 2002). Challenges concerning improvising sustainable quality through behaviour changes shall be much more effective if an individual desires a behaviour which substantively influences eco-friendly attribute, then considers which aspects may instigate those behaviour, and finally engages and evaluates interventions that change these antecedents and behavioural (Geller, 2002; Steg & Vlek, 2009). There are some models on psychological emphasis in educational

promotion which includes Bandura's (1977) 'social learning theory' and Rosenstock's (1974) 'health belief model theory' act as the foundation for education psychological behaviour growth. According to Bauman (1993), this framework pointed at the growth in understanding, fostering student's behaviours, and nurturing abilities towards constructive positive environmental behaviour lifestyles.

In the ASEAN region psycho-behavioural study, the 'moral theory' by Punthumanavin (1987) was developed grounded on the notion of psychosomatic traits were the causal reasons of psycho-behavioural. The model grounded on eight psychological elements: psychological-traits basis – intellectual aptitude, social experience with good psychological health, psycho-behavioural basis – knowledge, attitude, impending orientation, personality control and inner locus of influence belief (Punthumanawin, 1994). Few studies have been conducted based on this 'moral theory' and has shown a positive findings and appropriate approach on psychological characteristic towards positive behavioural conduct (Pitakjareaun, 2000; Ma-Oon, 2005).

This study is founded on moral theory (Punthumanawin, 1994) and psychological behaviour educating template in addition to characteristics psychology (Ma-Oon, 2013). The intermediation component framework approach was developed and designed on both of these theoretical models. The study was conducted based on five (5) psychological characteristics: sustainable awareness knowledge towards positive behaviour to the environment, green appreciation attitudes towards positive behaviour to the environment, sustainable awareness future orientation towards positive behaviour to the environment, sustainable awareness personality control towards positive behaviour to the environment and sustainable awareness belief in the inner locus of influence belief towards pro environmental behaviour. All results have signified that how sustainable awareness towards positive behaviour to the environment could further effectually fulfilled higher learning institution aim positioning.

CONCEPTUAL FRAMEWORK

Main aims in sustainable development agendas via education is environmental literacy and pro behavioural (Culen, 2001). Disinger and Roth (1992) Literacy in environmental issues can be defined as the ability in assessing the condition of the environment well-being, what are the corrective measure to rectify the setbacks and how to preserve the ecosystems that are in function within the nature setting. Thus, to evaluate the literateness in environmental issues is by measuring pro- environmental behaviour and responsibilities. According to Diekmann, & Franzen (2019), based on the study data from environmental sociologists affirm that peoples in under develop countries display a higher degree of environmental concern compared to the peoples in developed nations or wealthy countries. However, the concerns are that, even though the environmental attention is higher, it was not followed by the matching increase of the pro-environmental psycho-behaviour (Chawla, 1998). Many scholars have expressed the importance of the holistic sustainable development which will ensure continuous sustainable agenda and just (Kruger et al., 2018; Prabakaran et al., 2016; Sarmah et al., 2015).

From the notion of this research, the study framework is as indicated in Figure 1.

Independent variables employed in psychological behavioral education are:	The dependent variables are the core criteria of sustainable development
1. Knowledge on Sustainable Awareness 2. Attitude towards sustainable Awareness. 3. Sustainable Awareness on Future orientation 4. Sustainable Awareness on Self-control 5. Sustainable Awareness on Belief in internal locus of control	1. Energy Efficiency 2. Environmental Quality 3. Sustainable Planning & Management 4. Materials & Resources 5. Water Efficiency 6. Innovation

Figure 1. Research framework indicating the correlations of variables employed in this study (Adapted and developed based on Ma-Oon, 2013).

Research Objectives

Overall research objectives are to obtain the effectiveness of psycho-behavioural intervention module instruction on the sustainable awareness practices and pro environmental behaviour of students' in the higher learning institution. The study objectives are as listed below:

1. To classify the rank of five sustainable awareness psychological traits towards pro environmental behaviour at pre-training.
2. To investigate the correlation between sustainable awareness psychological traits towards pro environmental behaviour.
3. To measure psycho-behavioural effectiveness upon post-training towards the sustainable awareness practices and pro environmental behaviour in higher learning institutions.

RESEARCH METHODOLOGY

The research process is divided into three stages.

Stage 1.0: Intended to investigate pre-training samples of psychological traits level, pro environmental behaviour and sustainable awareness before joining the intervention module delivered by distinguishing the psychological traits as a causal factor of pro environmental behaviour and sustainable awareness. The sampling method, obtained purposely, comprised of 220 higher learning institution undergraduates (total of each 110 samples from class AP247 semester 5A and semester 5B) from Centre of Studies Interior Architecture, Faculty of Architecture, Planning and Surveying, MARA University of Technology (UiTM). All samples are third year, semester five students who attending Bachelor's in Interior Architecture and enrolled for INA 536 Green Interior course. The constructed survey questionnaires were split within two main parts: Section A survey questions were devised to investigate the samples demographic context and Section B survey questions were devised into measuring five traits of psychology plus six criteria towards pro environmental behaviour besides sustainable awareness. The data were gathered and evaluated by mean, standard deviation, percentage and also the coefficient-correlation.

Stage 02: The unit framework is acquired using variables-interventions, established upon standard Course Education Objective (CEO) and Course Learning Outcomes (CLO) of INA 536 Green Interior module for AP247, Bachelor (Hons.) in Interior Architecture:

1. Analysis of the related theories, principles and previous research on pro environmental behaviour and sustainable awareness in order to attain information and to employ the investigated information to acquire the intervention module framework and to form the learning activities.
2. Development of the pro environmental behaviour and sustainable awareness intervention module framework for INA536 Green Interior learned course based on the results obtained from item 1 above. The intervention module framework comprised of ten (10) week activities, through two (2) hours in the class conducts in order to finished complete intervention course.
3. Execution of the intervention module framework to experimental samples of class AP2475A (110 respondents) who enrolled the INA 536 Green Interior course.

Stage 03: Effectiveness of the intervention course framework were evaluated. Total respondents, acquired via purposiveness random sampling method from INA 536 Green Interior course students enrolment consist of 220 numbers of students from Faculty of Architecture, Planning & Surveying, MARA University of Technology (UiTM) sited at Puncak Alam Campus in Selangor Darul Ehsan, whom agreed to take part as the samples of the research. The pre-test then post-test assessment was evaluated. Chosen samples were allocated into two group: first group is experimental class (AP247 semester 5A) and, second group is control class (AP247 semester 5B). Required data were gathered twice — before employment of intervention framework and upon the accomplishment of full module. Responded data were examined using mean, percentage frequency, standard of deviation, analysis of variance and t-test. Figure 2 presented the methodology of the study.
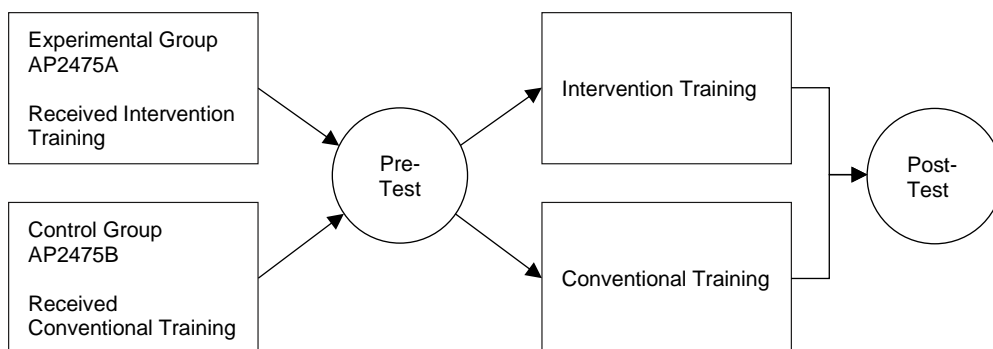
Figure 2. Sequence of Study Methodology

Note: Conventional Training referring to the learning activities delivered to the control group class in training throughout the research. However, these trainings are non-interventions module framework and were not hands-on to pro environmental behavior and sustainable awareness.

RESULTS

Stage 1: The level of the students' psychological traits and sustainable awareness and pro-environmental behaviour were at the medium and low level and the five psychological

traits were the causal factors of students' sustainable awareness and pro-environmental behaviour, (Table 1). In addition, the correlation values indicated that the psychological traits were the casual factors of sustainable awareness and pro-environmental behaviour (Table 2).

Table 1. Level of psychological traits, sustainable awareness and pro environmental behaviour

n   110

Level	Knowledge in SA	Attitude in SA	Future Orientation in SA	Self –Control in SA	Believe IL in SA	SA&PEB
LOW	19.1	11.8	19.1	27.3	24.5	21.5
MEDIUM	41.8	48.0	41.8	39.2	47.0	48.9
HIGH	39.1	40.2	39.1	33.5	28.5	29.6

Table 2. Correlations values signifying psychological traits as causal factors of pro environmental behaviour & sustainable awareness

n   110

Psychological Traits	SA-PEB
SA Knowledge	.32***
SA Attitude	.45***
SA Future Orientation	.25***
SA Self Control	.48***
SA Believe in Internal Locus of Control	.44***

***$p < .001$

Stage 2: The module delivery framework encompassed of two main sections. Section 1 was the delivery framework content which emphases the five (5) psychological traits as causal factors towards students' pro environmental behaviour and sustainable awareness. Section 2 was the procedure of the intervention framework module mode of delivery, with emphases given on student-centred. The delivered module content is developed based on five (5) psychological traits; 1. Knowledge towards Sustainable Practices; 2. Attitudes towards Pro Environmental Behaviour and Sustainable Awareness; 3. Future Orientation; 4. Self-Control; and 5. Believe in Internal Locus of Control. The intervention focused on the cooperation, critical mind, suitability development and enjoyment of the activities. The intervention focus variables consist of deliveries of knowledge, positive attitude, goal establishment, self-control and internal locus control. The expected outcome are the six core-criteria concerns of pro environmental behavioural and sustainable awareness which consist of; Energy Efficiency (EE), Indoor Environment Quality (EQ), Sustainable Planning & Management (SM), Material & Resources (MR), Water Efficiency (WE) and Business & Innovation (IN). The delivered intervention module framework is indicated as in Figure 3.

Figure 3. Intervention Module Framework employed in this research.

After completing the delivered module framework, students acquired more five (5) psychological traits measure up before delivery with significant statistical level of .001 (refer Table 3). The students of class AP2475A (experimental group) acquired psychological traits intervention at higher significant level compared the students of class AP2475B (control group). Upon complete module framework delivery, the students who had undertaken intervention module framework had acquired more pro-environmental behaviour and sustainable awareness compared to the control group (refer Table 4).

Table 3. Psychological traits comparative means of AP2475A (experimental group) before and after delivery of intervention module

Psy Traits	Before Module Delivery N = 110		After Module Delivery N = 110		T-Test Value
	X	Sd.	X	Sd.	
SA Knowledge	28.32	4.39	32.60	4.81	13.14***
SA Attitude	63.05	9.24	73.16	8.23	2.41**
SA Future Orientation	57.18	5.62	63.53	7.36	4.47***
SA Self Control	90.38	12.22	103.51	11.47	7.14***
SA Believe in Internal Locus of Control	54.20	5.71	57.01	6.92	4.27***

Table 4. Mean scores comparison of measured five psychological traits between experimental and control groups after training

Psy Traits	AP2475A (Experimental) N = 110		AP2475B (Control) N = 110		T-Test Value
	X.	Sd.	X.	Sd.	
SA Knowledge	27.50	49.86	24.82	4.52	2.41*
SA Attitude	74.68	7.51	67.77	6.83	2.53*
SA Future Orientation	58.35	4.82	53.65	4.34	2.02*
SA Self Control	53.88	5.41	51.93	5.74	2.15*
SA Believe in Internal Locus of Control	95.50	11.61	91.15	8.47	2.19*

* $p < .05$

The correlation value factor of five (5) psychological traits between pro-environmental behaviour and sustainable awareness of experimental group class AP2475A was greater compared to control group class AP2475B. The correlations between measured psychological traits upon completing the intervention module delivery generated greater value by the experimental class group than the control class group (refer Table 5).

Table 5. Correlations comparative values on five (5) psychological traits against pro environmental behaviour and sustainable awareness of class AP2475A (experimental group) and class AP2475B (control group) after module delivery

Psycho-Behavioural Traits	Correlation Values (R) SA & PEB	
	AP2475A (Experimental) n = 110	AP2475B (Control) n = 110
SA Knowledge	.31***	.11
SA Attitude	.38***	.21*
SA Future Orientation	.23***	.21*
SA Self-Control	.21***	.13
SA Believe in Internal Locus of Control	.40***	.17

* p < .05, *** p < .001

DISCUSSION

The research findings signified that the five (5) psychological traits were the casual factors of students' pro environmental behaviour and sustainable awareness. Students' pro environmental behaviour and sustainable awareness and five (5) psychological traits were on the lower level of significance because non-intervention module framework delivery on psychological traits. Thus, after the students were delivered using intervention module framework, both pro environmental behaviour and sustainable awareness; and psychological traits improved to a higher level of significant. This signified that intervention module framework is valid to provide positive pro environmental behaviour and psychological traits to students which will benefits themselves, society and nation as a whole.

The findings also indicated that the intervention module framework delivery was effective in nurturing and instilling pro environmental behaviour and sustainable awareness. Hence, this outcome had validated that the Intervention Module Framework, based on psychological traits were the casual factors of encouraging psycho-behavioural if it were implemented using suitable. Pertaining to this research, it was validated that the students' knowledge level was lower before the intervention module framework delivery, thus, it is important for the understanding and knowledge to be inculcated to the students.

CONCLUSION

Higher learning institution students who obtained intervention module framework of psychological traits which are, i) knowledge related pro environmental behaviour and sustainable awareness; ii) attitude concerning pro environmental behaviour and sustainable awareness; iii) future orientation towards pro environmental behaviour and sustainable awareness; iv) self-control towards pro environmental behaviour and sustainable awareness; and v) belief in internal locus of control towards pro environmental behaviour and sustainable awareness had attained both psychological traits and pro environmental behaviour and sustainable awareness compared to the students who were not presented with intervention module framework. Unambiguously, the relationships between psychological traits against

pro environmental behaviour and sustainable awareness are significant in the experimental group of class AP2475A which attained intervention module framework compared to regular module delivered in the control group of class AP2475B. Hence, in order to impart a framework of effective psychological traits related with delivery module in nurturing pro environmental behaviour and sustainable awareness, all five (5) psychological traits must be considered for effectual and valuable psycho behavioural.

The research conclusion is as presented in Figure 4.
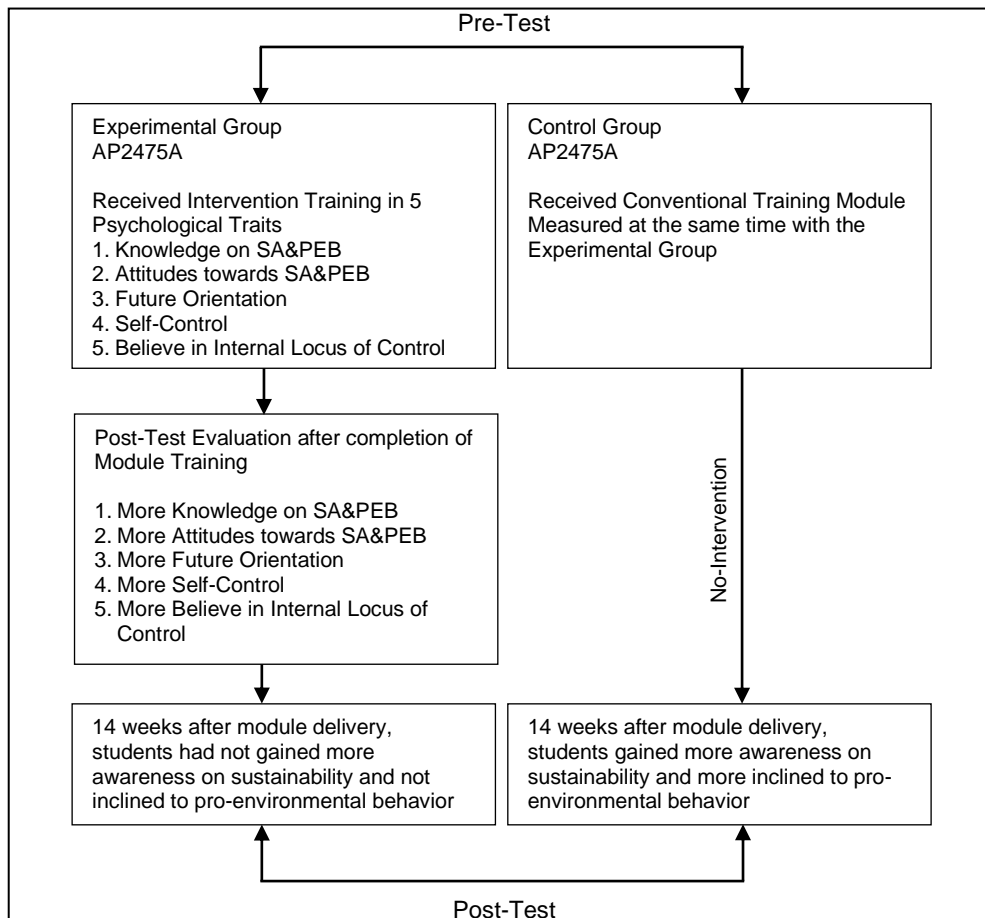
Figure 4. The Intervention Module Delivery Framework

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LEADERS' BOURDIEU CAPITALS AND SUBORDINATES' CREATIVE BEHAVIOURS: EMPIRICAL STUDY IN MALAYSIAN LANDSCAPE ARCHITECTURE FIRMS

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Abstract
This study investigated the influence of Bourdieu capitals possessed by leaders in Malaysian landscape architecture firms towards the creativity of their subordinates. Three design subordinates from each of the 73 landscape architecture firms in the database of Institute of Landscape Architects Malaysia were surveyed by mail. These design subordinates were asked to rate their leaders' Bourdieu capitals and their resulting creativity motivations. Ninety acceptable completed questionnaires from 39 surveyed firms were analysed. Factor Analysis on the data generated five leaders' Bourdieu capitals. The capitals are Social, Human, Emotional, Cultural and Political. Stepwise Multiple Regression Analysis ascertained the relationship of the leaders' Bourdieu capitals and their subordinates' creativity. The regression equation showed that Leader's Social and Emotional capitals are directly related to the subordinate's creativity. The mean rating scores between landscape architects (x̄=4.04) and assistant landscape architects (x̄=3.70) in their perceptions of leaders' emotional capital were significantly different ($p<0.05$). This study contributes to a novel approach of measuring the leader's personal 'resources' and their influence on subordinates' creativity in Malaysian landscape architecture firms. The findings show that there are more than the three original capitals proposed by Bourdieu (1986). The samples of different design occupations with larger populations and paired data sets of leaders and subordinates in future researches can further validate this study's findings.

