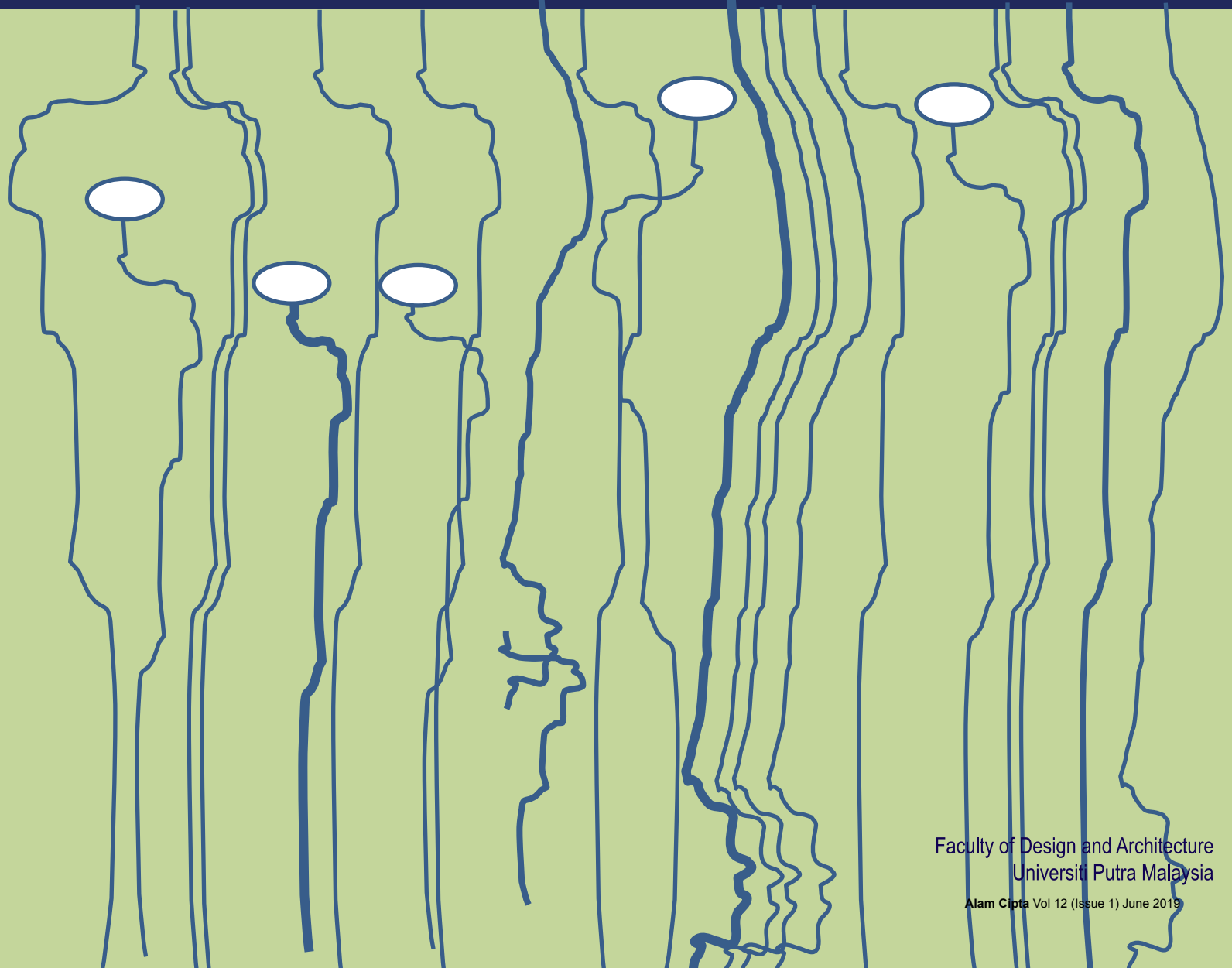


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EDITORIAL PREFACE

THREE COMPONENTS OF SUSTAINABILITY FROM THE MICRO CONTEXT OF ALAM CIPTA ARTICLES SUHARDI MAULAN^{1,2}

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²*Department of Landscape Architecture, Faculty of Design and Architecture, University Putra Malaysia*

The scope of ALAM CIPTA is about sustainability in the context of planning and design. Brundtland Commission Report in 1987 coin the term “sustainability” and since then, it is a norm to accept that sustainability comprises of three main components namely environment, people and economy. These three tenets have been widely used as a basis to formulate issue related to development either at the global or national scale. The most recent is Sustainable Development Goal (SDG) by United Nations which set 17 goals that should be achieved by the year 2030.

However, it is very important to discuss each component of sustainability thoroughly to ensure the main goal of sustainable development which is to have the “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland, 1987). Therefore for June 2019 Alam Cipta issue, ten articles are published. The articles can be categorized according to their inclination towards each component of sustainability.

For environmental component, four articles were published and two of them are related to buildings design specifically on daylighting and thermal comfort. It is crucial to understand how building design relates to environmental sustainability. Good daylighting and the thermal environment will ensure energy consumption by the buildings to be less especially in the tropic where heat is the main issue that needs to be solved. The other two articles are about waste management. As the technology of managing the waste are continuously improved, the question lingers on how to reuse the old landfilled. In a developed country, landfilled have been converted to be a park but how about in developing countries. Is the issue about leachate and gas can be resolved? In addition, wastes from the farms are another issue that needs to be tackled. Whilst it is a common knowledge to use farms’ wastes as fertilizer but the process of collecting the waste is important as well. An industrial design may offer clues on how the process can be done.

For people components of sustainability, five articles were published. Two articles discussed people understanding or perception for design namely buildings’ façades and products. The appearance of the design artifacts is crucial to prolong products life cycle. It is more crucial if we discussed in the context of sustainability as people are the main players and the relationship of the design appearance and sustainability is key factors to ensure people supports and awareness of sustainability remain intact. Two articles focus on the managing conflict of public spaces. In the context of inter-ethnic relationship, multi ethnic perception on design is crucial to be understood. Moreover, minority or special groups such as women also need special study especially in relation to the usages of public spaces such as a park. We also acknowledge that the understanding of sustainability and minimizing conflict could be achieved through education especially at the early stages; therefore one article specially discusses how toys design is crucial to increase social competency.

One article discusses sustainability from the perspective of the economy, in specific, creative economy in the developing world. Many efforts have been done by many countries to make creativity and innovation as a basis for economic development but how they has been carried out and have they been successful? By looking at Cyberjaya near Kuala Lumpur, Malaysia, the author critically analyzed the development of the city and provide suggestion how academia, government and industries players can joint force to ensure the successfulness of such an effort.

ALAM CIPTA accepts articles that concern with architecture, art, and design related to the process, methods, techniques, practices, and theories in expanding our understanding to ensure sustainability. All articles in this issue provide very relevant knowledge about how can we plan and design our environment, built environment and products better. On behalf of the editors, I would like to thanks all the authors and reviewers who had work very hard. Your contribution is very valuable as it helps the advancement and dissemination of knowledge to “cipta” [create] a better world. We encourage your feedback at alamciptaeditor@upm.edu.my and thank you for your continuous support of ALAM CIPTA.

DAYLIGHT SIMULATION OF DIFFERENT LIGHT WELL TYPES IN SINGLE STORY TERRACE HOUSES

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ABSTRACT

Indoor environment quality inside a house is greatly dependent upon good daylighting. Thus, an opening plays an important role in influencing the effectiveness of daylight distribution in building. A commonly used element in terrace house to admit natural lighting is light well. This study reviews different light wells typology in single story terrace houses, conducts daylighting simulations of different light well types and proposes daylighting rules of thumb for light wells. There are several types of light wells simulated for daylighting performances in this study. Light well models were simulated using Integrated Environmental Solution - Virtual Environmental (IES_VE) application software. Regression analysis was then carried out to find correlation between the measurements obtained in the daylighting simulation and the calculations derived from an established daylighting formula. Thus, existing daylighting formula is modified to create new daylighting rules of thumb for light wells in single story terrace houses. These new rules of thumb are actually simplified formulas to aid architects in estimating daylight levels in terrace house light wells.