Keywords: *Leadership; Bourdieu; Capitals; Creativity; Landscape Architects.*

INTRODUCTION

The Fourth Industrial Revolution (Industry 4.0) represents the industrial development of technologies which has significant implications on society. Automation, artificial intelligence and the Internet-based integration technology are among the technologies predicted to drastically change people's social, recreational and work activities. These technologies may lead to a more complex work environment where people must use higher thinking skills and creativity which such technologies lack (Schiuma, 2017; Prisecaru, 2016). Creative-based design occupations such as landscape architecture already apply these competencies on a regular basis. The increasing effects of Industry 4.0 and globalised trade in design services emphasise the need for more creativity among designers to stay relevant. The competitiveness of design firms is the result of the creativity of subordinates in those firms. Thus, the subordinates' creativity should be enhanced to improve the firms' competitiveness. In 2017, the Institute of Landscape Architects Malaysia (ILAM) introduced Landscape Architecture Agenda 2050 (LAA2050) to strategically improve the capabilities of landscape architecture profession in Malaysia. One of the strategic focus areas in the agenda is Human Capital Enhancement which involves the development of leadership and creativity among Malaysian landscape architects. Amabile et al. (2004) found that leadership support was positively

related to the subordinates' creativity. Past scholars (Andrews, 1967; Tierney et al. 1999) also provided evidence that subordinates' perceptions about their leaders are related to the creativity of those subordinates. Thus, the leaders in landscape architecture firms should improve their leadership effectiveness in order to influence their subordinates' creativity. This can be achieved provided that the leaders know the types of personal characteristics (traits) capable of influencing the subordinates. One of the approaches is through the Bourdieu's capitals of the leaders. According to Bourdieu (1986), capital is an accumulated labour (resource) of each individual beneficial for his advantages. Subordinates' creativity might be influenced by the leaders' Bourdieu capitals. This paper reports the findings of a study on the influence of leaders' Bourdieu capitals as perceived by subordinates towards their creative behaviours in Malaysian landscape architecture firms.

LITERATURE REVIEW

The impact of leadership to enhance performance of organisation has been long documented by scholars. According to Neider and Schriesheim (2002) and Dubrin (2010), there are abundant opinions and researches on leadership in management. Leadership theories such as the Path-Goal theory, Leader-Member Exchange theory, Transformational Leadership theory and Contingency theory were used in researches on the influence of leadership upon aspects of management of subordinates (Northouse, 2013). Bourdieu (1986) conceptualised capitals as powerful intangible resources that individuals use to advance their socio-economic status. He introduced three main forms of capital which are social capital, cultural capital and economic capital. These capitals were studied extensively in various fields such as education, organisations, migration, society, community, sport, and heath determinants (e.g., Dimaggio, 1982; Lareau and Horvat, 1999; Nahapiet and Ghoshal, 2000; Macinko and Starfield, 2001; Dumais, 2002; Ihlen, 2005; Stempel, 2005; Carpiano, 2006; Erel, 2010; Tzanakis, 2011; Prieur and Savage, 2011; Gaddis, 2013). However, there are very few studies on Bourdieu capitals in leadership and creativity perspective. There were few scholars (Akram et al. 2017; Nieves and Quintana, 2018; Carmeli et al. 2014; Gu et al. 2014; Yu, 2013; Liu, 2013) who focused on creativity and innovation in relation to a single or two Bourdieu capitals. However, they did not incorporate leadership effectiveness on subordinates in the relationship.

Leadership is commonly defined as intentional influences exerted by one person over other people to guide, structure, and facilitate activities and relationships in a group of organisation (Yukl, 2006). Approaches toward understanding leadership included leadership as a focus of group process, leadership as personality and its effects, leadership as an act or behaviour, leadership as an instrument of goal achievement, and leadership as an emerging effect of interaction (Bass, 1990 c.f. Pierce and Newstrom, 2006). One of these approaches is the Leadership Traits theory that proposes effective leaders having certain common traits. These traits are usually related to the leaders' innate attributes such as personality, motives, values, and skills (Yukl, 2006; Colbert et al. 2012; Kumar, 2013).

This study replaces the traits with forms of personal resources called Bourdieu capitals as per Bourdieu's (1986) Theory of Field. A person uses his capitals to advance his socio-economic status within a field. He lives simultaneously in many fields (or social environments) such a work field, a friendship field, a neighbourhood field, a recreational field etc. A person in the field owns certain amounts of tangible and intangible capitals with powers to maintain or enhance his position in the field (Grenfell, 2014). A person's capitals mostly

consist of intangible resources that arise from his social connection, academic qualification, work experiences or emotional attributes. The ability of the person to achieve his goals depends on the application of his capitals with respect to the doxa (inherent rules) and habitus (socialised dispositions) associated with the field (Bourdieu, 1986). Thus, the person can either sustain or enhance his social position in the field through successful attainment of his goals using his capitals. Likewise, failure to achieve his goals can lead to the diminishing of his capitals (Bourdieu, 1984; Bourdieu, 1986). Bourdieu proposed three capitals (social, cultural, and economic). The first two forms of capitals (social and cultural) have been widely explored by scholars. Past scholars (Akram et al., 2017; Bouckenooghe & Menguc, 2018; Sozbilir, 2018) found positive relation between social capital with creativity and innovation. There is also positive relationship between cultural capital and academic achievement reported by Gaddis (2013), Huang and Liang (2016), and, Bodovski and Byun (2016). Bourdieu (1986) operationalised cultural capital with three general components. First component is objectified-cultural capital (referring to individual's valuable properties), second component is institutionalised-cultural capital (referring to individual's academic recognition), and third component is embodied-cultural capital (referring to individual's values through means of communication). This study extends the institutionalised-cultural capital into human capital as both bear similar properties. Past Scholars (Van Uden, Knoben and Vermeulen, 2016; Nieves & Quintana, 2018; Diebolt & Hippe, 2018) found a positive link between human capital and innovation. However, Danquah and Amankwah-Amoah (2017) reported otherwise. Cottingham (2016) highlights the similarity of embodied-cultural capital with emotional capital. Past scholars inclined to use the concept of emotional intelligence in the study relating to creativity. The emotional intelligence refers to a person's ability to observe other's feelings and use it into his advantage (Salovey & Mayer, 1990). It is arguably relatable with the emotional capital. However, emotional capital refers to a person' emotional resources which includes the properties of emotional intelligence. There is a positive relationship between emotional intelligence and creativity as reported by Lassk and Shepherd (2013), Carmeli, Mckay, and Kaufman (2014), and, Silva and Coelho (2018).

These researches show the capitals' influence on the respondents' creativity, innovation and academic achievements. However, most of the past researches on capital were focusing on the influence of individual's capital towards his outcomes. There were only few researches about leadership capitals' influence on followers. Bouckenooghe and Menguc (2018) studied leaders' social capital influence on their followers' creative work involvement. However, they sampled IT employees. Zhou and George (2003) and Gupta and Bajaj (2017) proposed the influence of leaders' emotional intelligence (capital) on followers' creativity. However, they did not conduct any empirical study to validate their framework. There was a noticeable trend of studying capital as a single entity instead of combining all two or three individual's capitals (e.g., Santos-Rodrigues et al., 2010; Barczak et al., 2010; Yu, 2013; Liu, 2013; McGuirk et al., 2015; Liu et al., 2015). There were also no capitals researches about creative workers in design-based organisations. Past social capital-versus-creativity studies were focused on IT, computer services, and employment agencies. Cultural capital was empirically investigated among students. Past human capital-versus-innovation studies were in hotel establishments, manufacturing and service companies, and using secondary databases. Emotional capital was studied in health and beauty, software and service companies. These capitals studies were also conducted outside Malaysia. All of these point to a gap in the absence of knowledge about the influence of leaders' capitals on subordinates' creativity in Malaysian landscape architecture firms.

Authors proposed that capitals are intangible resources of a leader. These intangible resources are capable of influencing their followers' work behaviours or outcomes. A leader aims to influence others in his group to achieve the group and his own personal goals. Successful attainment of the group goals also leads to successful attainment of his personal goals that include either sustaining or enhancing his leadership position. Knowledge of one's own capitals associated with leadership can be achieved through the perspectives of their followers. Such knowledge enables the leader to act to enhance his capitals and thus improve his leadership effectiveness on their subordinates. Landscape architecture firms are creative oriented business organisations. Hence, the landscape architect and assistant landscape architects are professional creative workers. Their jobs require them to continuously be creative in designing and problem-solving. Their designs must consider cost, functionality, and aesthetics. It is argued that the subordinates' perceptions of the benefits of their landscape architect leaders' Bourdieu capitals can influence their creative behaviours. Therefore, this study firstly reports the findings relating to the type of Bourdieu capitals among leader landscape architects in Malaysian landscape architecture firms as perceived by their subordinates. Secondly, it provides the generated regression equation regarding the relationship of leader's Bourdieu capitals (as perceived by their subordinates) and their subordinates' creativity in Malaysian landscape architecture firms. Lastly, it informs the significant differences ($p<0.05$) in mean scores of capitals among the demographic variables' categories of the respondents.

STUDY METHODOLOGY

The quantitative data were collected using a postal questionnaire survey. The Institute of Landscape Architects Malaysia (ILAM, 2017) provided the list of registered landscape architecture firms in Malaysia. ILAM is the official professional association of landscape architects in Malaysia. All the 73 landscape architecture firms registered with ILAM were included in the survey. Questionnaire forms were mailed to managers of these firms requesting that three landscape architect subordinates in each firm respond to the survey. The potential respondents were thus 219 persons. The subordinates were required to rate their leader's (landscape architect superior) capitals that affected their creativity. The rating is based on a Unipolar 5-point Likert scale rating which consists of "1" as "disagree", "2" as "slightly agree", "3" as "moderately agree", "4" as "highly agree" and "5" as "totally agree". The terms traits instead of capitals were used to make the questionnaire more user-friendly. Items (statements) for the scales were constructed based on Bourdieu capital theory, findings of a prior exploratory qualitative study (Zahari et al., 2018), and the review of past researches. Zahari et al (2018) had shown the irrelevance of Bourdieu economic capital as a variable. The subordinates rated their agreement with personal creativity statements using the similar Unipolar 5-point Likert scale adapted from Scott and Bruce (1994) and Zhou and George (2001). The first author conducted a pilot test with seven experienced landscape architects to test and improve the questionnaires' validity before administering them to the potential respondents.

FINDINGS

One hundred and five questionnaires were obtained from the potential 219 respondents from 39 surveyed landscape architecture firms (48% gross response rate). Fifteen questionnaires were discarded as they were incomplete and have unreliable responses. Hence,

the net response was 90 persons (41.1%). The Statistical Package for Social Sciences (SPSS) version 20 software was used to analyse the data. Factor analysis was conducted on all scale items to generate capital related factors. Descriptive analysis generated the demographic statistics, the factor means scores and personal creativity mean score. Tests of differences in the mean rating scores of the capitals among the categories of each demographic variable were done. Multiple Regression analysis was used to determine the relationship of the generated capitals mean scores with creativity mean scores.

Profile of Respondents

Females constituted 55.6 percent of the respondents. Most respondents (67%) were within a range of 25 to 30 years of age. Malays constituted the majority of the respondents (87.8%), followed by the non-Malays, (Chinese – 11.1% and Kadazan Dusun - 1.1%). Respondents with Bachelor degrees made up 88.9 percent of the respondents while 8.9 percent have Diploma degrees and only 2.2 percent own Master degree. Most respondents (80%) worked as landscape architects and the rest worked as assistant landscape architects. The majority (81.1 percent) of the respondents had worked in their respective firms between duration of one to five years.

Factor Analysis of the Leaders' Capitals

The Multicollinearity test, Kaiser-Meyer-Olkin (KMO) test, Barlett's test of sphericity and Anti-Image correlation matrix test verified that the data meet the factor analysis test assumptions. The Multicollinearity test showed that the matrix for all items are lower than 0.9 and the determinant value is 0.00059 which is greater than 0.00001 (Field, 2013) thus warrants no issue. The KMO test verified the sampling adequacy as the data has a 'great' value of 0.845 (Hutcheson and Sofroniou, 1999). The Barlett's test of sphericity (Field, 2013) showed that the correlation matrix is significantly different from identity matrix (p<0.01). The Anti-Image correlation matrix diagonals' values were more that 0.05; indicating that all the scale items can be included in the factor analysis testing (Hutcheson and Sofroniou, 1999). According to MacCallum et al. (1996) and Kumar et al. (2013), a sample response size below hundred (100) is adequate for factor analysis when the average communalities extraction value is above 0.60. The factor analysis was valid because the forty-four scale items' data yield an average communality value of 0.68. The scale items (statements) were subjected to Principal Axis Factoring with Varimax Rotation. The Factor Analysis generated six factors; each having eigenvalues exceeding Kaiser criterion of 1.0 and that collectively explained 64.01 percent of the cumulative variance. Table 1, 2 and 3 show the scale items and their means, factor loadings from varimax rotation, overall mean relevant to each capital, and the cumulative variance.

Table 1. Factor 1 Attributes (Leaders' Social Capital)

Attributes	Mean	Factor Loading	Factor	Overall Mean	Cumulative variance (%)
Leader's relationship with members of the firms provides him/her information that helps in designing	3.96	0.81	Factor 1: Leader's Social Capital	3.96	37.64
Leader's relationship with members of the firms provides him/her ideas and inspiration that helps in designing	3.92	0.80	*(reliability alpha score: 0.95)*		
Leader's relationship with members of the firms provides information in solving design problems	3.91	0.79			
Leader's social network provides him/her information that helps in solving design problems	4.02	0.76			
Leader's relationship with members of the firms provides access to further information in designing	3.96	0.74			
Leader's social network provides access to further information in designing	3.93	0.74			
Leader's social network helps the firm solving problems in design implementation	3.96	0.72			
Leader's social network provides him/her information that helps in designing	3.96	0.71			
Leader's social network provides him/her ideas and inspiration that helps in designing	4.02	0.70			
Leader's social network ensure the firm secure future jobs thus making confident to continue designing	3.99	0.70			

Table 2. Factor 2 and 3 Attributes (Leaders' Emotional and Human Capitals)

Attributes	Mean	Factor Loading	Factor	Overall Mean	Cumulative variance (%)
Leader willing to make time discussing works related matters	4.16	0.71	Factor 2: Leader's Emotional Capital *(reliability alpha score: 0.94)*	3.97	47.63
Leader sensitive to feelings	3.30	0.70			
Leader concerned with personal wellbeing	3.75	0.68			
Respect from the leader	3.92	0.67			
Trust from the leader	3.94	0.64			
Leader is supportive of career	4.16	0.63			
Leader trust in making design decision	3.77	0.63			
Leader opens to new ideas	4.22	0.62			
Leader opens to different point of view	4.20	0.60			
Leader shows collaborative relationship	3.92	0.60			
Leader is in control of his/her emotions	3.84	0.57			
Leader shows rewarding relationship	3.60	0.57			
Leader gives encouragement in works	4.10	0.56			
Trust the leader	4.32	0.54			
Support the leader's work effort	4.41	0.50			
Leader is respected in landscape architecture field	4.57	0.79	Factor 3: Leader's Human Capital *(reliability alpha score: 0.95)*	4.47	54.61
Leader got new jobs from recommendations from people in industry	4.33	0.79			
Leader got new jobs from recommendations from former clients	4.44	0.78			
Leader is highly skilled in landscape architecture design	4.57	0.72			

Attributes	Mean	Factor Loading	Factor	Overall Mean	Cumulative variance (%)
Leader is open to new experiences to update his/her knowledge	4.41	0.69			
Leader is highly experience in landscape architecture	4.63	0.68			
Leader is committed to update his/her skills in landscape architecture design	4.44	0.68			
Leader is committed to update his/her knowledge in landscape architecture design	4.53	0.68			
Leader is highly creative in landscape architecture design	4.52	0.63			
Leader has received awards for his/her landscape architecture design	4.29	0.60			

Table 3. Factor 4 and 5 Attributes (Leaders' Cultural and Political Capitals)

Attributes	Mean	Factor Loading	Factor	Overall Mean	Cumulative variance (%)
Leader's style of dressing reflects his/her creativity	3.61	0.70	Factor 4: Leader's Cultural Capital *(reliability alpha score: 0.88)*	3.82	58.70
Leader's interest reflects his/her creativity	4.07	0.69			
Leader's behaviour reflects his/her creativity	4.00	0.68			
Leader's choice of possession reflects his/her creativity	3.71	0.66			
Leader has an impressive family background	3.72	0.62			
I design as my leader's preferences although I'm against the idea	3.62	0.84	Factor 5: Leader's Political Capital *(reliability alpha score: 0.70)*	3.40	61.79
I design as my leader's preferences as I will be rewarded	3.16	0.62			

The factor analysis generated six factors (44-scale items) but only five are retained because of following reasons. There is only one scale item in Factor 6. Hence, it was discarded. One item in Factor 4 was also discarded as it yields a low factor loading (0.44) compared to other items in the factor (>0.6). The factor loading of each item in a factor must be greater than 0.40 to be reliable (Stevens, 2002). Table 4 shows the details of the discarded items and factors.

Table 4. Discarded Factors and Items

Attributes	Mean	Factor Loading	Factor	Overall Mean	Cumulative variance (%)
Leader's inspires me (*Item discarded*)	3.93	0.60	Factor 6	3.93	64.01
Leader is my role model in landscape architecture field (*Item discarded*)	4.01	0.44	Factor 4	-	-

Out of forty-four initial scale items, forty-two valid items remained were grouped into five factors which are labelled as leaders' Social Capital, Emotional Capital, Human Capital, Cultural Capital, and Political Capital. These five Factors were used in the subsequent Multiple Regression analysis to test these capitals' relationships with creativity variable. Table 5 shows the scale items in creativity variable and its mean scores.

Table 5. Creativity Mean Scores

Attributes	Mean	Overall Mean
People (e.g. colleagues, clients) praise my designs	3.79	4.02
I always apply innovative (new and fresh) features in my design	4.06	
My designs are buildable	4.22	
My colleagues ask me for ideas for their design work	3.91	
My designs are functional (practical and useful)	4.22	
My leader gives me freedom to design as I like	3.85	
My designs are actually used in the projects	4.12	

Multiple Regression Analysis (Leaders' Capitals and Subordinates' Creativity)

The data skewness and kurtosis value of each factor were analysed and were all found to meet the normality assumption of MRA (Kim, 2013; Field, 2013; Aldrich and Cunningham, 2016). Table 6 shows the skewness and kurtosis values of each variable involved for MRA.

Table 6. Summary of Distribution

Variables (Leaders Capitals)	Skewness value	Kurtosis value	Distribution	Citation Referred
Social Capital	-1.05	2.76	Normal	Brown (1997), Pallant (2001), Kline (2005)
Human Capital	-0.98	0.64	Normal	Brown (1997), George & Mallery (2010), Tabachnick & Fidell (2013)
Emotional Capital	-0.67	0.83	Normal	Brown (1997), George & Mallery (2010), Tabachnick & Fidell (2013)
Cultural Capital	-0.11	-0.56	Normal	Brown (1997), George & Mallery (2010), Tabachnick & Fidell (2013)
Political Capital	-0.30	-0.01	Normal	Brown (1997), George & Mallery (2010), Tabachnick & Fidell (2013)
Creativity	-0.87	2.20	Normal	Brown (1997), Pallant (2001), Kline (2005)

The independent variables for the MRA are the leaders' social capital, emotional capital, human capital, cultural capital, and political capital. The dependent variable is the creativity. Stepwise method of regression was used to decide the predictors' order based on mathematical criterion (Field, 2013). Predictors with the highest correlation with the outcome are entered while the least useful predictors were removed. The result of the MRA indicated that the leaders' social capital and emotional capital ($p<0.05$) are retained while the other capitals were removed. Table 7 shows the model summary of the MRA.