Keywords: : Daylighting, rules of thumb, light well, terrace houses, indoor environment

1. INTRODUCTION

Light well is commonly used in terrace houses to admit natural lighting. The use of natural light is important in improving the indoor environmental quality and energy efficiency of buildings (N. Lechner, 2009). In the Uniform Building By-Laws (UBBL) of Malaysia, all terraced residential buildings are required to be equipped with light wells in the living areas with suitable opening sizes (Undang-undang Kecil Bangunan, 2008). Light wells are not allowed to be closed except with openable lids and roof monitors. These requirements are meant to ensure ventilation as well as admission of natural daylight as required by UBBL (1984). The use of light well as a means for daylighting in building is not a new strategy as it has been used in historical buildings. Figure 1 shows the concept and function of light wells in allowing natural light and ventilation simultaneously into terrace houses. If the opening size is increased, more daylight can be admitted inside the houses with light wells (Amran Atan & Nik Lukman Nik Ibrahim, 2017).

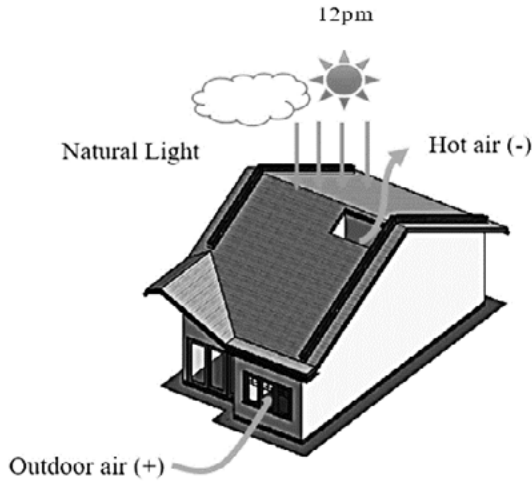


Figure 1: The role of light wells in providing daylight and natural ventilation for terrace houses

Light well renovations without proper consideration of its functions in terraced houses can result in dark interiors. Frequent complaints from the residents of terrace houses with light wells include the issue of security as the provision can facilitate house break-ins through the opening of the light well. Other problems include water leakage during rain falls and the growth of fungi and moss. Besides, dirt on the roof may also block the light well apertures. These problems have led the residents to obstruct or eliminate light wells in their houses completely without realizing their action is a violation of the UBBL (1984), which requires natural lighting and ventilation openings of not less than 5% of the floor area. Generally, the residents of terraced houses are not aware about this rule of law.

Based on a previous study by A. Atan and N. L. Nik Ibrahim (2016), there are various modifications made on light wells in terrace houses. The primary reason for the renovation is the negative acceptance of the dwellers to the light well designs in their terrace houses. Occupants only accept light wells positively after modifications are made to suit their needs. According to A. Atan and N. L. Nik Ibrahim (2016), there are four light well types (Figure 2) usually found in terrace houses in Merlimau, Melaka namely, i) open hole

(original design), ii) roof monitor with single side opening, iii) roof monitor with two side openings and iv) glazed skylight. Among the typologies, light well with roof monitor and single side opening was the most frequently found in terrace houses? However, occupants survey carried out by A. Atan and N. L. Nik Ibrahim (2016) shows that light well with roof monitor and two side openings provides better daylight and receives better responses amongst residents. Renovation that maintains the basic function of light wells is very important to ensure effective ventilation and natural lighting in terrace houses. Typical light wells in terrace houses usually meet the UBBL criteria for the allocation of 5% opening area to floor area for ventilation and daylighting purposes.