Table 7. Model Summary of MRA

Model		Standardised Coefficients			t	Sig.
		R	R Square	Beta		
1	(Constant)			1.726	5.162	.000
	Leaders' Emotional Capital	.597	.357	0.387	3.533	.001
	Leaders' Social Capital			0.275	2.509	.014
Dependent Variable: Creativity						

The correlation coefficient value of the multiple regression results showed moderate correlation (R=0.597; Schober et al., 2018). The leaders' Emotional and Social capitals explain for 35.7% of the variance in the creativity variable (R^2=0.357). The model is statistically significant (p=0.000; $p < 0.01$) with independent variables emotional capital (p = 0.001; $p<0.01$) and social capital (p= 0.014; $p<0.05$). The standardised B-value was used in MRA because the value is not dependent on the unit of measurement of the variables and is easier to interpret (Field, 2013). Thus, the MRA equation is as follows;

$$Creativity = 1.726 + (0.387\ Emotional\ Capital) + (0.275\ Social\ Capital)$$

The equation shows that the subordinates' perception of the leaders' emotional capital and social capital has a significant positive influence on the subordinates' creativity.

Tests of Differences

Independent Samples T-Tests and ANOVA were conducted to identify significant differences in the mean rating scores for each capital among the categories of the demographic variables. Only the mean rating scores between landscape architects ($\bar{x}$=4.04) and assistant landscape architects ($\bar{x}$=3.70) on their perceptions of leaders' emotional capital showed significant differences ($p<0.05$).

DISCUSSION

This section provides discussion regarding the generated Bourdieu capitals and the findings from the regression analysis between the leaders' Bourdieu capitals and subordinates' creativity. Finally, the practical contributions and limitations of the research are evaluated.

Generated Bourdieu Capitals

The Factor Analysis generated five acceptable factors which are leaders' Social Capital, Emotional Capital, Human Capital, Cultural Capital, and Political Capital. The items underlying these factors approximated with the initial proposed capitals.

Ten scale items constitute the leaders' Social Capital. Four scale items seem to mirror the leaders' internal social capital which denotes the relationships with people within the firm. Six scale items reflect the leader's external social capital which indicates the relationships with persons outside the firm. This concurs with Leana and Pil (2006) and Zahra (2010) that social capital is derived from relationships with people inside and outside the work organisation. According to Bourdieu (1986), social capital is defined as a collection of actual or potential resources which are related to one's relationship to a durable network of people arising from mutual acquaintance and recognition. A simpler definition is a trusted network of people that an individual may use to obtain valuable help or information. The usefulness of an individual's social capital depends on the size of connections that he can effectively mobilise, and the amount of capitals possessed by those connections.

Fifteen scale items constitute the leaders' Emotional Capital. Bourdieu (1986) did not directly indicate the presence of Emotional Capital. However, the properties of Emotional Capital are found in one facet of the Cultural Capital stated in Bourdieu's theory. Cultural Capital is grouped into three facets. One of the facets is called the embodied state that refers to a person's means of communication and self-presentation which cannot be transmitted instantaneously like other tangible property such as qualification, money, land, or title of nobility (Bourdieu, 1986). The aspects of communication and self-presentation are relatable with emotional attachments between two persons. Everett (2002) stated that the process of engagement stated by Bourdieu might be related to emotional considerations between individuals. It is argued that the embodied state is related to Emotional Capital. This is

supported by Cottingham (2016). Nowotny (1981) and Allat (1993) defined Emotional Capital in family relationships as a parent's emotionally valued assets and skills, love and affection, expenditure of time, attention, care and concern that are available to their offspring. The offspring' perceptions of the parent's emotional capital are similar to the way the leader's emotional capital is viewed by subordinates in a work environment.

Factor 3 is the leaders' Human Capital that consists of ten scale items. These items appear to belong to three categories. The first category is the leader's recognition in landscape architecture industry as perceived by the subordinates. The second category is the leader's competencies (skill, experiences, creativity) and the third category is the leader's openness to sharing knowledge. This first category of Factor 3 is similar to a component of Bourdieu's (1986) cultural capital called institutionalised state. Cheng and Kaplowitz (2016) defined institutionalised state as the society measure of a person's value based on his academic or education qualifications. Bourdieu (1986) highlighted the importance of societal recognition. This recognition is in the form of academic qualifications that confer evidence of competence to the qualification holders. Coleman (1988) and Somaya et al. (2008) described Human Capital as a group of elements including education, skills, knowledge, firm-know-how, and personal experiences that are focused to improve the productivity and competitive advantage of an individual. Thus, the Human Capital factor generated from this study is a combination of Coleman's (1988) and Somaya's et al. (2008) Human Capital and a facet of Bourdieu's (1986) Cultural Capital.

Factor 4 is labelled as the leaders' Cultural Capital which consists of five scale items. A facet of Bourdieu's (1986) Cultural Capital is called objectified cultural capital that is defined as material objects that people use to indicate social classification in the society (Bourdieu, 1986). It relatively tells of the amount of cultural capital through the symbolic objects that an individual possesses. A person's refined and high tastes (lifestyle), behaviours and attitudes can signal his high societal status. His dressing style and material possessions also signal his personal interests, behaviours and family background (culture) and thus signals the degree of objectified cultural capital he possesses (Lamont and Lareau, 1988). Hence, the factor generated actually represents the objectified cultural capital of Bourdieu's Cultural Capital.

Factor 5 is labelled as the leaders' Political Capital which consists of two scale items. This factor explains how the leader's political capital influences the subordinate's design direction. The hierarchy of authority demonstrated by the leader by the uses of his political capital can influence the subordinate's reluctance to abide to the design preferences. Bourdieu (1986) labelled a person's use of his capitals to influence another person's behaviour and attitudes as symbolic violence. However, the political capital refers to the potential of the leader to cause a subordinate to acquiesce to the leader's demands because of the leader's power over the subordinate. The low mean scores for these factors indicates that this capital is not perceived by the subordinate as conducive in influencing his creativity.

The five generated factors (capital) do not completely mirror the Bourdieu's (1986) original three capitals. Four factors were facets of these capitals. The fifth factor is more relevant to the leader's ability to use his capitals to inflict symbolic violence upon his subordinates. This factor is not a component of original Bourdieu's capitals. This study's findings regarding the perceived types of capitals possessed by the leaders also show that the original three Bourdieu capitals can be fragmented further. The findings also suggest that the

leaders in Malaysian landscape architecture firms are appointed based on their high human capital. However, the study's focus on the landscape architects limits the generalisation of the capitals to other societal and occupational groups. It suggests that different and new capitals would be found due to the different doxa and habitus in the 'fields' of these groups.

Leaders' Bourdieu Capitals & Subordinates' Creativity

The results of stepwise method of multiple regression analysis showed a positive significant relationship between two leaders' capitals and subordinate's creativity (p<0.05). The two capitals are Emotional Capital and Social Capital. Both capitals contribute to 35.7% percent variance of creativity. There is a positive moderate correlation (R =0.597) between these capitals and creativity. The findings concur with past studies.

Capitals are resources that can enhance one's position in society or an organisation. The scale items of emotional capital in this study refer to the emotional and personal characteristics of the leader that are relatable to the subordinates. Among the scale item statements are the willingness of leader to make time in discussing works, the leader's sensitivity to feelings, the leader's concern about their personal wellbeing, the trust from the leader and many more. The finding suggests that leaders in Malaysian landscape architecture firms should enhance their emotional capital resources to increase their subordinate's creativity. Positive perceptions regarding the leaders' emotional and personal characteristics may cause subordinates to feel at ease with the leader and consequently affect their ability to be more creative. The exploratory phase of this study (Zahari et al, 2018) found six causes of emotional capital capable of influencing the subordinate's creativity. The causes for emotional capital creativity influence are the leader's chemistry, respect, knowledge acquisition, trust and understanding. The term emotional intelligence is relatively synonymous with emotional capital. Emotional intelligence refers to a person capability to observe his and other's feelings and emotions and use the information to guide his thinking and actions (Salovey and Mayer, 1990; Berman and West, 2008). Zhou and George (2003) claimed that emotional intelligence of the leader plays significant role in enabling the subordinate's creativity. Carmeli et al. (2014) found that emotional intelligence is positively associated with creativity and is mediated by generosity and vigor. An important element of the leader's emotional capital to fostering subordinates' creativity is trust (Zahari et al, 2018; Yoshida et al, 2014). Trust is important in fostering employee's creativity. The trust that the subordinates have of their leader will lead them to take risks in becoming creative (Zhou and George, 2003). This consequently gives them confidence that their leaders will seriously consider their proposed ideas and design directions. However, this study's findings imply that the trust must be mutual. The leader must also trust the subordinate to be creative by showing respect to their ideas and design outputs.

The leaders' social capital was found to influence the subordinate's creativity. The exploratory phase of this study (Zahari et al, 2018) listed down three causes for leader's social capital to influence subordinate's creativity; knowledge acquisition, problem solving, and motivation boosting. This implies that subordinates view their leader's social capital as resources to gain knowledge, to solve problems, and to boost motivation. Gu et al. (2014) reported that social capital helps an individual to accumulate knowledge and information which consequently triggers original ideas and creative thinking. A leader who knows the importance of social capital is motivated to enhance their capital to better influence the

subordinates. Leaders can accumulate knowledge, information, ideas and inspiration and job security by having a large and relevant social network. A less knowledgeable and experienced subordinate will thus benefit from their leader's social capital resources through the transfer of new knowledge and problem solving in their work interactions.

There are significant differences (p<0.05) in the mean rating scores between landscape architects ($\bar{x}$=4.04) and assistant landscape architects ($\bar{x}$=3.70) in their perceptions of leaders' emotional capital. The possible explanation is the higher job satisfaction and loyalty experienced by landscape architects. The assistant landscape architect subordinate position is generally perceived as hierarchically lower than the subordinate landscape architects. Thus, the leaders would have more trusting and closer working relationships with their subordinate landscape architects thus igniting positive relationship.

CONTRIBUTION AND LIMITATION

This study addressed the empirical evidence of the existence of perceived leaders' Bourdieu in Malaysian landscape architecture firms. Two of these capitals (Emotional and Social) were found to positively related to subordinates' creativity. This study's findings contribute to understanding this relation specifically for landscape architects. It introduces a novel approach to identifying the intangible characteristics of effective leaders. A possible outcome is the development of a scale that enables leaders to improve their leadership by determining their intangible resources in the form of Bourdieu capital. This study's findings have its limitations. Firstly, there is a potential of occurred common method variance for the score of leaders' capitals and subordinates' creativity. The common method variance is a bias problem emerged when the data was collected from a single source (Tse, To and Chiu, 2017). The presence of the leader's actual capitals based on the perceptions of the subordinates suffers the risk that such perceptions be faulty. This study can be improved if the leader himself rates his Bourdieu capitals and the results compared with the subordinates' scores. There is also a potential bias when the subordinates rated their own creativity. The findings could be more robust if the leaders had rated the subordinates' creativity and the results were compared with the subordinates' scores. The second limitation is regarding the uses of cross-sectional design to collect the data. The third limitation is the small sample size of this study. Although more than half of landscape architecture firms (53%) responded to the invitation, the number of respondents answered from the firms is only ninety. The small population of registered Malaysian landscape architecture firms contributes to this limitation.

There was a practical difficulty in obtaining the relevant leader of the subordinate in this study. It was uncertain that the three potential respondents will be assessing the same leader who is a participant in the survey. If they are assessing the same leader, the participation of the leader in the survey can potentially bias the respondents of the subordinates. Furthermore, a longitudinal research risks the attrition of the participants of the survey because they lack commitment to the longer duration and repetitions of the survey. This is a serious challenge in surveys of small populations as in the case of registered landscape architecture firms. Thus, the three-subordinate approach and cross-sectional survey method were chosen. Further research should be replicated using a larger population involving other creative-oriented firms such as architects' firms, interior designer firms and engineering design firms. A longitudinal research approach should also be considered in future researches because a larger population can mitigate the attrition effects commonly found in longitudinal survey researches.

CONCLUSION

This study investigated the influence of the subordinates' perceptions of their leader landscape architects' Bourdieu capitals on their (subordinates) creativity. The sample consisted of subordinates' landscape architects and assistant landscape architects who worked in registered landscape architecture firms in Malaysia. Factor Analysis of the data generated five Bourdieu capitals namely leaders' social, human, emotional, cultural and political capitals. Stepwise Multiple Regression Analysis generated an equation where the Leaders' Social and Emotional capitals are directly and positively related to the subordinate's creativity. Subordinate landscape architects scored their leaders' emotional capitals higher than subordinate assistant landscape architects ($p<0.05$). This study contributes to a novel approach of measuring the leader's personal 'resources' and their influence on subordinates' creativity in Malaysian landscape architecture firms. The samples of different design occupations with larger populations and use of paired data sets of leaders with subordinates in future researches can further validate this study's findings.

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THE LEVEL OF RISK DISCLOSURE AND AFFECT ON CONSTRUCTION PUBLIC LISTED COMPANIES PERFORMANCE

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Abstract
Due to regulatory reforms, corporate governance has evolved with Enterprise Risk Management become prominence since the 1990s. In Malaysia, Statement of Risk Management and Internal Control with Malaysian Corporate Code of Governance are regulatory compliance on risk management for the Public Listed Companies. Companies are required to make risk disclosures in their annual report based on Risk Management Framework, which indirectly provided insights for shareholders and investors to assess the company's performance. This study objectives are to determine the extent of risk implementation based on Risk Management Framework and the effect of risk management on construction Public Listed Companies performance. The sample of this study consists of 227 construction Public Listed Companies in Malaysia Bourse from 2011, 2014, 2015, 2016 and 2017. Content analysis is conducted on the companies' annual reports for the five years focuses on Risk Management Framework components and financial information. The study revealed the presence of both guidelines had increased risk disclosure among construction Public Listed Companies but there is no significant improvement in their financial performance.

Keywords: *Risk Disclosure; Performance; Risk Management Framework; Malaysian Corporate Code of Governance; Construction Public Listed Companies.*

INTRODUCTION

Companies have encounter a myriad of risks in the era of globalization, which makes Enterprise Risk Management (ERM) a vital activity to ensure business sustainability (Dafikpaku, 2011; Kommunuri et al., 2016; Özlem and Muhammad, 2017). ERM evaluate and manage all of the risks faced by the company in pursuit of its corporate objectives (Arena, Arnaboldi and Azzone, 2010). The aftermath of 1990s the financial crisis has trigger the attention on managing risk, which affects the corporate governance reform in companies (Kleffner, Lee and McGannon, 2003; Puan, 2010). As integral part of good corporate governance, a comprehensive ERM framework (ERMF) is required to safeguard the shareholders' investment and the company's assets.

Although ERM allows for better assessment of the overall risk situation, companies seldom reveal its implementation publicly (Gates, Nicolas and Walker, 2012; Majid, Dildar and Waqar, 2016). However due to regulatory requirement by Malaysian Bourse, all Public Listed Companies (PLCs) are enforced to declare their risk management programmes in annual reports in accordance to the Statement of Risk Management and Internal Control (SRMIC) as well as the Malaysian Corporate Code of Governance (MCCG) (Bursa Malaysia, 2012, 2016; Securities Commission, 2017). These risk management programme is very much alike ERM, which allows for a better assessment of the company's risk situation and improves the PLC's decision process with respect to strategic, financial and operational objectives (Bromiley et al., 2015; Hoyt & Liebenberg, 2011; Lam, 2014; Pagach & Warr, 2010).

The Board is ultimately responsible for risk management when it was clearly stated in MCCG 2000 for the first time. Additionally, the Board is obligated to set up a holistic risk management framework (RMF) as recommended in MCCG 2017 and SRMIC 2012 (Securities Commission, 2017). In accordance to paragraph 15.26(b) Malaysia Bourse listing requirements, the Board is required to disclose the company's RMF in their annual report (Bursa Malaysia, 2012). An RMF outlines the governance structure, policy, risk appetite/tolerance and processes that provides an integrated approach enterprise-wide. In regard to this regulatory compliance, a study on the extent of risk disclosure in PLCs' annual reports have yet to be conducted.

The implementation of ERM can optimise resource allocation and improve decision making, which indirectly enhance the company's performance and increase its' value (Grace et. al., 2014; Lai, Noor Azlinna and Azilah, 2011; Teoh and Rajendran, 2015). Studies by Bertinetti, Cavezzali, & Gardenal (2013); Eckles et al.(2014); Florio & Leoni (2017); Gates, Nicolas, & Walker (2012); Gottwald & Mensah (2016); Hoyt & Liebenberg (2011, 2015) discover there significant and positive relationship between ERM and organization's performance. On the other hand, Kommunuri, Narayan, Wheaton, Jandug, & Gonuguntla (2016); Özlem & Muhammad (2017); Pagach & Warr (2010) found there is no significant relationship between ERM and firm value.

Another study by Norlida and Zahiruddin (2013) compare the PLCs performance between two MCCG. The results show MCCG 2000 helps to increase non-financial PLC's value. However, the companies; ratios did not show any significant improvement or decline in relation to MCCG 2007. Even there are studies on PLCs performance in relation to ERM implementation, the research on the current regulatory requirement such RMF or ERMF effects on the company's performance or value has yet to be carry out.

The two objectives for this study are to i. establish the range of risk implemented by construction PLCs in relation to RMF; and ii. ascertain the ERM effect on construction PLCs performance. The following section present the components of RMF associate to International Standards Organisations –ISO: 31000 (ISO, 2009), SRMIC 2012 and MCCG 2017. Next, the RMF impact on company's performance is reviewed. The research methodology is deliberated in the subsequent section. Additionally, findings and discussions are presented before concluding with a summary.

Risk Management Framework

According to ISO31000:2009 (ISO, 2009), the effectiveness of the RMF is significance to ERM implementation in a company. Furthermore, the framework provides a structured approach in identifying, evaluating and managing key risks, which is embedded in the company's management systems. Although the Board is required to establish RMF, there is no specific reference mentioned in SRMIC 2012 and MCCG 2017. Therefore, the RMF components for this study is referred to International Standards Organisations: ISO31000:2009 (ISO, 2009) as one of the commonly known risk management framework.

There seven components identified from ISO31000:2009 framework are as the following: i. mandate and commitment, ii. risk policy, iii. risk appetite/tolerance, iv. accountability, v. risk management integrated into organisation's processes, vi. appropriate resources, vii.

communication and reporting mechanisms. Table 1 shows the correlation of RMF components between ISO: 31000: 2009, SRMIC 2012 and MCCG 2017.

Both SRMIC and MCCG recommend the appointment of risk committee at board level to focus on risk management as part of risk governance. The Board fulfils its responsibilities in risk governance and oversight functions through this committee (Grace et al.,2014;Puan,2010). It also demonstrates the commitment from the top management in developing an integrated RMF. In addition, the risk committee oversee, review and approve the risk policy as well as the risk appetite/tolerance. The risk policy explains on the objectives of risk management functions. Meanwhile, risk appetite/tolerance is based on measurable parameters related to critical risks that may impact the strategy, performance and reputation of the company (COSO, 2004; ISO, 2009; Levy et al., 2015; Tapestry Networks, 2014).

Table 1. The Components of Risk Management Framework (RMF)

No.	Risk Management Framework Components	ISO31000 2009	SRMIC 2012	MCCG 2017
1.	Mandate and commitment	√	√	√
2.	Risk policy	√	√	√
3.	Risk appetite/tolerance	√	√	√
4.	Accountability	√	√	√
5.	Risk management process integrated into organisation's processes	√	√	√
6.	Appropriate resources	√	√	√
7.	Communication and reporting mechanisms	√	√	X

The RMF must be embedded in the company's management systems with clearly defined authority and accountability in its implementation (ISO, 2009). Risk committee is accountable for the effectiveness of RMF. Furthermore, Ashby & Power (2014) highlight accountability means members are capable to perform their prescribed roles and aware that they are held responsible for their actions in relation to the organisation's approach on ERM. Besides that, skills and competence; documented procedures and training are the appropriate resource required to set up the RMF in an organisation (ISO, 2009). A dedicated risk management department working together with Chief Risk Officer are example of skill resources that are essential to continuously strengthen the risk initiative within the company (Miccolis, 2003; Nocco and Stulz, 2006).

As a part of appropriate resource, training and awareness programme are also important to instil risk awareness and knowledge across the organisation (IRM, 2012; Dafikpaku, 2011; EY, 2014). This includes documented procedures whereby the company must have an ongoing process for identifying, evaluating and managing key risks in the context of its business objectives. Any significant risk and mitigation control are communicated between top management and Head of Business Units (Grace et al., 2014; ISO, 2009).The Board is able to make informed risk-based decisions when risk issues are reported and discussed in periodic meeting (FSA, 2006; ISO, 2009).

On the whole, RMF aims to provide an integrated approach enterprise-wide, which comprises of top management support; risk infrastructure including risk policy, risk appetite/tolerance, risk processes; risk governance; resources including skilled and competent personal, risk training ; risk interaction and information. The effects of ERM implementation on organisation's performance and value is presented in the following section.

ERM Influence on the Company's Performance

When an organisation manages risk through ERM that adopts a systematic and consistent approach, it is presumed to lower the organization's overall risk of failure and thereby increase the value of the organization (Gottwald & Mensah, 2016; Ariff & Siti, 2017; Siti, Nargess, Mokhber, Tan, & Nor, 2017). The study by Waweru & Kisaka (2013) found that companies with ERM are valued at 15.7% higher than those, which have not implement ERM. Bohnert, Gatzert, Hoyt, & Lechner (2018) also indicate that ERM activities are associated with a significant positive impact on the shareholder value of firms. In another study by Hoyt and Liebenberg (2015), Italian PLCs have a higher performance in financial and market evaluation with advance level of ERM implementation.

At the same time, some studies have highlighted that ERM do not affect organisation's performance. Özlem & Muhammad (2017) discover that there was no significant relationship between value and ERM among the 130 manufacturing companies in Turkey. This finding is similar to studies by Beasley, Pagach, & Warr (2008) and Gordon, Loeb, & Tseng (2009). Izah & Ahmad (2011); Mohd. et al. (2017); Norlida & Zahiruddin, (2013) found ERM implementation is negatively related organization's performance or value in Malaysia.

RESEARCH METHODOLOGY

Generally, PLCs are sizable organisation with complicated operation, which are exposed to different types of risk (Pagach and Warr, 2008; Waweru and Kisaka, 2013). In addition to regulatory compliance, PLCs are more likely to practice ERM and disclose the risk information in the annual report as a commitment to their shareholders for good corporate governance. Naturally, PLCs listed under construction in the Main Market of Malaysian Bourse is chosen as the unit of analysis. This is because the construction industry is volatile, risky and exposed to variety of risk (Liu, Zou and Gong, 2013; Low, Liu and He, 2009). Besides, there are limited ERM studies focusing construction industry with exception of Singapore-based Chinese Construction Firms (Zhao et al., 2012; Zhao, Hwang, Low, et al., 2013); Malaysian construction companies (Irzan, Nik, Mohamad, & Fazli, 2012; Mazlina & Amirah, 2015) and Vietnamese construction company (Tran & Huynh, 2017).

The source of data for this study is obtained from annual reports of Malaysian construction PLCS because of the easy access of information through Malaysian Bourse website. This approach is similar to Bertinetti et al., 92013); Florio & Leoni (2017); Kommunuri et al. (2016) and Majid et al. (2016), who have used annual reports to examine ERM implementation in their studies. The sample comprises of 227 PLCs in total with 47 (2017), 46 (2016), 46 PLCs (2015), 42 PLCs (2014) and 46 PLCs (2011). Content analysis on annual reports from year 2011, 2014, 2015, 2016 and 2017 is the research method for this study. It is a process to analyse the content of documentary materials or verbal materials, which can be either printed or spoken (Kothari & Garg, 2014).

The analysis is focus on RMF components whereby the sentences containing these keywords are read to verify on how ERM is practiced in the construction PLCs. Furthermore, a disclosure index is the ratio of item disclosed to the total numbers, which the item is applicable to the company, to calculate the level of disclosure. The item disclosed is referring to the keywords from RMF each component. Meanwhile, the total numbers attribute to the

total construction PLCs each year since each company is subject to develop the RMF. It is un-weighted ratio index that measures the level of risk disclosure because each item disclosed is equally important. If information on the item is disclosed, the score is one but it is zero if it is on the contrary (Botosan, 1997; Meek, Roberts and Gray, 1995).

The content analysis is conducted comparatively for year 2011, 2014, 2015, 2016 and 2017. Since RMF is introduced for the first time in SRMIC 2012 and MCCG 2012, 2011 is selected as the year before its introduction. As Mohd. et al. (2017) highlight the advantages of ERM may only become evident subsequently one year or more implementation, it is the same for RMF whereby its implementation effect would only be seen in the year 2014, 2015, 2016 and 2017. In regard to company's performance and value, it tabulated through financial ratio from finance data obtained from the annual reports. The five financial ratios, which this study is looking into are leverage, slack, opacity, Return of Asset (ROA) and Return of Equity (ROE). The further details on this financial calculation is presented after the next section on the keywords selected based on RMF components.

The Keywords Selected in relation to Risk Management Framework

The indication of ERM level of implementation is related to the keywords that can be identified from RMF components. Table 2 displays the selected keywords from annual reports established from seven framework components. First, ERM framework and RMF are the keywords to decide of its implementation as the framework is required from MCCG 2012 and SRMIC 2012. It includes the establishment of risk committee that shows the top management including the Board commitment in pursuing the ERM implementation. Some of the keywords, which can be found in the annual reports are risk management committee; risk committee; board risk management; internal control and risk policy committee; audit and risk management committee.

Table 2. Keywords based on RMF Components

RMF Components	Keywords
Mandate and commitment	Enterprise Risk Management Framework; Risk Management Framework risk management committee; risk committee; executive risk management committee; risk management working committee; board risk management; compliance, internal control and risk policy committee; audit and risk management committee; risk management and audit committee; audit and risk committee, risk management framework, ERM framework
Risk policy	risk policy; risk management policy
Risk appetite/tolerance	risk appetite/tolerance
Accountability	responsible; responsibility; accountable; accountability
Risk management process integrated into organisation's processes	Integrated, integral or embedded risk management function within the organisation
Appropriate resources (skills and competence; documented procedures and training)	risk manager; risk coordinator; risk management unit; risk management team; risk management department; risk management section; internal audit & risk department identifying, evaluating and managing the significant risks risk awareness program; training and workshop, refresher program
Communication and reporting mechanisms	periodic, scheduled, informal, monthly, weekly and regular including management or committee meeting risk register; risk profile; risk management report; risk assessment report

Second, the keyword for risk policy is the word itself or risk management policy. It is very much alike for the risk appetite or risk tolerance as the keyword is the third component of RMF. The fourth component is accountability where the Board, management and

employees are in charge of the risk management process with some of the keywords available are responsible, responsibility and accountable. Next, the risk management integrated into organisation's processes is comparable to integrated, integral or embedded risk management function within the organisation.

The sixth of RMF component consists of three subcomponents of process, resource and training. As for the process, the keywords include identifying, evaluating and managing the significant risks. Additionally, there must be sufficient resources such as people, who are skilled and qualified in risk management. Some of the keywords for skilled personal are risk manager; risk coordinator; risk management unit; risk management team; risk management department; risk management section and internal audit & risk department.

Whereas, the training organised by construction PLCs to equip the employees with adequate knowledge and awareness on ERM is indicated from keywords such as risk awareness program, session and workshop. Lastly, communicating and reporting is the seventh of RMF component. The communicating subcomponent consists of meeting whether periodic, scheduled, informal, monthly, formal, weekly and regular management or committee meeting as the keywords. In term of reporting subcomponents, the keywords include risk register, risk profile, risk report and risk assessment report.

The Measurement of Company's Performance

The performance of construction PLCs in this study is assessed through financial ratios that involve relationships between balances and calculations. Many studies have used Return of Equity (ROE), Return of Asset (ROA), leverage, slack and opacity as the common ratios in measuring a company's performance and value (Eckles et al., 2014; Hoyt & Liebenberg, 2011; Kommunuri et al., 2016; Mohd. et al., 2017; Özlem & Muhammad, 2017; Waweru & Kisaka, 2013). ROE is a measure of the percent returned for each dollar (or other monetary unit) invested by shareholders. It is calculated as ROE = Net Income / Book of Equity.

On the other hand, ROA is the net income returned on each dollar of assets whereby higher ROA is desirable. It is tabulated as ROA = Net Income / Average Total Assets. Meanwhile, leverage is measured as total liabilities to assets whereby a low leverage shows there is sufficient assets to cover debt load. During cash shortage, slack provides a measure of a company's ability to continue its operating cash flows. Slack is calculated as cash or highly liquid assets against its total asset. Besides that, opacity is intangible asset (such as, name brand and goodwill) that does not have a physical accounting value. Opacity is the ratio of intangibles to total assets.

The results on the extent of ERM implementation in construction PLCs in term of risk disclosure is presented in the following section. It is followed by the PLC's performance and value from the adoption of ERM for this study.

FINDINGS

The total risk disclosed in construction PLCs have surge from 32% in 2011 to 40% in 2014 and 43% in 2015 due to regulatory compliance. The trend continues to rise from 47% in 2016 to 53% in 2017. The Board establishes the appropriate framework and forms the risk

committee as part of its mandate and commitment to ERM implementation. Therefore, the ERM framework disclosure has increase to 26% in 2017 from 14% in 2011, 24% in 2014, 22% in 2015 and 24% in 2016. On the contrary, the RMF keyword appeared consistently in 2011, 2014, 2015 and 2016 for 19 or 18 construction PLCs' annual reports until 2017 when there is a leap to 26 construction PLCs.

There is also a number of risk committee set up in PLCs, which has increased steadily from 19 construction PLCs in 2011, to average around 25-26 companies in 2014-2016 before reaching 30 construction PLCs in 2017. On the other hand, the combined risk and audit committee do not exist in 2011 but this type of committee is set up in 2 construction PLCs in 2014 with 4 construction PLCs in 2015 and 2016. The number flourish to 7 construction PLCs in 2017. The surge of risk committee establishment indicates the pledge of top management including the Board in managing enterprise-wide risk. Table 3 displays the detailed findings of the risk disclosure based on RMF.

Table 3. Risk Disclosure based on RMF

Keywords on RMF	Year, No. of PLCs and percentage									
	2011		2014		2015		2016		2017	
ERM framework	6	14%	10	24%	10	22%	11	24%	12	26%
RM framework	19	43%	19	45%	18	39%	19	41%	26	55%
Risk Management Committee	19	43%	25	56%	26	57%	26	57%	30	64%
Combined Risk Committee	0	0%	2	5%	4	9%	4	9%	7	15%
Risk policy	9	20%	11	26%	17	37%	17	37%	29	62%
Risk appetite/ Tolerances	4	9%	8	19%	11	24%	19	41%	20	43%
Accountability	14	32%	24	57%	36	78%	39	85%	40	85%
Integrated into systems	16	36%	21	50%	18	39%	18	39%	23	49%
Risk management Department/Unit	4	9%	6	14%	10	22%	11	24%	12	26%
Process	46	100%	42	100%	46	100%	46	100%	47	100%
Training	4	9%	6	14%	8	17%	7	15%	7	15%
Meeting	26	57%	26	62%	29	63%	32	70%	39	83%
Documentation	24	52%	20	45%	22	48%	32	70%	34	72%
Total	189	32%	220	40%	255	43%	283	47%	326	53%

The approved risk policy in the construction PLCs grew from 9 companies in 2011 to 11 companies in 2014, 17 companies in 2015 and 2016 with 29 companies in 2017. Meanwhile, the total construction PLCs with risk appetite/tolerance are as follows: 4 (2011), 8 (2014), 11 (2015), 19 (2016) and 20 (2017). As for PLCs taking ownership in manging risks, the figures for accountability rise from 32% in 2011, 57% in 2014, 78% in 2015 to 85% in 2016 and 2017. More construction PLCs gave assurance in embedding ERM within the management systems with the total 16 companies in 2011 increased to 23 companies in 2017.

As for having appropriate resources, there are mixed results in for skilled and competence, procedures and training. The construction PLCs have started appointing risk manager or setting up risk management unit/department from 4 companies in 2011, 6 companies in 2014, 10 companies in 2015, 11 companies in 2016 and 12 companies in 2017. Currently, the total of 227 PLCs in this study have the risk procedure including identifying, evaluating, monitoring and managing significant risk integrated in the various work processes. On the contrary, risk training and awareness program are limited but increasing steadily from 4 PLCs (2011), 6 PLCs (2014) and 8 PLCs (2015) with 7 PLCs (2016 and 2017).

Generally, majority of construction PLCS have communication and reporting mechanisms in place for ERM. Board level or management level meeting related to risk management are conducted with an upturn trend from 57% in 2011, 62% in 2014, 63% in 2015 and 70% in 216 to 83% in 2017. It is the same tendency for risk documentation whereby PLCs illustrate a growth from 24 companies (2011), 20 companies (2014), 22 companies (2015), 32 companies (2016) to 34 construction PLCs (2017).

In regard to the company's performance, the value of ROE shows a decreasing trend whereby it is 0.113 (2011), 0.107 (2014), 0.099 (2015), 0.077 (2016) and 0.098 (2017). It is a similar tendency for ROA whereby it is 0.124 in 2011, drops to -0.073 in 2014 before surge to 0.050 in 2015 but drops again to 0.039 in 2016 and 0.034 in 2017. Both ROE and ROA are lower in 4 consecutive years (2014 to 2017) in comparison to 2011. Table 4 illustrates the company's value for five years (2011, 2014, 2015, 2016 and 2017).

Table 4. PLCs performance in 2011, 2014-2017

Financial ratios	Year / Mean				
	2011	2014	2015	2016	2017
Leverage	1.743	1.582	1.374	1.555	1.474
Slack	0.109	0.097	0.089	0.085	0.083
Return of Equity	0.113	0.107	0.099	0.077	0.098
Opacity	0.023	0.008	0.016	0.037	0.014
Return of Asset	0.124	-0.073	0.050	0.039	0.034

The value of leverage also has a steadier downward trend with average 1.743 to 1.474 from 2011 to 2017. It is the same for slack whereby the value is 0.109 (2011), 0.097 (2014), 0.089 (2015), 0.085 (2016) and 0.083 (2017). There is upward and downward trend for opacity value where is the highest in 2016 at 0.037.

Table 5. T-test and p-value for 2014 and 2015

Financial ratios	Year 2014		Year 2015	
	T-test	p-value	T-test	p-value
Leverage	0.187	0.149	0.452	0.072
Slack	0.565	0.463	1.002	0.215
Return of Equity	0.039	0.154	0.087	0.053
Opacity	1.819	0.002	0.705	0.288
Return of Asset	1.246	0.681	0.782	0.088

Table 6. T-test and p-value for 2016 and 2017

Financial ratios	Year 2016		Year 2017	
	T-test	p-value	T-test	p-value
Leverage	0.227	0.120	0.308	0.760
Although the	1.129	0.392	1.103	0.276
Return of Equity	0.228	0.096	0.111	0.912
Opacity	-0.943	0.055	-0.142	0.888
Return of Asset	0.903	0.108	0.972	0.337

On the whole, the financial worth of opacity is significant whereas leverage, slack, ROE and ROA are insignificant. The value of opacity is lowest in 2014 at 0.002 and significant, which reveals investment of intangible assets is minimum for construction PLCs. Table 5 shows the comparisons of T-test and p-value results for 2014 and 2015 to 2011. Next, Table 6 displays the T-test and p-value results for 2016 and 2017. The results are furthermore deliberated in the subsequent section.

DISCUSSIONS

Although the RMF is only made compulsory for all PLCs to develop in 2012, many construction PLCS already establish the framework since 2011 or earlier. The number of construction PLCs with RMF remained consistent but there is increase trend for ERM Framework. The development of a structured risk management as well as being aware of the ERM concept have encourage construction PLCs to take ERM seriously. Both frameworks set out the company's risk context, which comprises of strategies, policy, overall risk appetite/tolerance and procedures to better manage risks faced in the changing business environment (COSO, 2004; Smart & Creelman, 2013).

Risk committee signify the commitment of top management in managing risk is accountable for the effectiveness of RMF or ERM Framework. The numbers risk committee in construction PLCs have increased from 2011 to 2017. According Subramaniam, McManus, & Zhang (2009), separate risk committee rather than combined committee will enable a greater concentration to review the organisation's key risk and mitigation plans. Additionally, the numbers of risk policy and risk appetite/tolerance approved by risk committee has increase within the five years.

Generally, risk committee is responsible for the overall ERM but also promotes risk ownership to respective Head of Departments in managing risk at their level. This concurs with Ashby, Palermo and Power (2013), Muralidhar (2010) and Nocco and Stulz (2006), who highlight risk is the responsibilities of the ones from bottom-up steps. As part of top management mandate and commitment, some PLCs ensures the ERM process is integrated into the management and operation systems. This indirectly will facilitate its implementation by management and employees in the construction PLCs.

All construction PLCs have the structured ERM process for the five years with some companies made reference to international framework such as Committee of Sponsoring Organisations of Treadway Commission (COSO) and International Organisation for Standardisation (ISO) 31000. Although the number is limited but some PLCs have appoint risk manager or set up risk department/unit to champion risk awareness, which include risk identification, assessment, treatment and monitoring key risks in the company. Gordon et al. (2009), Grace et al. (2014) and Liebenberg & Hoyt (2003) mention the presence of risk manager or risk department/unit can indirectly imply the ERM implementation in the organisation.