Further study proceeds to evaluate the effectiveness of various light well typologies in daylighting performances. Another objective of the study is to generate daylighting rules of thumb or simplified formula for light wells. According to Nik Lukman, N.L. (2002) daylighting rules of thumb in architecture are simple and comprehensive principles, which can be readily applied in the design process in order to quickly predict daylight levels in interior. The study also aims to identify effective aperture sizes in light well designs. IES-VE software is the simulation tool used in the daylighting experiments conducted.

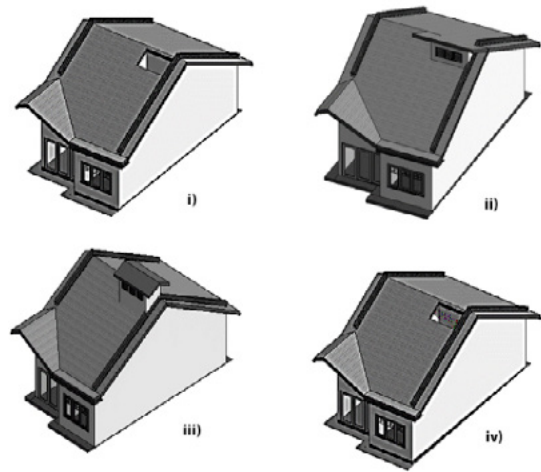


Figure 2: Four main types of light wells in terrace houses

2. EXPERIMENT PROCEDURE

A computer simulation study was conducted to investigate the effect of daylighting from different light well typologies as shown in Figure 3. The daylighting simulation study was carried out under an overcast sky condition using RADIANCE application in IES-VE 0.6 Software. The first two light well types simulated were based on the light wells of single story terrace houses in Merlimau, Melaka. The other light well typologies were modifications of the two common types. The sky condition projected was based on the annual climate data and the level of sky illumination in Melaka location (Latitude 227° North and Longitude 102.25° East). The simulation time was set at noon (12:00 pm) on March 21.

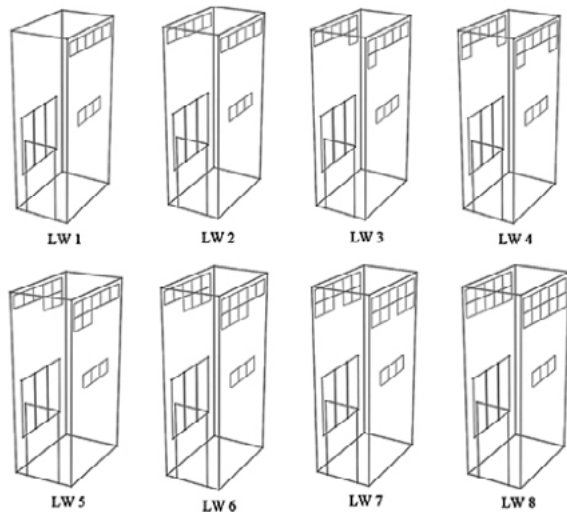


Figure 3: Eight different types of light wells in the simulation

Light well shaft parameters in this study are kept constant at 1.8m width, 2.5m length and 4.0m height, but with eight typological variations involving different aperture configurations and sizes as indicated in Figure 3 and Table 1. Glass transmittance of light well's aperture was set at 0.9 or 90 percent (a normal clear glass transmittance). Following the study by M. F. M. A. Sadin, N. L. N. Ibrahim, K. Sopian and E. Salleh (2014), the variable parameter in this experiment was the aperture glazing area or its percentage to the light well's floor area. Light well surfaces reflectance in the simulation was set to 0.3m for floor surface reflectance, 0.6m for wall surface reflectance and

0.8m for ceiling surface reflectance. These surface reflectance parameters were based on a previous study by J. E Flynn, J.A Kremers, A.W. Seencrazy and G.R Steffy (1992) in which case the surface reflectance recommended were 0.8 for ceiling, 0.6 for wall finishing and 0.2 for floor surface. Daylight illuminance was measured at the work plane of 0.9m above the floor surface as indicated by the sectional diagram in Figure 4.