Construction PLCs must also put more effort in providing risk training or workshop to educate the employees whether by risk manager or risk department/unit or external trainers. It is because the findings demonstrate that only few PLCs are taking action on this matter. Most of the risk committee also have periodic meeting to discuss on key risks. During these meetings, the top management including the Board review and evaluate the information in risk register or risk profile. It is an indication of ERM implementation when there is direct reporting to the top management. This is practiced is many construction PLCs as a form of communication and reporting mechanisms in ERM implementation.

As for performance, construction PLCs have lower profit earnings in terms of equity and assets after RMF is required to be set up by regulatory compliance. ROE and ROA calculation

do not show financial growth from 2014, 2015, 2016 and 2017. The values for leverage and slack are also lower for 2014, 2015, 2016 and 2017. In term of leverage, construction PLCs can cover debt load with sufficient assets. As for slack, PLCs are investing in liabilities to increase the shareholder's value to manage risks.

Opacity also has a similar trend and it is an indication whereby the construction PLCs have more highly liquid assets and invest less in intangible assets to hold companies' value intact. A large opacity value signifies a deprecation of shareholder value and indirectly the company's performance. Therefore, it is favourable to have a lower opacity value in deciding a company's performance. In general, these findings concur to Ahmad, Ahmad, & Izah (2011); Pagach & Warr (2010) and Roslida & Normah (2015) studies, which also reveal there is no significant relationship between organisation's value and ERM implementation. This study is concluded with limitations and recommendation for future study in the following section.

CONCLUSIONS

This study has achieved the objectives to ascertain the level of risk disclosure and the effect of ERM implementation on performance. Both SRMIC 2012 and MCCG 2017 guidelines have encourage risk disclosure among construction PLCs. Clearly, many companies are practising a structured risk management procedure, which indirectly indicate good governance and transparency. Furthermore, risk disclosure can be taken as guidance for stakeholders or shareholders in assessing the construction PLCs ability in managing business challenges. However, the construction PLCs' value has lower financial worth in 2014, 2015, 2016 and 2017. Although ERM might have no significant impact on performance, construction PLCs are affected by instability of worldwide oil prices or the economy slowdown.

Similar to other studies, there are limitations in this study. The selection of sample from five years period is may is not adequate to ascertain the effect of ERM implementation on the construction PLCs performance. Additionally, the dependency on certain keywords based on RMF components is insufficient and may not disclose the magnitude of ERM implemented in the PLCs. There is also limitation of data collection as content analysis is the sole research method.

Nevertheless, the findings provide valuable information to the industry players and academicians. Besides encouraging PLCs to improve in compliance, the results on ERM can facilitate companies to enhance policy development, improve employees' competence and allocate sufficient resources to strengthen risk management functions. Industry players can further enhance ERM implementation as their obligation to shareholders and stakeholders. This will certainly be viewed positively as part of good governance.

Meanwhile, ERM studies preferably conducted on larger sample for the results can be generalised. Comparable research in different industry for PLCs can be conducted to analysis whether there might be any distinct outcome. Additionally, the level maturity of ERM implementation among PLCs is another area that can be explored. Moreover, future research can be conducted the effects of firm's performance in non-financial indicators.

On the whole, the findings from this study not only disclose ERM is implemented extensively but also its effect is insignificant to construction PLCs' performance. In general, the results have created risk awareness among shareholders, stakeholders and academicians on its implementation among construction PLCs.

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TECHNOLOGY TRANSFER IN MASS RAPID TRANSPORT (MRT) PROJECT IN MALAYSIA

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Abstract
Technology transfer is the process of transferring or sharing skills and knowledge from one people or one place to another. Technology transfer is known as a convenient resource used to improve technology in various sectors. One of significant application of technology transfer in the construction industry can be viewed thru the Mass Rapid Transit (MRT) project. The transfer of technology has been implemented during the construction of the MRT and involves multiple types of technologies during construction phase. However, there is also number of barriers found in implementation. Therefore, this paper attempts to understand the technology transfer in the MRT project in the country by identify the technologies involves and barriers in the process of technology transfer within the MRT project. The data collection was conducted through interviews with respondents that involved in technology transfer MRT project namely MRT Corporation Sdn. Bhd. And MMC-Gamuda KVMRT (PDP) Sdn. Bhd. The result showed that advance technologies transferred in Malaysia's MRT project include tunnelling work, signalling, train assembly, train control, track work, underground work, rail work and stair tower project. Meanwhile, differences between transferor and transferee environment and language barrier are the barriers in implementation of technology transfer in Malaysia's MRT project. The findings of this study can be used as a guide for the MRT project in the future to enhance the technology transfer.

Keywords: *Technology transfer; Mass Rapid Transportation; Construction Industry; Malaysia.*

INTRODUCTION

Technology transfer is the process of disseminating skills and knowledge from one people or one place to another thru transferring or sharing activity. Technology transfer which is an advantageous source for technology improvement is widely used in various industry fields (Inken and Dinur, 1998). Appropriate technology transfer will transform and enhance the technology of the firm and thus improve the competitiveness and performance of the organisation. Technology transfer also widely applied in construction industry which clearly seen from Mass Rapid Transit (MRT) project. MRT is a public transport which involves highly technology including sensor door, underground MRT station and energy saving lightning are the breakthrough from the old train service (Omar et al., 2019).

Technology transfer in MRT is considered one of the best mitigations in controlling the air pollution issue and traffic congestion issue in Malaysia (Omar et al., 2019). Many countries like Singapore and Hong Kong had successfully applied high quality public transport which includes MRT in order to reduce the reliance on car travel (Luk and Olszewski, 2003). Elevated or underground MRT system which can accommodate large number of passengers will decrease the number of vehicles on the road. Lesser carbon footprint can be achieved with the application of MRT in big cities instead of private vehicles. A study showed that MRT managed to reduce 2000 tons of Carbon Dioxide (CO_2) emission per year (Lahiri, 2010).

For the last few decades, technology transfer from a developed country was viewed as a solution for technology development of developing country (Devapriya and Ganesan, 2002; Chen et al., 2010: Omar et al., 2012). According to a study, developed country such as United Stated of America, United Kingdom and Germany are the leading country in technology transfer research (Chen et al., 2010). Technology which was successful invented will be transferred to the developing countries to allow the increasing knowledge and awareness regarding technology of the people in their respective field. Technology transfer process may happen thru transferring technologies from laboratory scale to industry scale within the industry.

In addition, the movement of knowledge via various channels would allow the construction firms to deliver a higher quality and unique project. Example of technology transfers include of elevator, tower crane and fire-fighting system (Omar et al., 2019). Improvements in such technologies may help the construction firms in cost reduction and output quality improvement (Hoonakker et al., 2010). Many developed countries such as Singapore and Japan had established technology in order enhance and maintain their good train services and Malaysia also started applying technology in MRT project in year 2010 (MRT Corps, 2017).

Initially, the first rapid transit system in the world which was opened in London in 1863 was operated using steam engine (William, 2010). In about 150-year period, rapid transit's operating system had changed from steam to electric and further down to magnetic. Without transferring and sharing of key knowledge, these drastic changes will not be achieved. These drastic changes were resulted from the continuous improvement in technology in MRT. As compared to the past, MRT projects nowadays were improved by using the latest technologies such as tunnelling, Building Information Modelling (BIM), train control and railway track (MRT Corps, 2017). Besides that, some modern applications such as open screen door and wireless train can be found in MRT too. These technologies improve the quality and service of MRT.

RESEARCH PROBLEMS

According to Devapriya & Ganesan (2002), the purpose of technology transfer is to improve productivity at project, firm and industry level and benefit to economic growth in the host country in the long term. In recent years, Malaysia had started the first MRT project in order to accommodate increasing amount of residents in Kuala Lumpur area. Herrenknecht, the global market leader in mechanized tunnelling technology, developed a new type of machine for Klang Valley MRT Project to complete the tunnelling process (Kenyon, 2012). Furthermore, Mitsubishi Heavy Industries Ltd was in charge of the design and engineering, procurement and installation of track works for Klang Valley MRT project (Ee, 2012). These showed that various advanced technologies used in constructing the MRT project were mainly transferred from other developed countries.

Rapid industrialisation can be credited to technology transfer (Devapriya & Ganesan, 2002). One of the main factors of applying technology transfer in developing countries is to improve local technological capabilities and knowledge level in the respective field (Takim et al., 2008; Omar et al., 2012). By enhancing the local technological capabilities and knowledge level of developing countries, rapid growth in construction industry can be

achieved. Furthermore, technologies were transferred from other countries in Malaysia's MRT project due to the limited resources and human capitals in Malaysia which are not enough to build a high quality MRT (Lai and Yap, 2004). These are among the driving factors for applying technology transfer in Malaysia's MRT project.

However, a successful technology transfer faced a lot of challenges and is not an easy process. Ting (2006) highlighted that poor financial system, human resource constraints and limited or inability to adopt technology is the problem faced by most of the company in Malaysia. Another researcher who studied barriers in technology transfer in India concluded that lack of skills, capability and financial support are the reasons that obstructed technology transfer (Stuti, 2005). Expensive infrastructure and price competition with other competitors from other countries such as Indonesia, China, Thailand and India are also among the factors that caused failure in technology transfer (Burhanuddin et al., 2009).

Challenges and barriers are also faced in technology transfer in Malaysia's MRT project. In the process of transferring technology in MRT project, the construction firms met barriers which caused unavoidable delay in time of completion and increasing in cost of project, claimed by MRT Corp (Palansamy, 2015). Mayuri (2015) reported that there were few cases of fatal accidents happened in 2-year time in the construction process of Klang Valley MRT project. The above showed that even though technologies were transferred from other countries into Malaysia's MRT project, the construction work still faced problems such as delay in completion time and increasing cost of construction. In response to the problems faced in technology transfer in MRT project, this study aims to benefits future development and improvement in technology transfer in Malaysia's MRT projects through identifying types of technology that transferred and barriers of technology transfer in MRT project.

TECHNOLOGY TRANSFER

Technology transfer is the process of transferring or sharing skills and knowledge from one people or place to another. Technology transfer which is a useful source for technology improvement is widely used in various industry fields (Inkpen and Dinur, 1998). Technology transfer is embedded in the current phenomenon of growth in a global economy and is the market-driven process by which innovations are adopted and implemented (Coppola, 2006). The components of technology transfer consist of transferring of skills, technical knowledge, machinery, soft skills and equipment (Wie, 2003). In most cases, technology transfer requires physical processes related to knowledge (physical elements such as digital components) as well as know-how or advanced skills on instalments.

Technology transfer can be enhanced if theory is accurately applied by the practitioner and researchers (Zimmerman et al., 2007). Besides that, successful technology transfer depends largely on technology, ownership, transfer, purpose, specialist, environment, timing and process (Mostert, 2008). Hence, in this study, technology transfer is defined as the process of technology, knowledge, and equipment in MRT project which transferred from a developed country to a developing country namely tunnelling skills or tunnelling machines in MRT project. This section also will explain type technologies involves in MRT construction and barrier of technology transfer in MRT.

TYPE TECHNOLOGIES IN MASS RAPID TRANSPORT

In about 150-year period, rapid transit's operating system had changed from steam to electric and further down to magnetic. These drastic changes were resulted from the continuous improvement in technology in MRT. As compared to the past, MRT projects nowadays were improved by using the latest technologies such as tunnelling, BIM, train control and railway track. Besides that, some modern applications such as open screen door and wireless train can be found in MRT too. These technologies improve the quality and service of MRT.

Tunnelling

According to Occupational Safety and Health Act (1970), tunnel is an excavation or passageway that goes under the ground. Tunnel serves different functions such as vehicular road traffic, rail traffic, military purposes and also utility purposes. Tunnel is widely used to reduce the space usage beneath the ground especially for countries with smaller land area. However, not every land is suitable for constructing tunnels due to the characteristic of surrounding land and also the underground conditions. Construction of tunnels usually starts off with geotechnical investigations (Bickel et al., 2004).

Tunnelling is a method to construct a tunnel. In order to build an underground MRT, tunnelling technology is required. One of the tunnelling methods is tunnelling shield, a structure used in the excavation of tunnel to protect and stabilize the soil which is too soft or fluid with a support structure of concrete, cast iron or steel. The first successful tunnelling shield was developed by Sir Marc Isambard Brunel in January 1818 (Bagust, 2006). Shield tunnelling method is a rational system for ensuring and improving the qualities and efficiencies of the sewerage systems in cities (Maeda and Kushiyama, 2005).

Building Information Modelling (BIM)

BIM is an advanced computer technology that allows building performance to be simulated digitally so that design conflicts can be collectively resolved upfront to avoid costly abortive work at the construction stage. BIM consists of 3D models and is used for both qualitative and quantitative estimation (Shih et al. 2013). It is widely accepted as an essential tool for built environment professionals to improve their productivity from the design to the downstream construction stages. BIM was widely used in construction industry in many developed countries such as USA and Singapore. BIM was used in Singapore in the Tuas West MRT extension project (Das et al., 2011). BIM produces accurate project models and construction schedules which help to avoid unnecessary delay and mistakes in the MRT project.

In recent construction world, BIM plays a very important role in managing complex communication and information sharing processes in collaborative building projects (Sebastian and Barb, 2010). BIM is widely used by many construction firms as their preferred method of communicating the design profession's intent to the owner and project builders (Burt, 2009). Furthermore, BIM is also widely used as an emerging technology to assist in conceiving, designing, construction and operating the buildings in many countries (Wong et al., 2009). BIM brings benefits for construction project is also applicable in construction of MRT.

Train Control

According to Railway Safety Act (1985), train control systems refers to mechanical, electric or electronic signal systems which include interlocking system and systems used in non-signalled territory. Train control system consisting of signalling systems secures safe railway traffic together with the regulations on traffic movements and forms the traffic capacity of the track. Train control system has to be secured in such a way that a single failure in a train control system directs the train control system controllably into a safe state. Designing a train control system is a challenging task as unreliable wireless networks will affect the performance and stability of the control systems (Murray et al., 2003). By introducing a good train control system, train trip profile can be optimised, and this is essential for energy efficiency improvement (Huang et al., 2016).

Therefore, train control technology which involves the entire MRT train network is also considered as one of the types of technology that involves in an MRT project. This is because train control technology is essential in MRT as it controls and manages the entire MRT operation in order to ensure a structured and safe MRT operation.

Railway Track

Railway track consisting of tails, fasteners, ties, ballast and subgrade is the permanent pathway for train to move. Railway track are also equipped with electrification system in order to provide electricity for electric trains like mass rapid transit. Good designs of railway track include low noise pollution, high sustainability and high safety usage. According to Yang and Bradford (2016), railway tracks are prone to buckling when subjected to temperature increases, as occurs frequently during heat waves. Railway track which can withstand temperature changes is crucial for Malaysia's MRT as Malaysia has very high temperature throughout the year. Besides that, study showed that railway track is a source of noise pollution (Vogiatzis and Vanhonacker, 2010). According to Land Transport Authority of Singapore, noise barriers managed to reduce noise levels by about five to ten decibels. Thus, railway track for the train to move is an important consideration in MRT project. Different methods or skills to construct the railway track will produce different stability and effectiveness of the MRT operation. It is also considered as one of technology used in MRT project.

BARRIER IN IMPLEMENTATION OF TECHNOLOGY TRANSFER

Technology transfer is a process of learning and passing technology from a country to another country or from a company to a company. Hence, difficulties will definitely occur as this process involved two parties with different objectives. Li-Hua (2004) reckons that there are many difficulties in transferring of knowledge and some common barriers are known as cultural differences, language barriers, social values, and different objectives. Barriers which occurred in construction industry in the past and related to MRT project were discussed.

Learning Environment

According to Fisher and Ranasinghe (2001), distance between learning and teaching ability of transferor and transferee is a major issue in technology transfer process. Kumaraswamy and Shrestha (2002) also support the statement by commented that the bigger the learning gap between two parties affects the technology transfer process. To obtain an effective technology transfer process, the parties involved need to have a good relationship and build a culture of mutual trust through effective communication (Malik, 2002). This mutual trust should start from the management teams of both parties. Without strong commitment from management teams from both parties, an effective technology transfer would not be able to achieve (Devapriya and Ganesan, 2002). Furthermore, the knowledge culture should fit the existing culture of the organisation to provide better understanding between the parties and common approach can be adopted in the transfer process (Liu, 2009). Hence, learning environment is one of the barriers in technology transfer process.

Transferor and Transferee Environment

In order to achieve an effective technology transfer process, transferor should transfer the appropriate technology and the transferee should have every intension to adopt it. A large gap between the parties involved, transferor will face difficulties in transferring technologies while transferee faces problems in learning the technologies. This gap obstructs the application of technology transfer in the construction project. The level of international experience of both parties and the nature of experience can impact significantly on the technology transfer process, claimed by Steward and Waroonkun (2007). Kumaraswamy and Shrestha (2002) commented that the capacity of the local construction industry to assimilate, adapt, modify, and generate technology is important to an effective transfer of technology.

This capacity building cannot be done only by transferring technologies from developing countries but also through advanced manpower and management training, domestic production of materials, tools and equipment and individual innovation focused on construction industry. Education and training programmes, knowledge in designs and construction planning within a construction joint venture is important to train the local firms on the latest construction technology (Ganesan and Kelsey, 2006). Therefore, attitudes and mind set of both parties play critical role in an effective technology transfer process.

Language Barrier

Language barrier is a common issue in different sectors in many developing countries which has been existed for many years. In construction industry, many foreign workers were hired by the employers to fulfil the vacancies in the construction project. With the different backgrounds of workers, language barrier increases the complication and misunderstanding in workplace. Language problem in a workplace can affect the lack of productivity and trust between the employer and the workers. Trajkovski and Loosemore (2006) discovered that workers whose mother tongue was not English at workplace have contributed towards higher accident rates in the construction industry in Australia because the foreign workers could not fully understand the instructions and guidelines. Bust et al. (2008) found out that in UK and USA, the language barriers occur among foreign workers in the construction industry and foreign construction workers faced higher injury risks because they have lesser training on

safety and health as they were not able to communicate in English. Different languages used create a problem for technology transfer as the two parties cannot fully understand the messages or knowledges conveyed by the other party.

Barriers in Relation to Procurements Options

According to Toor and Ogunlana (2008), the major problems faced by numerous construction projects are usually caused by an inadequate understanding of the procurement system, lack of resources, discrepancies between design and construction, inadequate project management practices and numerous variation orders. Design-bid-build has been one of the principal methods of delivery systems for the past few decades. According to Kang et al. (2015), many owners of the projects have faced diversity of disappointments using this system. This procurement system caused barrier in technology transfer due to some problems in the system. One of the problems is the design procedure must be completed before tendering stage, leading to longer process duration. Besides that, technological and programmatic obsolescence can put the owner in difficulty of transferring programmatic and technological changes.

RESEARCH METHODOLOGY

In this study, data collection method will be used is qualitative data collection method which include interview sessions and reference books. Interview sessions will be conducted with the employees who have experience in technology transfer of the company in charge of the MRT project such as project manager, safety manager and public relation executives to fulfil the objectives of this study. The collected data are essential and accurate as the targeted interviewees are familiar to the targeted MRT project. Related reference books and past researches on MRT project are used to certify the data collected from the interview sessions. This would enhance the reliability of the data collected.

According to Banerjee and Chaudhury (2010), population is the target group of people in a study with specialized set of characteristics. The selected group of people are the key person to generate the results of the study. Population of the study may be small but with experience or knowledge which are useful to the study. On the other hand, if the population is too large, difficulties will be occurred in the data collection and data analysis process. Determination of the study population is important in the study because the population will determine how and how many samples will be selected for further details on the study.

The population in this study are the MRT Corp who is the owner of the Klang Valley MRT Project. Furthermore, MMC-Gamuda KVMRT (PDP) Sdn. Bhd. who is the Project Delivery Partner of MRT Corp is also the target group for this study. The sample of this study consisted of the employees who are experienced in technology transfer from both from MRT Corp and MMC-Gamuda KVMRT (PDP) Sdn. Bhd. Three experienced employees from MRT Corp – project manager, safety manager and public relation executive are the respondents for this study. Besides that, head of public relation department and public relation manager of MMC-Gamuda KVMRT (PDP) Sdn. Bhd. have also helped in answering questions for this study. Five respondents of this study who have great experiences in technology transfer in Klang Valley MRT project are chosen based on inductive logic of research in a qualitative study.

As suggested by Cannon (1998), qualitative content analysis was used to analyse the data obtained from interview. In this analysis method, coding system is required in order to have clear understanding on the information obtained. Furthermore, Cannon (1998) also stated that the coding system provides a clear guidance to the researchers on the further information. In this study, researcher obtained qualitative data through interviews. After collecting data, researcher will organise all the collected data and undergoes data analysis process. Researcher will read through and understand all the collected data. Next, researcher will code the data using computer. All the data will be tabulated according to different categories in form of table.

RESULT AND DISCUSSION

Technologies Involves in Malaysia MRT

Based on the results obtained from data analysis, there are a lot of advance technologies that transferred in Malaysia's MRT project in order to achieve a successful technology transfer in MRT project. Technologies that transferred in MRT project include tunnelling work, signalling, train assembly, train control, track work, underground work, rail work and stair tower are shown in Table 1.

Table 1. Technologies Involves in Malaysia MRT

Respondent	Type of Technology that Transferred in Malaysia's MRT project	Category
R1	*"In MRT project, Tunnel boring machines, signalling, train assembly, train control and track works are transferred by MRT Corp.*	Tunnel boring machines Signalling Train Assembly Train control Track work
R2	*"Tunnelling work, rail work, signalling, train control and stair tower are transferred by MRT Corp in MRT project."*	Tunnelling work Rail work Signalling Train control Stair tower
R3	*"Tunnelling, engineering design, track work and train signalling that are transferred into construction industry by MRT Corp.*	Tunnelling Engineering design Track work Train signalling
R4	*"The Tunnel Boring Machine Refurbishment Plant and the Tunnel Training Academy are two major facilities set up by MMC-Gamuda to ensure first, the tunnel boring machines are fit and usable for the next job."*	Tunnelling Underground works
R5	*"Tunnel Training Academy and Tunnel Boring Machine Refurbishment Plant were set up with a vision to develop local talents that would be technically trained and equipped to take on tunnelling operations for future jobs."*	Tunnelling Underground works

According to Respondent 1, types of technology that transferred in MRT project also include train assembly, train control, signalling and track works which is similar statement given by respondent 2 as shown in Table 1. Respondent 2 mentioned that rail work, signalling, train control and stair tower for construction are transferred into Malaysia's MRT project. Train control system consisting of signalling systems secures safe railway traffic together with the regulations on traffic movements and forms the traffic capacity of the track (Murray et al., 2003).

Meanwhile, Respondent 3 stated that engineering design, track work and train signalling are transferred into MRT project by MRT Corp. According to Yang and Bradford (2016), railway tracks are prone to temperature changes. Railway track that can withstand temperature changes is crucial for Malaysia's MRT as Malaysia has very high temperature throughout the year. However, these segments were not mentioned by Respondents 4 and 5 because MMC-Gamuda Sdn. Bhd. only in charge of the tunnelling works for the project.

According to all respondents, track work, signalling and tunnelling are the main type of technologies that transferred in the MRT project. This is because Klang Valley MRT is the first underground MRT in Malaysia (Land Public Transport Commission, 2010). Tunnelling is a method to build a tunnel. Tunnelling technology used in Malaysia's MRT project was developed by Herrenknecht, the global market leader in mechanized tunnelling technology from Germany (Kenyon, 2012).

According to respondent 4 and 5, initiatives were carried out by their organisation to enhance human capital capabilities and technology transfer in MRT project as shown Table 1.Construction of tunnels usually starts off with geotechnical investigations because not every land is suitable for constructing tunnels due to the characteristic of surrounding land and also the underground conditions (Bickel et al., 2004). Technology was transferred from Herrenknecht to assist in the tunnelling process (Kenyon, 2012). Both respondent 4 and 5 commented that locally trained technical experts have moved up the value chain in terms of salary and career advancement and they will be widely sought after in tunnelling jobs elsewhere around the world for their expertise.

In conclusion, there are various types of technology that transferred in Malaysia's MRT project such as tunnelling, signalling, engineering design work and track work. Although different types of technology are transferred, the main objective of technology transfer is to achieve a good output for the MRT project. Based on data, research also identify tunnelling is the most frequent technology had been transferred during MRT construction.

Barriers in Implementation of Technology Transfer in Malaysia MRT Project

According to previous researches, there are four categories of barriers in implementation of technology transfer in MRT project which are learning environment, transferor and transferee environment, language barrier and barrier in procurement options as shown in Table 2.

Table 2. Barriers in Implementation of Technology Transfer in Malaysia MRT Project

Respondent	Learning Environment	Transferor and Transferee Environment	Language Barrier	Barrier in Procurement Options
R1	No impact to their	Candidate selection	Different language, message distorted	No impact to their organisation
R2	Big gap affects learning	Problems in learning and understanding	Different language, message distorted	No impact to their organisation
R3	No impact to their organisation	Difficulties in learning	Different language, technology transfer fails	No impact to their organisation
R4	No impact to their organisation	No impact to their organisation	No impact to their organisation	No impact to their organisation
R5	No impact to their organisation	No impact to their organisation	No impact to their organisation	No impact to their organisation

According to previous researches, learning environment is one of the barriers in implementation of technology transfer in MRT project. Unfortunately, only respondent 2 stated that the technologies that transferred might not be able to fully adopt by the organisation without a good learning environment. The other three respondents didn't find that learning barrier is an issue. The MRT Corp and MMC-Gamuda Sdn. Bhd. are very supportive toward technology transfer in their projects as of the companies create a very positive learning environment where training was given to the employees. Besides that, there is a good relationship between employer and employees that lead to successful technology transfer in Malaysia's MRT project. In short, learning environment may affect the learning process; however, it is not be the dominant barrier in implementation of technology transfer in Malaysia's MRT project.

In previous research, transferor and transferee environment become one of great challenges in MRT technology transfer. In MRT Malaysia, the first three respondents agreed by opine that transferor and transferee environment leads to learning difficulties as construction industry involves with various key player's background. Different environments of the players lead to confusion and misinterpretation as different background digested the technology in differently. Meanwhile, respondent 1 mentioned that the organisation had difficulties in finding competent transferor and transferee. Candidates are required to have a certain level of experiences to deliver the technologies input and high passion in learning new technologies that are transferred. Meanwhile, respondent 4 and respondent 5 doesn't meet any challenges in such issue as they believe positive learning environment diminished various barriers from many dimensions.

"…*if the environment is positive, it will not be the barrier in implementation in technology transfer* (Respondent 5).

Communication is the key of information flow in technology transfer. Many previous researches faced communication issue in delivery new input of technology including construction sector. Based on data collection, the first three respondents faced communication issue from different level, whereas, respondent 4 and respondent 5 claims are not facing such issue as the employee able to interact in same language. Respondent 1, respondent 2 and respondent 3 agree language barrier happened to participant involvement of MRT construction comes from various knowledge background and different cultures. Respondent 1 highlights message could be distorted along the way even when both parties speak in same languages. Respondent 2 and respondent 3 added that the different language, the meaning of messages could be distorted as technology transfer involves learning new technologies from the other party.

Lastly is the barrier in procurement options which is usually caused by inadequate understanding of the procurement system (Toor and Ogunlana, 2008). However, all the respondents involved in this research believed that procurement system is not a barrier in implementation of technology transfer in Malaysia's MRT project. According to Respondent 1, respondent 2 and respondent 3 the procurement method used by MRT Corp is Design-Bid-Build method for the MRT project where the tenders to bid the MRT project is prepared through the procurement traditional method. Therefore, such procurement system is not a barrier in implementation of technology transfer in Malaysia's MRT project. Whereas respondent 4 and 5 prepared tenders to bid the project to run the tunnelling works in MRT

project. Both parties have to agree on the Terms and Conditions listed in the contract and claimed that procurement system is not a barrier in implementation of technology transfer in Malaysia's MRT project.

Based on the discussion above, researcher believes all the barriers bring direct impacts in technology transfer with MRT project. However, not all the barriers are lists as dominant barriers in Malaysia MRT projects. Based on data collection, the dominant barriers in technology transfer within Malaysia MRT are; transferor and transferee and language barrier.

CONCLUSION

The aims of this research to identify the type of technologies involve in Malaysia's MRT construction project and determine the dominant barrier of the technology transfer during MRT project within the industry. Based on the results obtained from data analysis, there are many technologies had been transferred and being used. The advance technologies that transferred in Malaysia's MRT project include tunnelling work, signalling, train assembly, train control, track work, underground work, rail work and stair tower. These advance technologies were transferred into Malaysia's MRT project from few developed countries such as Germany, Japan, Korea, France, Australia, Italy and Canada. Developed countries mentioned above owned good and advance construction technologies in MRT. Those technologies were transferred into Malaysia mainly due to unavailability of those modern technologies and equipment in Malaysia. Technology transfer does bring benefits to Malaysia's MRT project. Advance technologies that transferred help to improve the safety, quality and efficiency of the entire construction work in Malaysia's MRT project. On the other hand, technology transfer also helps to improve the knowledge and skillsets among the local experts.

Through qualitative research, second objective of this research is achieved too. Based on the data obtained, differences between transferor and transferee environment and language barrier are the barriers in implementation of technology transfer in Malaysia's MRT project. According to statements given by respondents from MRT Corp, transferor will have problems in transferring technology to transferee and transferee will face difficulties in learning knowledges and skills of technology transfer which are of different level. Meanwhile language barrier issues situation will cause failure in transferring technology in Malaysia's MRT project. Since all the aims are fulfil, this research is considered succeed.

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SOCIOSPATIAL RISK ASSESSMENT OF HUMAN-ENVIRONMENT-TUBERCULOSIS INTERACTIONS IN RURAL-URBAN SETTINGS

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Abstract
Malaysia has recorded a moderate burden of TB (TB) incidence as indicated by World Health Organization (WHO), however the present trend of TB cases is mostly distressing. The Ministry of Health (MOH), Malaysia has come upon many pointers to manage the disease, but, the national TB technical report in 2015 emphasised that existing detection strategies of TB at the locations still have to be compelled to be integrated with relevant methods. A sociospatial method is proposed to assess potential risk factors in the rural-urban areas of Shah Alam and then used for targeting missing cases of the disease. The approach was created with three main steps: framework development, data sets acquisition, risk investigation and modelling. Urbanization, location of factory, financial status, potential group, human movement, house type, location of healthcare centres, and number of populations were fundamental factors used to decide the risk of TB endemic. This creative method has effectively evaluated a 65 % of potential high-chance TB risk areas. These areas have general similitudes with other endemic spots around the world, yet there are some fascinating discoveries uncovered in this neighbourhood ponder towards in the national TB control program. The vast majority of TB cases did happen in high rise housing regions, as well as they are accumulated at industrial area, high mobility human and low financial status in urban areas. Urban areas are commonly favoured region for the global TB cases, but the local TB endemic could likewise possibly happen in semi-urban or rural setting.

Keywords: *Spatial risk assessment; Human social behaviour; Built environment health; Tuberculosis*

INTRODUCTION

Ministry of Health (MOH) Malaysia informed that the nation has an expanding trends of TB cases begins from 16 665 in 2006 to 25 739 of in 2016. Selangor is among the top three most noteworthy TB cases in the nation within excess of 4000 cases recorded from 2013 to 2016. Along these lines, the MOH has created a few frameworks to monitor the disease deliberately. Nonetheless, the national report of TB in 2015 figures that the current strategies for TB screening among high-risk community should be strengthened so as to expand TB cases identification rate at the sites. Nishikiori (2011) likewise concurred that the methods still neglect to address biased conveyance of the disease and does not examine numerous TB patients in relegated areas.

This circumstance is brought about by a few factors particularly the lack of the current technique to thoroughly detect the TB cases. For instance, even though the biomedical method has preferences regarding diagnosis of TB on human body, this clinical method may does not really think about spatial and ecological variables. This is on the grounds that TB cases are affected by human-based variables, as well as are influenced by social and spatial factors, for example, land use pattern, human mobility and residential conditions. Subsequently, this

current strategy should be joined with different methods (Burgos and Pym 2002; Mathema et al., 2002; Narayanan et al., 2004) to improve TB prevention and analytical power tactics.

In tackling this issue, Narayanan et al. (2004) has also recommended that the blend between bio-molecular methods and spatial methods can improve the TB transmission analysis for recognizing distinctive environmental regions in endemic areas and consequently upgrading targeted screening programme at the sites. This study suggests a spatial method as an alternative approach to assess the risk factors and then to detect potential risk areas in Shah Alam, Malaysia. Geographically, Shah Alam is located within the district of Petaling in the state of Selangor with 232.3km2 area. It is surrounded by the urban areas of Subang Jaya, Petaling Jaya, Klang, Kuala Selangor and Gombak. Shah Alam is additionally one of the primary and urban communities inside the Klang Valley.

Malaysian analysts have attempted to investigate and foresee the frequency of TB cases specifically regions utilizing spatial methods, yet there are just a couple of attempts of spatial applications to assess the local level of TB risk areas. For example, local specialists underscored on the spatial pattern and the risk exploration of tuberculosis using derivative datasets (Abdul Rasam et, al., 2018; Azhar Shah et, al.,2002; Abdul Rasam et al., 2016). Therefore, practical functions in spatial epidemiology (SE) such as geostatistics, GIS multicriteria decision analysis (MCDA) and spatial statistics are inventively merged to conduct spatial risk assessment of potential variables in the TB endemic areas of Shah Alam. A spatial method can play out a superior spatially basic framework for general disease control and management system (Fuller et al., 2014) to estimate potential TB endemic spots (Daley and Gani, 2005; Lin, 2012; Middelkoop et al., 2014; Moonan, 2006; Musenge et al., 2013).

SOCIAL RISK ASSESSEMNT AND SPATIAL MODELLING OF TUBERCULOSIS ENDEMIC AREAS

Tuberculosis Ecology and Social Risk Factors

Tuberculosis is delivered by microorganisms of *Mycobacterium* tuberculosis, *M*TB that most habitually influence the lungs, and spreading from individual to individual through the air (WHO, 2015). This transmission system decides compelling danger risk factors and pattern of TB incidence that connect to time, place, and individual attributes. Risk factors and geographical pattern are imperative functions to examine geographical relationship or assessment in disease risk to the human socio-environmental health condition. (Ostfeld et al., 2005). The other explicit capacities incorporate health mapping, spatial connection analysis, distinguishing risk factor, disease transmission classification and assessment.

Mathema et al. (2005) evaluated that 33% of the worldwide population is possibly tainted with *M*TB, where most of TB cases originate from African and Asian regions particularly in South Africa and India which are slanted overwhelmingly toward the poor regions (WHO, 2014). There are also discrete dissimilarities in the influential risk factors between the non-industrial and industrial nations. TB cases in non-industrial nations are gathered in populated thickness, low financial status and poor residential conditions, though in the industrial nations the epidemics are led by foreign-born populations and animal-borne factors.

In Malaysia, the patterns of TB distribution are marginally expanding (MOH, 2015). Selangor, Sabah and Sarawak reported the three-top incidents of TB cases in 2015. The local study of TB cases in Peninsular Malaysia has discovered that the key centralization of TB is situated at central zones particularly those with a high population density, a low financial status and high urbanization (Abdul Rasam et al., 2018).

In order to define an integrated TB risk factors for a particular area is challenging task since every region in the world have own environments and of off course having unique risk factors. Therefore, assessing risk factors of TB contributing to Malaysia as shown in Table 1 need to be conducted using suitable modelling approaches, especially GIS and sociospatial method. In general, the factors that decide the likelihood of MTB transmission can be separated into a few epidemic stages from human body (exogenous factor) to human situations (endogenous factor). As indicated by CDC USA, (2011) and Narasimhan et al. (2013), human level conditions are predominant or settled factor of infectiousness, while outside or endogenous variables incorporate environmental or exposure conditions.

Table 1. Potential TB risk factors according to global and local review

Risk Factors of Global TB incidence	
Individual Level (exogenous/ internal factors)	Interpersonal/Community/Population Level (endogenous/ external factors)
- Human genetic/ biological, and immunization factors	- Socio economic status (Education, income, employment, crowding, sanitation and others)
- Bacillary load, proximity to an infectious case	- Biology and natural environment (Air pollution, land cover, elevation, insect, cow and others)
- Immunosuppressive conditions	- Physical / Built environment (Healthcare facilities/technology capability and others)
- Socioeconomic and behavioural factors	

(Source were modified from Narasimhan et al., 2013)

Spatial Risk Assessment of Tuberculosis Endemics

Intervention program of TB at the spot are yet essential to control the disease worldwide as addressed by agenda of WHO and Malaysian Ministry of Health. Unluckily, the present TB epidemics in Malaysia still report a slight rise in the rate drifts even though there are several guidelines as set in the Millennium Development Goal (MDG) 2015. A spatial method is recommended in this study as an inventive methodology in distinguishing approach of detecting the TB missing cases at the sites.

Spatial modelling method is a multiple process to quantity a phenomenon, for example, the hidden ways of the irresistible disease dispersion. Modelling is utilised in a specific field to evaluate a distribution pattern, connection and appraisal of a phenomena. The mix of social-based epidemic ideas and spatial modelling systems is a perfect route in assessing TB risk zones and their risk factors relationship, such as financial status, human and built environment.

Selecting a correct way for an epidemiological modelling can create a complex task. The spatial modelling used will vary contingent upon the point of the study, how well the disease dynamic is understood, the number and nature of data availability, and the modeler familiarity on the disease dynamic (Musenge et al., 2013). Spatial modelling methods are the elective methods in comprehension of the infection spread as proposed by previous researchers (Childs et al., 2013; Roberts, 2016).