Daylight factor was calculated from the illuminance levels obtained in the simulation. Daylight factor was a measure of the ratio or percentage between inside and outside illuminances or the proportion of the daylight illuminance that reaches a point inside an interior (A.M.A Rahman, M.H.A Samad, A. Baharuddin and M.R Ismail, 2009). The use of daylight factor has persisted to the present day as it has an important characteristic which is a good indicator of the overall appearance of light. This is because the brightness appearance of a place depends at least as much on the relative luminance of surfaces within the field of vision as on absolute values (P.Tregenze and M.Wilson, 2011). A standard recommended daylight factor (DF) for an effective daylight-lit space is 2%. In the other hand, IESNA and CIBSE recommend indoor illuminances of 100-200 lux for minimum activity spaces where visual tasks are only occasionally performed (P.Micheal, 2001).

Table 1: Floor areas and window sizes of the light wells simulated

Light Well	LW1	LW2	LW3	LW4	LW5	LW6	LW7	LW8
A_f (m ²)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
A_g (m ²)	1.1	2.2	2.7	3.3	3.5	3.8	4.3	4.7

A_f - floor area of light well, A_g - area of window or light well's opening

The daylight measurements obtained in the simulation were used to modify Littlefair's daylight factor formula which was meant for rooms with normal windows. In this case, the formula was modified to address different light well typologies simulated under an overcast sky in Merlimau, Melaka. The original Littlefair's daylight factor formula (J. A. Lynes, 1992) is shown below:

$$DF_{avg} = \frac{T_w A_g \theta}{A_s (1 - R^2)}$$

DF_{avg} average daylight factor
 A_g window glazing area (m²)
 T_w transmission of window glazing
 θ sky angle measured at the centre of the window in degree
 A_s total area of the room surfaces ceiling, floor, walls and windows (m²)

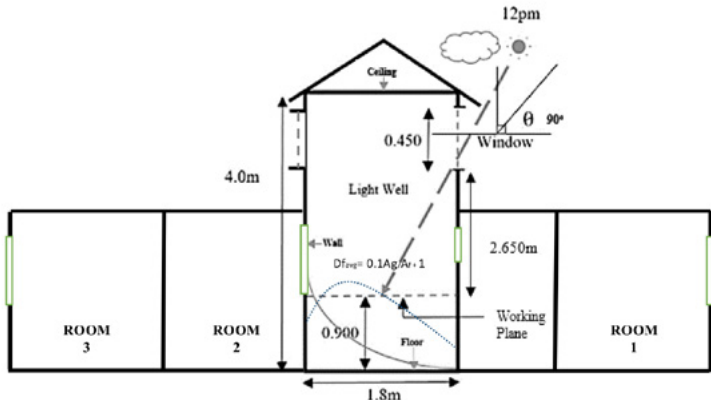


Figure 4 shows the general center line illuminance in the light wells simulated.

Table 2: Daylight factors for different light wells under an overcast sky

Light Well	LW1	LW2	LW3	LW4	LW5	LW6	LW7	LW8
A_s (m ²)	24.0	48.0	60.0	72.0	77.6	84.0	96.0	155.3
A_g (m ²)	1.1	2.2	2.7	3.3	3.5	3.8	4.3	4.7
DF_{avg} (%)	1.0	1.5	1.7	1.8	1.9	2.0	2.1	2.3

A_s - surface area of light well, A_g - area of window or light well's opening, DF_{avg} - average daylight factor

Table 2 shows the daylight factors for the eight different light wells simulated. A_s is the surface area of the light well and A_g is the area of window or light well's aperture with standard clear glass transmittance. Light wells LW6, LW7 and LW8 have generous aperture sizes which contribute to higher percentages of daylight factors. The graft in Figure 5 shows that in different types of light wells, the ones with larger apertures located on two sides obtain better daylight factor. Therefore, with this finding, the size of light well aperture (A_p) can be regarded as a prominent criterion in light well designs for daylighting.

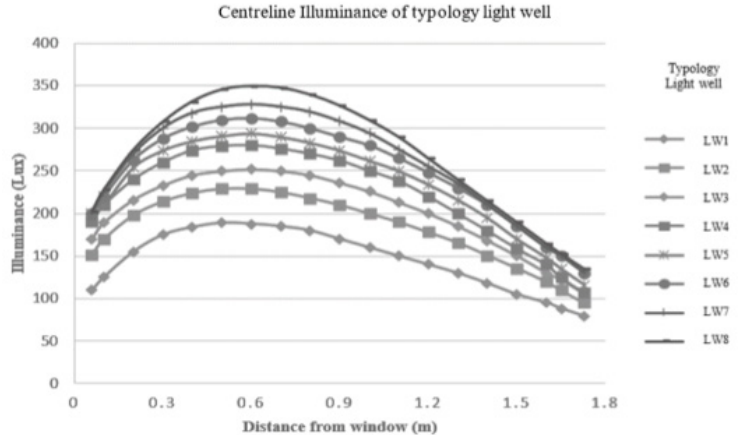


Figure 5: Center line illuminance of the light wells simulated under overcast sky

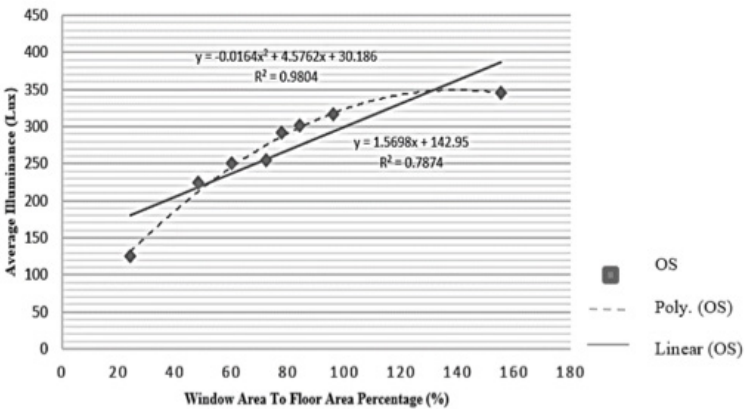


Figure 6(a): average illuminance vs window area to floor area under overcast sky

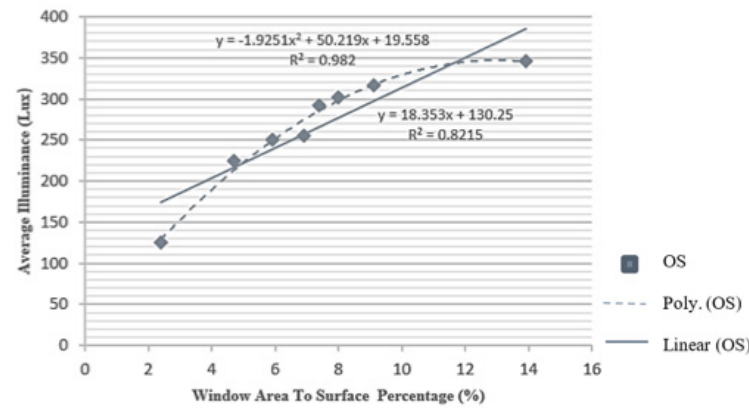


Figure 6(b): average illuminance vs window area to surface area under overcast sky

Figure 6(a) and Figure 6(b) show the correlations between average illuminance inside the light wells with the percentage of window area to floor area and surface area respectively. Sufficient average illuminance of about 250 lux can be achieved inside light well with window to surface area ratio of 70% and average illuminance of approximately 325 lux can be obtained with window to floor area ratio of 10% under the overcast sky. The correlative equations between average illuminance and the percentage of window area to surface area and floor area of the whole light wells are shown below:

$$E_{\text{avg}} = 18A_g/A_s + 130$$

E_{avg} average illuminance
 A_g light well's aperture size (m²)
 A_s light well's floor area (m²)

$$E_{\text{avg}} = 1.5A_g/A_f + 140$$

E_{avg} average illuminance
 A_g light well's aperture size (m²)
 A_f light well's floor area (m²)