Table 2 illustrates numerous techniques that can be used to model an infectious disease or epidemic phenomena even though the mechanisms underlying the spread of TB diseases is highly challenging and complex. Most epidemic modelling techniques are dominantly by statistical or mathematical techniques or framework, but Lloyd-Smith (2015) suggested three key criteria to produce a good model even though he had mentioned the specific techniques to be used: i) theory infection and dynamics, ii) methodology data analysis, integration, model and iii) policy absorption and development. These criteria will be fulfilled in the sociospatial modelling method that proposed in this study.

Table 2. Challenges and solution for selecting epidemic modelling method

Authors, Title	Challenge and Suggestion
Childs et al. (2015)	Critical knowledge gaps of spatial and temporal variation in dynamics disease predominance and transmission force, have pathogen connections and infection result, and human behaviour. Therefore, its needs to understand the theory and real infection transmission and experienced modellers to certify that the analytical work guides to relevant policy and better control of all.
Lloyd-Smith (2015)	Classes of infections, getting elements, information examination and incorporation, modelling approach, and the interface with policy. It suggests developing a better and current infectious disease dynamic model.
Roberts et al. (2014)	Two challenges concern the uses and limitations of deterministic models as approximations to stochastic systems, super infection is possible; models Therefore, integrating spatial and statistical for modelling TB is an ideal solution.

(Sources from Childs et al. (2015); Lloyd-Smith (2015) and Roberts et al. (2014))

Spatial risk assessment model in spatial epidemiology (SE) such as a spatial or GIS perspective is commonly comparative as far as setting to medical geography. Chang (2011) defined a model as a disentangled portrayal of a phenomena or a system for specific applications. This model has advantages in analysing disease phenomena (Pfeiffer, 2008; Lawson, 1999). Chang (2011) proposed a powerful GIS or spatial model as a prescient model as having uncommon qualities, for example, prescriptive, stochastic and deductive or hypothetical procedures. Spatial entities will also likewise assume a substantial role in demonstrating social populace and ecological situations of infectious diseases.as study in the local waterborne diseases of Malaysia (Abdul Rasam et al., 2011).

MATERIALS AND METHODS

A spatial epidemiology framework (Pfeiffer, 2008) and GIS-multi-criteria decision making (MCDM) method (Chang, 2011; Malczewski, 2000) are mainly utilised in this spatial modelling method. The main stages cover framework construction, data acquisition, risk assessment analysis and modelling of TB disease risk as illustrated in Figure 1.

Research Framework of SocioSpatial Risk Assessment of Tuberculosis

Sociospatial risk assessment approach used in this study consists of two frameworks. First framework clarifies theoretical framework of a local TB transmission that is developed from firm reviews on TB risk factors. The fundamental inner and outer risk factors of the TB are also included, namely urbanisation, distance to factory, socioeconomic status (SES), high-risk group, human movement or mobility, type of house, distance to healthcare centres, and number of populations. These variables were used to decide chance pace of TB modelling in the study area. Academic papers and the health reports were additionally utilized in choosing neighbourhood chance factors dependent on a GIS-MCDM method.
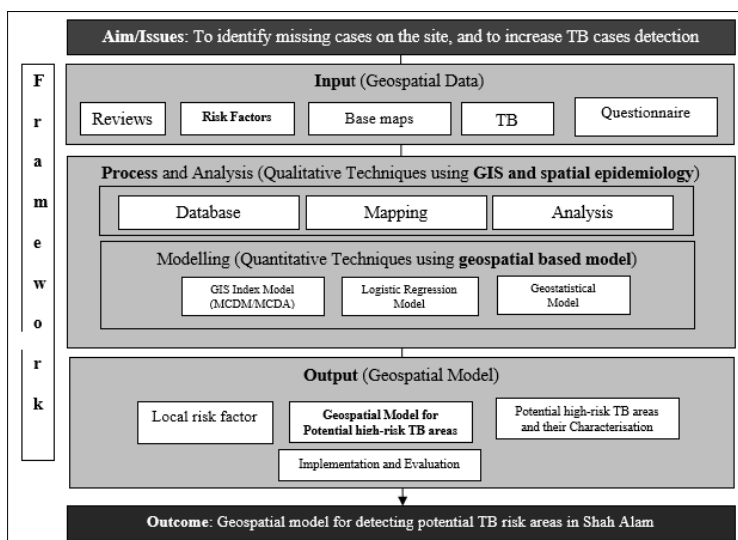
Figure 1. Sociospatial-based framework in developing TB risk assessment

Second framework underscores on assurance of risk level of the endemic areas. The potential risk or endemic areas of TB are portrayed by picked risk factors and a five-chance scale, whereby 1 (dull green) and 5 (red) show the most negligible and most dumbfounding potential risk spots. The confirmation of the risk scale is united from GIS-MCDA and logistic regression method. The thought resembles the characterizing of high burden nations by WHO and high chance gathering of TB in Selangor State Health Department (JKN) Selangor.

The two frameworks are indispensable to characterize risk centralization of TB risk zones and focusing on the conceivable risk regions in the investigation zone as represented in Figure 2. Risk attention in this disease can be portrayed as any single presentation or gathering exposures with the likelihood to convey infection adequately broad towards undermining people's prosperity or its ability to keep up its areas.
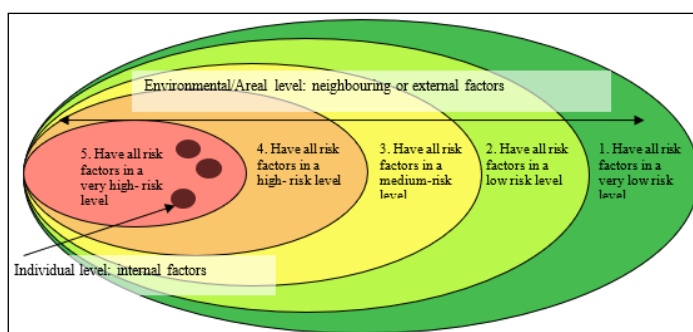

Figure 2. A five-risk scale used in determining TB risk areas

Data Collection and Methods

Shah Alam as presented in Figure 3 is chosen as study area since it presently has a decent variety of socio-environment related TB risk variables. Meanwhile, the information and instruments utilised in this investigation join the disease cases, spatial-ecological information for risk variables and geostatistical packages with SPSS and ArcGIS.
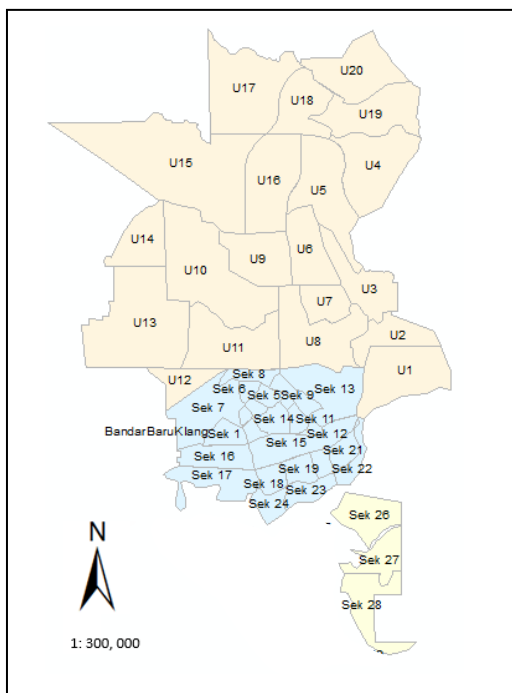
Figure 3. Map of Shah Alam

Primary data were collected through four experienced officers from the TB Unit of Petaling District Health Office, PKD) and site visit at proposed endemic areas of the study area. Meanwhile, the secondary data used in this investigation are TB cases from 2013 to 2015 gathered from MyTB framework, JKN Selangor. Spatial information of eight risk factors, in particular urbanisation, distance to factory (in meters), income status (RM), risk group, human mobility, house, distance to healthcare centres (in metres), and number of populations were also collected from related agencies. Base maps of the study were acquired from Google Earth, topographic map and land use maps.

Spatial Data Process and Assessment

This phase includes the proposed modelling method using GIS-MCDA, logistic regression, and geostatistical model. This key rational framework of the study is also creatively integrated to create a spatial risk map as recommended by earlier researchers (Chang, 2011; Pfeiffer et al., 2008; Longley et al., 2005).

GIS-MCDA method involves three principle stages as delineated in equation (1) (Chang, 2011; Malczewski, 2000; Abdul Rasam et al., 2017) i) choice of risk factors, ii) computation of risk factor weights and iii) evoking local risk factors. Every factor was legitimately positioned (from 1 to 8) by the chose specialists from PKD and afterward the qualities or weight were standardised utilizing rank sum system as shown in equation (1) from 0 to 1.

$$W_j = \frac{n - r_j + 1}{\sum (n - r_k + 1)}$$

$$(1)$$

Where;

Wj = the normalized weight for the jth criterion
n   = the number of criteria under consideration
r_j = the rank position of the criterion
         each of the criterion is weighted
         and then normalized by the sum of all weights
         and that is $\Sigma (n - r_k + 1)$.

The next stage is evoking the prominent TB risk factors and weights based to MCDA. The number of consistent weight (W_j) were increased with each risk factor risk value. The total of risk values was then computed (as Total_risk Rank [DV]) using a Likert scale by 1 to 5; Scale 1 and 5 explain the lowest and the highest risk of the TB risk correspondingly. The values of 1-5 were included to the TB database and logistic outcome using 1 (Yes Risk) and 0 (No Risk) for the disease mapping. Three tables in block 1 reports of regression were principally stated as the statistical tests of decency to decide which model is appropriate for the study area.

Inverse Distance Weights (IDW) in geostatistical mapping was then applied for scrutinising TB disease scenario in the study area. A developed five-risk scale of the existing TB cases or control points as shown in Figure 2 were interpolated to quantify the undetermined surface areas. The residual means standard error (RMSE) used to determine the accuracy of the risk map of local TB cases.

RESULTS AND DISCUSSION

Spatial Assessment of Risk Factors and Targeted Endemics Locations of TB

The outcome of risk model has indicated that the chosen risk factors of TB cases were substantially related to the probability of potential TB risk locations (p=0.008, Wald test).The outcome offers the coefficients for intercept = -46.807 and risk factors with their coefficients. These coefficients were then inserted in the regression equation (2) to guess the probability of risk model by converting odds to probabilities (Y=Odds/1+Odds or $1/1+exp^{-(\beta0+ \beta1x1 + ...)}$. The Log_Outcome (0-1) was contained in the database as probability of potential TB risk locations (Y) and operated as control points to calculate risk map using IDW in a geostatistical environment. The values of the outcome in the equation are vital to categorize the local TB risk TB areas.

Model of TB Risk Hotspot (Y) = 1 / (1 + exp (-46.807 + 1.161 (Urbanisation)
+ 2.061 (Population) + 1.715 (House Condition) + 2.395 (SES)
+ 2.841 (Risk Group) + 1.598 (Factory Distance) + 3.654 (Risk Human Mobility)))   (2)

Pertaining to influential risk factors on the local TB cases. It was found that 7 out of 8 ordinary risk factors are enticing components in the cases utilizing multi-criteria and regression result. It includes factory distance, urban areas, house type, high-risk group, income status, mobility and population. The quantity of populace in a house is not a measurably noteworthy factor, yet as indicated by the local specialists, this factor ought to be considered in characterizing the genuine impact of TB in the local condition. While the

distance of healthcare is not statistically significant even though it is a typical factor of TB cases dependent on worldwide and local experts' viewpoint.

The selection of actual risk factors of the study area is the explanation behind the advancement of the proposed model. The factors used for evaluating and mapping of potential TB risk areas by utilising GIS-based logistics regression approach. Risk appraisal utilising a logistic technique shows that statistical test exhibits that a strong association among expectation and grouping (p=0.797), and the characterization is accurately finished at 93.2%. Furthermore, human-based factors particularly human movement made a huge important to forecast rather than biophysical factors.

In a common scenario, human-based factors are more driving elements than biophysical factors as found in past research (Narasimhan et al.,2013; Abdul Rasam et al., 2018). Regression findings likewise unmistakably state by showing that the Coefficient (ß) of risk factors as indicated by ranking incorporates Score_Mob (3.654), Score_Gro (2.841), Score_Soc (2.395) and Score_Peo (2.061). While biophysical factors just noted least Coefficient (ß, for example, Score_Hou (1.715), Score_Fac (1.598), and Score_Urb (1.161), urbanization is really not huge, however in term of the local officers it ought to be one of the significant factors in local context. The location of healthcare centres is not considered as a factor because of the way that it is statistically insignificant, as indicated the results of GIS-MCDM.

Spatial Mapping of Targeted TB Endemic Areas

Figure 4 illustrates the estimated risk spots of TB in the study area by integrating a GIS-logistic regression and geostatistical model. These projected areas have possible risk of 65 %, while 35% of non-possible risk areas. These anticipated risk zones led in geostatistical model are additionally predictable with results obtained in the regression model where the study areas have a medium-high risk of TB. The risk regions, as projected, are spread at northern zone (Section U20 and U19), focal zone (Section 17) and southern zone (Section 26 and 27), with the probability of having a significant level of TB spread and endemic.

The non-risk regions are generally placed at focal zone and a couple of zones at southern and northern zone. Spatial clustering of the risk zones is visited by individuals who are united at residential, social and economic areas as revealed from the subjective discoveries of MCDM. Human or anthropogenic factors are the fundamental indicators of TB particularly to individuals who have high-risk attributes, for example, a debilitate resistant system, tobacco smoker, and a low-income population (WHO, 2015).

The potential risk areas have resemblances of spatial risk factor identified with TB cases, for example, swarmed populace and high-risk gathering particularly from medium and low SES and immigrant workers. These areas are additionally in near to the factory zones where there are enormous quantities of foreign-borne laborers, other than being removed from medicinal services focuses that give TB facilities (x-ray and other TB discovery items), with the exception of in the focal locales of S7 and S19.
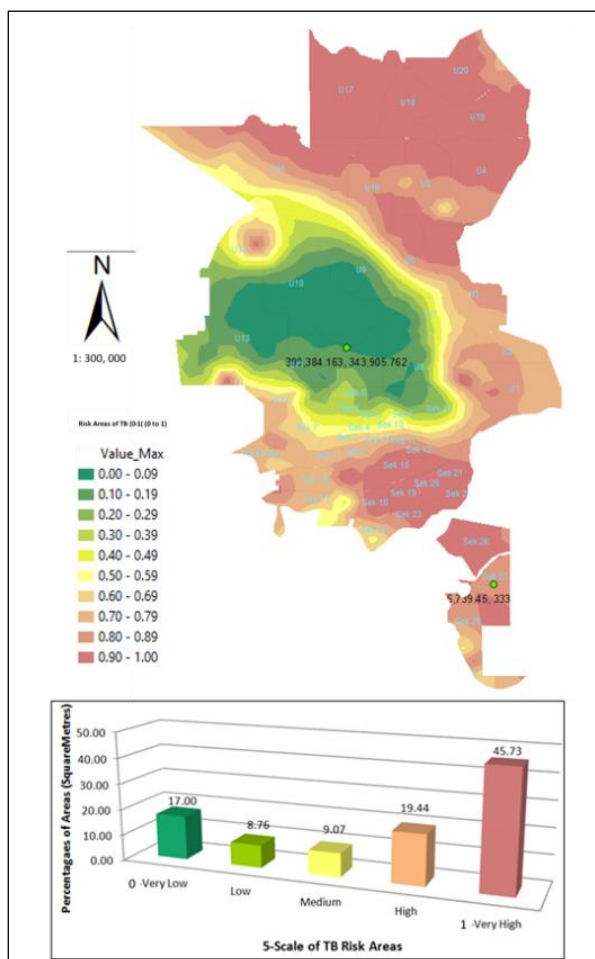
Figure 4. Map of projected TB endemic areas in Shah Alam using the spatial risk assessment method

The conflicting factors are the types of house and number of populations which are not obviously identified with TB neighbourhood since majority the sections are developing areas. The areas are still in the locations of a village except for Section U13, U5, U6, and U17 which are experiencing advancement of urbanization. Another scene highlight incorporates a disarranged settlement example or town condition explicitly in northern zone, southern zone and not many in central zone.

Spatial Risk Assessment for Targeting Targeted TB Endemic Concentration

The huge implications of this investigation are to evaluate the risk factors and map of the local TB utilizing sociospatial approach for anticipating the possible endemic areas and screening program in the region. This sociospatial-based technique has fortified the intensity of risk estimation for potentially dangerous TB regions because of it covers parts of local spatial knowledge and spatial uncertainty. This proposed approach has additionally viewed as a widespread risk mapping for recognizing high-chance TB zones. By evaluating the spatial risk elements of TB in Shah Alam, the potential TB endemic territories in the zone could be characterized and it can help the PKD, Petaling in directing TB screening programmes at the site viably.

CONCLUSION

Intensifying current methods in monitoring the disperse of TB cases at the site is one of the main agendas of Malaysian Ministry of Health. Detecting potential risk area of TB is not a simple aspect, while the relevant approaches for infection causality likewise need fastidious connection of variables and settings before a disease happens in a real site. Thus, combining spatial-based method with epidemic based approach in the study is an ideal solution in order to holistically identify TB cases on a human body and ecological condition. Spatial risk assessment of TB in Shah Alam found out that human based indicators are more dominant factors than biophysical indicators, especially the factors of high human mobility, high-risk group and low social status. In addition, the spatial method has demonstrated that it could be employed in Malaysia since it has good attributes in locally determining the possible risk factors and hotspots of TB cases.

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AN EXPLORATION OF THE RELATIONSHIP BETWEEN THE SAFETY AND HEALTH COST DIMENSIONS AND THE ACCIDENT COSTS INCURRED BY THE EMPLOYERS OF URBAN RAIL INFRASTRUCTURE PROJECTS

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Abstract
The Klang Valley Mass Rapid Transit (KVMRT) System is set to be one of the mega projects in Malaysia. The occurrences of the accidents for the project create economic issues for our society. The awareness of accident costs is absent because the stakeholders always leave the matters to the insurance company. They are ignorant of the cost of an accident without realising the greatness of its impacts on the industry and the country. Therefore, this study aims to determine the relationship between accident costs and the factors influencing the accident costs of urban rail infrastructure projects to the Employer. All these factors are known as safety and health cost dimensions. For this research, the Employer, also known as a Contractor, is the person who bears the accident costs (direct and indirect costs) of the project. Multiple regression was performed on the sixty-two (62) accident cases from the MRT 1 SBK (Sungai Buloh-Kajang) Line Projects. The finding shows that the types of accident classifications, the day of the stop work order and location of the body's injury were significantly affected to the total accident costs. These findings could heighten the importance of the effect of an accident on the Employer's company's economics and budgeting.

Keywords: *Safety and Health Costs; Cost Dimensions; Accident Costs; Employer; Urban Rail Infrastructure Projects.*

INTRODUCTION

When the construction industry is compared to other industries, it is quite unique as the majority of the construction activities most often take place in the outdoors and under conditions which are not conducive to the safety and health of the workers (Misnan & Mohammed, 2007). There are numerous kinds of dangers that are identified as being involved during the various kinds of construction projects going on at any given time. The construction of the most prestigious urban rail infrastructure project in Malaysia, known as the Mass Rapid Transit (MRT) system has also experienced its share of hazards. The MRT accident reports for the MRT 1 Project have recorded a thousand incident cases since the beginning of the project in 2011.