Regression analysis was carried out between the simulation average daylight factors and the average daylight factors obtained from Littlefair's formula as shown in Figure 7. The generated correlative equations are the basis for the rule of thumb formulated for the light wells. As the linear correlation is rather accurate and in much simpler equation than the polynomial correlation, the following rule of thumb is thus proposed for the light well typologies:

$$DF_{\text{avg}} = 0.1A_g/A_f + 1 \quad (R^2 = 0.8658)$$

DF_{avg} average daylight factor
 A_g light well's aperture size (m²)
 A_f light well's floor area (m²)

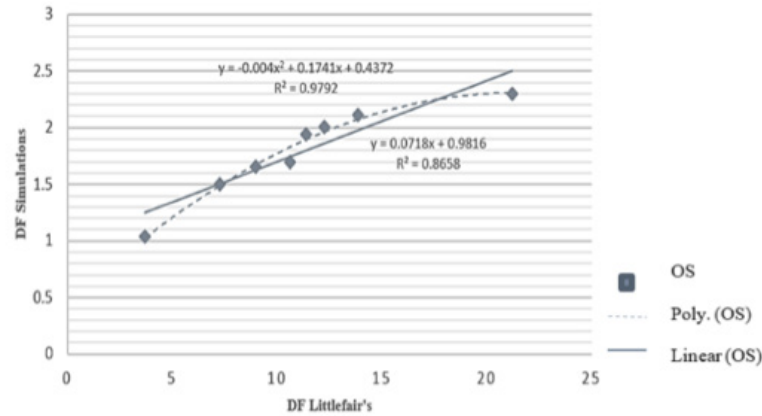


Figure 7: Simulation average daylight factor vs Littlefair's average daylight factor

4. CONCLUSIONS

The simplified equations or rules of thumb produced in this study are applicable for the light well typology of 1.8m width, 2.5m length and 4.0m height in single story terrace houses with standard clear glass covering its aperture. Regression analysis is carried out to find correlations between the measurements obtained in the simulations and the calculations derived from Littlefair's daylighting formula. These simplified equations can be considered

as rules of thumb for predicting daylight levels inside light well spaces. The experiments show that typical light wells with approximately 4m² to 7m² area of aperture can provide sufficient interior illuminance under the overcast sky in Merlimau, Melaka. For future studies, more light well types can be simulated and analyzed. The rules of thumb generated and presented in this article can be used as simple guides for local authorities and architects in designing light wells in Melaka.

ACKNOWLEDGMENT

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SUSTAINABLE MANAGEMENT OF BROWNFIELD GREENSPACE: A STUDY OF WORLDWIDE LANDFILLS PARK AIR HITAM, PUCHONG, MALAYSIA

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ABSTRACT

Decades ago, landfills were designed and operated on the outskirts of the city. However, due to the sprawl of urbanization, many residential areas have been developed around the landfill areas. Therefore, the environmental and hazardous issues such as landfill gas, leachate and foul odour have risen up. As the greenspaces have recently decreased, Malaysia government in 2010 suggested that the ex-landfill areas which are part of the brownfields should be turned into valuable urban greenspaces. This study thus reviews the management practices of closed landfill to become a sustainable greenspace. A case study was carried out at the Worldwide Landfills Park Air Hitam Puchong, Selangor Malaysia. It is the first ex-landfill in Klang Valley Malaysia developed as a park. Two research methods were adopted for this study, namely key informant approach and secondary data analysis. The result indicated that the safe closure and post-closure management including leachate management and landfill gas management using the gas collection system have successfully rehabilitated the site into a park. A reduction of CO₂e using landfill gas collector and natural absorber i.e. vegetation is also discussed in this review.