Accidents, both non-fatal and fatal, have had an extremely significant impact on the financial burden faced by the stakeholders of the MRT project. Substantial losses have been incurred by all the parties involved, which include the employers, victims and their families,

and society as a whole (Davies & Teasedale, 1994; Jallon et al., 2011a; Goestsch, 2013; Pellicer et al., 2014; Feng et al., 2015: and Asan, n.d.).

Additionly, accidents can also have an impact on the construction company's profit and loss statements because of the damages to property, equipment, and productivity, as well as the morale of the employees, which result in delays to the completion of the project. These accidents result in two types of costs, namely the most obvious direct costs which are directly measurable like sick leave, medical treatment, etc. and the less obvious indirect costs which are not directly measurable.

Nonetheless, it is quite a challenge to quantify these costs involved with accidents. Jallon, et al. (2011b) reported that a lot of researchers have found it difficult to provide firms with a reliable technique to make accurate measures of these costs because the cost assessment is very complex (Dorman, 2000; Gavious et al., 2009). Jallon et al. (2011b) also explained that, no indirect cost evaluation technique is generalisable/universal. Therefore, employers require solid, quantifiable data which comprise the real costs involved with the accidents.

Although the MRT Projects have experienced a number of occupational accidents, to the best of our knowledge no one has conducted any research to specifically measure the associated costs of this type of accident. Thus, this study will bridge this gap through the use of quantitative methods to measure the economic costs resulting from occupational accidents. As a result, this study has aimed to a certain the relationships amongst the cost of accidents and the factors influencing the costs of accidents incurred by the employers with regards to the urban rail infrastructure projects. These factors are known as the cost dimensions of health and safety.

DEVELOPMENT OF URBAN RAIL INFRASTRUCTURE PROJECTS IN MALAYSIA

Recently, Malaysia had excelled in another urban rail infrastructure project with the completion of the Mass Rapid Transit (MRT) 1 line from Sungai Buloh to Kajang in July 2017. Other rail infrastructure projects which are currently in the construction progress are the MRT 2 line, from Serdang to Putrajaya, Light Rail Transit (LRT) 3 line and LRT Bandar Utama to Klang line.

The MRT 1 (SBK) Line Project begins from Sungai Buloh and runs through the city centre of Kuala Lumpur before ending in Kajang. Other than that, the spanning of the MRT 1 (SBK) Line Project is 51 km with a total of 31 stations along its route. A total of 41.5 km of the 51 km long of rail track is an elevated track and 9.5 km is underground featuring both elevated and underground stations. There are 24 elevated stations and seven underground stations.

The MRT 2 (SSP Line) Project connects Sungai Buloh, Serdang and Putrajaya. The MRT 2 (SSP Line) serves as a corridor that stretches from Sungai Buloh via the Central Business District of Kuala Lumpur to Bandar Malaysia, Kuchai Lama and Serdang before ending at Putrajaya. The 52.2 km line includes a 13.5 km underground section (between Jalan Ipoh and Kuchai Lama) and 38.7 km of viaduct. Besides that, there will be 37 stations, 26 of which will be elevated and 11 underground stations. The stations will include Sri Damansara,

Kepong, Kampung Batu, Jalan Sultan Azlan Shah, Jalan Tun Razak, KLCC, Tun Razak Exchange, Kuchai Lama, Seri Kembangan, and Cyberjaya (MRT Annual Progress Report, 2013).

The LRT 3-line route is divided into three main segments. The first segment will begin from Bandar Utama and end at the proposed Persada Projek Lebuhraya Utara Selatan (PLUS) station. It will pass through Damansara Utama, Taman Kayu Ara Indah, Puncak Damansara Condominium and Dataran Prima areas. Segment two will start from Persada PLUS Station and pass through the Temasya, Glenmarie, Shah Alam town centre, UiTM campus, and I-City Station before ending at Bukit Raja. The segment will include a 2 km underground section. The third segment of the line, situated in the Majlis Perbandaran Kelang (MPK) area, will start from Bukit Raja and pass through Kawasan 17, Jalan Meru, Klang town and Bandar Botanic to end at Johan Setia (Railway Technology, n.d.).

The LRT3 will have 26 stations, five of which will be integrated stations to provide an enhanced transport link for commuters and easy interchange with the current rail system. These stations will be integrated with MRT Bandar Utama, Kelana Jaya Line, Bus Rapid Transit (BRT) Federal Line, and the Keretapi Tanah Melayu (KTM) Komuter Port Klang Line, and feature a passenger information display system (PIDS), fire protection systems, closed-circuit televisions (CCTV) and automatic fare collection (AFC) systems. Ten of the stations on the line will be equipped with parking areas accommodating approximately 6,000 cars. All stations will be equipped with sustainable solutions, including rainwater harvesting technology, noise reduction and energy management systems, and natural ventilation.

DETERMINANTS OF SAFETY & HEALTH COST PARAMETERS

When calculating the costs of accidents occurring in the urban rail infrastructure projects A large selection of various parameters are needed. To verify the suitability of the determinants of the safety and health cost bearers, dimensions, components, and categories of this study of the accident cost estimation of urban rail infrastructure projects, a further validation from experts was required.

Determinants of S&H Cost Bearers

Based on the review of the safety and health cost models found in previous research works, the cost bearers for the allocation of the safety and health costs were determined. The costs are borne by the employees, the employer, and the government/community/societies when the accidents occur at the work site. The cost bearers have been identified to explain, in detail, which parties would bear the costs related to health and safety from the start of the project until it is completed.

A similar classification of the bearers of the costs was found in Aaltonen et al., 1996; Hrymak & Pérezgonzález, 2007; Shalini, 2009; Health and Safety Executive, 2014; Safe Work Australia, 2015; and KLIACS JKKP, 2013. The three key stakeholders that were determined previously to be responsible in handling the allocations of the health and safety costs for all work-related injuries in all types of business sectors were the employee, employer, and government.

However, for this research, the employer as the cost bearer was the researcher's only focus. The employer, also referred to as the contractor, is the party who is usually responsible for bearing most of the burden for short-term and minor accidents. The cost factors that are borne by the contractor consist of both the direct costs (insurable) and the indirect costs (uninsurable).

Determinants of the S&H Cost Components

Lopez-Alonso et al. (2013) classified the costs related to health and safety in the workplace into three categories, namely non-safety costs, safety costs, and other extraordinary costs. Yet there have been other scholars who have analysed two well-known safety and health cost dimensions, namely accidents costs and prevention costs (Cheng et al., 2012; Gurcanli et al., 2015a; and LaBelle, 2000). Thus, there are three classifications for the costs involved with safety and health. They are the costs for prevention of accidents and the actual accident, and other extraordinary costs. The accident costs were the focus of this research.

Tangible costs and intangible costs are the two categories for accident costs. When an accident happens at the work site, the costs associated with the accident that can be calculated or estimated by way of traditional cost accounting techniques are known as tangible costs. However, accident costs that cannot be measured in economic terms, or for which no performance indices are available to determine their the impact on the organisation, for example the damage of the company's image, labour disputes, low morale of the workers, or market loss, are known as intangible costs (Gosselin, 2004).

The accident costs in regards to Malaysia are categorised at indirect costs and direct costs (KLIACS JKKP, 2013). Both these costs (indirect and direct) have been employed in this study as they are suitable in regard to the terms commonly used in the country. The costs directly accrued when an accident occurs, related to the treatment of any injury as well as any compensation the employer offers to the worker due to being injured, are known as the direct costs. These direct accident costs are usually the costs which are insurable and covered by SOCSO and the firm's insurance company. These costs are very easily calculated. Examples of these costs are those for any treatment at the work site, for the hospital, and for property damage/repair.

The costs which cannot be measured in economic terms or for which no performance indices are available to measure the organisational impacts are known as indirect costs. They result from the accident and can be quite costly. However, calculation of these costs is difficult and they are usually uninsurable (Gosselin, 2004).

There are several different definitions of uninsured or indirect costs; but in general, these costs are considered as those which comprise all of the costs for items which are not covered under the worker's compensation insurance policy. There are several elements that make up the indirect costs of accidents. They include loss related to medical expenses, loss because of the worker being injured, loss because of the inefficiency of the worker upon resuming work after having just recovered from an injury, loss of the employees' productivity, loss because of idle machinery or equipment or because of damaged equipment, plants or materials, and loss because of fines and other legal expenses.

Determinants of S&H Cost Dimensions

The elements that influence the safety costs and health costs in construction projects are known as the dimensions which influence the direct and indirect costs of the accident. Each of these dimensions of cost has been grouped into several categories according to previous related studies. A review and summary of the dimensions are presented in Table 1.

Table 1. Summary of Safety and Health Cost Dimensions & Categories

Author	S&H Cost Dimensions
Lopez-Alonso et al. (2013)	Accident rate (phase of project implementation)
Feng (2015)	Accident frequency rate, Project hazard level
Jallon et al. (2011a)	Type of accident, Number of lost days, and Number of days of temporary assignment
Waehrer et al. (2007)	Event of injury
November (2015)	Direct costs-severity of the incident, Indirect Costs-duration of absence and nature
Shalini (2009)	Days of absence from work (medical leave), Average number of days admitted in general ward, Number of days and income lost
Forteza et al. (2017)	Number of days lost, Temporary assignment and productivity
Tang et al. (2017)	Length of hospital stay in a government hospital
Ministry of Health Malaysia (2017)	Average Length of Stay in Hospital (Days)
KLIACS JKKP (2013)	Zone of accident

METHODOLOGY

The methodology is the plan of action that dictates the choice and use of methods, either qualitative or quantitative. The quantitative approach to this research was considered because it provides strong evidence for researchers to address accident costs. The respondents for this study (members of the KVMRT project' safety personnel) were asked to provide answers for a questionnaire regarding the accident incidents that had taken place during the construction of their projects. The respondents had to give information or make estimates of the accident cost factors in regard to the questions presented in the questionnaire.

This study was carried out using the contractors of the work package (WPC) from the viaduct (guideway) package for the KVMRT Sungai Buloh Kajang (SBK) Line Project. Eight members of the WPC, representing eight projects (V1-V8), were chosen as the study's sample population. As reported in regard to the above projects, 68 of the accident cases, consisting of Class 8 (Dangerous Occurrence), Class 3 (Temporary Disability), Class 2 (Permanent Disability), and Class 1 (Fatality), took place whilst those projects were under construction. The response rate was a total of 62 questionnaires being returned.

The multiple regression analysis is commonly utilised for analysis of the relationships amongst variables by way of the Statistical Package for Social Sciences (SPSS) software. In order to reduce the variability of the data as well as to make the data conform more closely to the normal distribution, the log transformation is utilised for continuous data. If the data are categorical, then multiple regression is utilised with dummy variables. In this study, this robust analysis was employed so that the variables that had the most significant influence on the accident costs could be identified.

To guarantee the explainability and reliability of the MRA models, five tests were performed. These were the correlation variance inflation factors (VIF), pairwise correlation matrix, F-test, T-test, and coefficient of determination (R^2).

Measurements of the Major Variables

Safety & Health Cost Components

The major variables included the safety & health cost factors at the time of the accident. These included the hospital and other medical treatment costs, fine costs, and damage/repair costs. On the other hand, the indirect accident costs included twelve cost factors consisting of the accident costs, uninsured medical costs, legal & administrative costs, replacement costs, productivity costs, schedule costs, work in progress costs, recruiting costs, management costs, corrective action costs, reputation/company image costs, and ex-gratia costs.

Safety & Health Cost Dimensions & Categories

Table 2. Major Variables of Accident Costs Components, Dimensions and Categories

Safety & Health Cost Components	S&H Costs Dimensions	S&H Costs Categories
Direct Accident Costs: 1) Medical Treatment at Site Costs 2) Hospital Costs 3) Damage/Repair Costs 4) Fine Costs	(AC)	1 = Class 1 (Fatality), 2 = Class 2 (Permanent Disability), 3 = Class 3 (Temporary Disability), 4 = Class 8 (Dangerous Occurrence)
Indirect Accident Costs: 1) Accident Report Costs	(SWO)	1 = 0-14 days, 2 = 15-30 days, 3 = >30 days
2) Replacement Costs 3) Administration Costs 4) Schedule Costs 5) Productivity Loss Costs 6) Work in Progress Costs	(ML)	1 = 0-3 days, 2 = 4-7 days, 3 = 8-14 days, 4 = 15-30 days, 5 = >30 days
7) Compensation to Victim/Ex-Gratia Costs 8) Recruiting Costs	(HA)	1 = 0-20 days, 2 = 21-30 days, 3 = >30 days
9) Uninsured Medical Costs 10) Management Costs 11) Corrective Action Costs 12) Reputation Loss Costs	(LBI)	1 = No injury, 2 = Upper limb, 3 = Head, 4 = Trunk, 5 = Lower Limb, 6 = Multiple, 7 = Neck

Through the literature review, the researchers were able to determine five major variables for the dimensions of the direct health and safety costs. These were the accident classification (AC) type, the day of the medical leave (ML), the day of the hospital admission (HA), the day of the stop-work order (SWO), and the locations of the injuries on the body (LBI). They should all be included in the scales that deal with the estimation of the accident costs as presented in Table 2.

RESULTS AND DISCUSSIONS

Pairwise Correlation Matrix

The pairwise correlation matrix is quite useful as a predictor of the relationships of the variables between two datasets that involve dependence. When determining multicollinearity, this test is also utilised as the first stage in its detection. Employing the multicollinearity test allows the researcher to observe the correlation present between each of the explanatory variables. One variable is statistically independent from another if the findings show that no relationship exists between the explanatory variables (Brooks & Chris, 2010).

Highly correlated explanatory variables will lead to an estimator that is not only unreliable but also unstable. In Table 3, it can be seen that none of the variables had a collinearity index greater than 0.8. According to Ismail et al. (2009), no guidelines exist to indicate which of the variables is causing a problem when two variables have been found to possess a high collinearity index greater than 0.8.

Table 3. Correlation Indices

	AC	SWO	ML	HA	LBI	TAC
AC	**1**					
SWO	.333**	**1**				
ML	.055	-.063	**1**			
HA	.333**	-.016	.261*	**1**		
LBI	.416**	-.038	.005	.432**	**1**	
TAC	.449**	.218	.048	.175	.405**	**1**

Variance Inflation Factors (VIF)

The VIF values of the independent variables was also utilised in this study to provide a step for double-checking the detection of multicollinearity. When using VIF values, two opinions exist in the indication of high multicollinearity. The first opinion belongs to O'brien (2007) who stated that, VIF values less than 10 show low multicollinearity, whilst the second opinion belongs to Des Rosiers et al. (2000) and Theriault et al. (2003) who both stated that VIF values less than 5 show low multicollinearity.

On the other hand, according to Ismail et al. (2009), there is no basis, theoretically, for the choice of using the below 10 VIF value or below 5 for the detection of multicollinearity. Thus, the researchers of this study decided to adopt the value of 10 for the detection of suspicious variables in regard to multicollinearity. As seen in Table 4, for each of the regressors, the VIF value was less than 5 showing that no serious multicollinearity existed amongst them.

Table 4. Summary of the Multicollinearity Test

Dependent Variable	Independent Variable	VIF
Total Accident Costs (TAC)	(AC)	1.480
	(SWO)	1.188
	(ML)	1.096
	(HA)	1.388
	(LBI)	1.435

The Coefficient of Determination (R²)

The coefficient of determination (R^2) is the percentage of the variance present in the dependent variable that is explained collectively by the independent variables. It uses a convenient 0-100% scale for measuring how strong the relationship between the dependent variable and the model is. As Table 5 indicates, .446 was the value of the coefficient of determination (R^2) for the MRA model of accident costs. That value means that 44.6% of the variation in the dependent variable was explained by the independent variables of the accident costs.

Table 5. Summary of the Basic Statistics of R²

MRA Model	R^2	Adj R^2	Sig
Total Accident Costs	.446	.396	.000

F-test

Table 6 presents the ANOVA test results. From the results, it can be seen that 0.000 was the p-value of the total accident costs. As this value was lower than the alpha level (0.05), it can be concluded that the model tested would provide a better fit as compared to the intercept-only model (a regression model with no predictors).

Table 6. ANOVA Test Results of the Total Accident Costs

MRA Model	F-Value	Sig.
Total Accident Costs	9.004	.000

T-test

The t-test result in Table 7 shows the significant variables for the MRA model. Three out of the five variables, which had been analysed for the total costs of the accident, were found to be significant. It shows that the total costs of the accident (both direct & indirect) had been significantly influenced by the AC ($p < 0.05$), LBI ($p < 0.01$), and SWO ($p < 0.01$). That means, these variables possessed strong relationships with the total costs of the accident which the employer incurred.

It was revealed by the results that the different accident classification types of (AC) ($\beta=.493$), the different locations of the injuries on the body (LBI) ($\beta=.714$), and the number of days for the stop-work order (SWO) ($\beta=1.827$) affected the total accident costs.

This result provides further reinforcement of the idea that the accident costs that an employer incurs are related to the results in other studies. Jallon et al. (2011b) reported that, when calculating the indirect costs of an accident,the number of days lost and the accident category are both factors that need to be included. Furthermore, Shalini (2009) came to the conclusion that the number of days a worker is admitted in the hospital has a relationship with how severe the accident is when the economic costs of an occupational accident are being measured.

Table 7. The t-values of the MRA Model

Dependent Variable	Independent Variable	Coefficient	t-value	Sig.
Total Accident Costs	(AC)	.493	2.322	.024
(lgTAC)	(SWO)	1.827	3.605	.001
	(ML)	.068	.436	.665
	(HA)	-.450	-.822	.415
	(LBI)	.714	2.773	.008

Other studies have been found similar results. Safe Work Australia (2015); Forteza et al. (2017); and Tang et al. (2017) also reported that of all these factors had significant impacts on the total accident costs, both the indirect and direct costs. Moreover, Ministry of Health (2017) described the occupational injury costs as being represented by three influential factors, namely the industry level, the event causing the injury, and the characteristics of the injured worker.

Contrary to these results, the Occupational Safety and Health (OSH) Calculator developed by the Department of Occupational Safety and Health was used in a study that determined a different factor that had significant effect on the accident costs. That was the zone (location) of the accident factor (KLIACS JKKP, 2013).

CONCLUSION

This paper has provided valuable insights into the relationships amongst the costs of accidents and the cost dimensions of safety and health. The conclusion can be made that, the accident classification type, the day the stop-work order is made, and the location of the injury on the body have been found to be significantly related to the accident costs in total. These results could aid employers in making estimates of their accident costs, as well as increase their awareness of how important the impact of accidents on the companies' budgeting and overall economics is. Furthermore, it could increase the awareness of the need to improve the preventive measures taken for a construction project. When a reliable and accurate estimate is made of accident costs on construction projects, it may help employers to plan more appropriately to invest in more adequate safety measures.

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