Keywords: : Landscape management, ex-landfill, sustainable planning, urban greenspace

1. INTRODUCTION

Landfill is a major issue of urban management in the world due to the problems of environmental pollution and the shortage of urban land (Hoorweg & Bhada-Tata, 2012). As consequences, many of the ex-landfills in urban area have been turned into beneficial alternative spaces to urban dwellers.

Currently, there are 303 landfills in total available in Malaysia, where 143 of them were declared closed (SWCorp, 2017). The number of closed landfills increased each year from 115 in 2003 to 131 in 2012, and expected to be 296 in the year 2020 (Simis et al., 2016). It has been expected that more than 70.0% of the future ex-landfills would be located in urban areas and become a major concern of the urban communities (Chun-Yang & Talib, 2006) due to the health and environmental problems such as foul odours, leachate released and gas pollution (Simis et al., 2015). Therefore, the Act 672 for Solid Waste and Public Cleansing Management 2007 enforced in September, 1st 2011. The act requires that every ex-landfill must undergo waste recovery through new technologies such as (i) waste to energy facilities; (ii) construction and demolition recovery facilities; (iii) organic waste facilities; (iv) landfill closure, and (v) integrated waste management.

As the natural areas in every state have been declining at a great speed due to rapid urbanization, the Department of Town and Country Planning Peninsular

Malaysia in 2010 has thus specified that the urban ex-landfills are assets of greenfield for future developments and provisions according to the standard of 2 hectares per 1,000 urban populations. Consequently, future rehabilitation of 303 urban ex-landfills will lead to an increasing of 462,500 social recreation opportunities for the urban population in 2020 (Mazifah et. al., 2014) as inherently sustainable greenspace.

The question is how the landfills are rehabilitated and managed for sustainable use by community. What are the actions needed and stressed during restoring them into greenspaces or public parks? As the restoration process is time-consuming, the right management practices must be carefully planned to prevent future problems.

Hence, a study was carried out at the Worldwide Landfills Park Air Hitam Puchong, which is the first ex-landfill park in Malaysia. It has been 10 years since the landfill turned into a public park. This study aimed to investigate the management practices of the park, and the process to become an ex-landfill’s public park. It is important to be a guide for similar development of other landfills in the country.

2. EX-LANDFILL AND GREENSPACES

2.1 Ex-landfill

Ex-landfill is a former land of a big rubbish bin (JICA, 2010) which closed due to the completion of waste filling activities. However, there are few factors to consider before announcing the land to be closed such as over the limit design capacity or improper construction and design that cause serious environmental problem and health hazards. It is clearly stated in the Volume 5 Technical guideline for Sanitary Landfill, Design and Operation Landfill (MHLG, 2004b) that there are three functions of the landfill which are storage and treatment, environmental protection, and land development. Therefore, a proper management of the landfills are essential to preserve the functionality of the landfills as a safe solid waste disposal site and to prevent environmental pollution such as leachate and landfill gas. After a completion of landfilling activities, the sanitary landfills should be closed in a safe and proper manner.

Based on the Volume 3 Guideline for Safe Closure and Rehabilitation of MSW Landfill Sites (MHLG, 2004a), safe closure consists of 4 levels of environmental pollution and hazardous prevention. Each landfill site should be assigned with a targeted closure level at the initial stages of the safe closure process as shown in table 1.

Table 1 : Closure level at the initial stage of the safe closure process

Level	Requirement
C1	Minimal closure level (to provide final cover and drainage system around the site)
C2	Low closure level (similar to C1, but with the addition of dike, controlled slope and gas ventilation system)
C3	Middle closure level (similar to C2, but with the addition of semi-aerobic landfill system with leachate re-circulation)
C4	High closure level (similar to C3, but with the addition of groundwater pollution control measures with leachate treatment)

In order to implement the safe closure of landfill site, proper physical closure and post closure management should be carried out. The Physical Closure (PC) consists of the measures or facilities necessary for the safe storage of waste, prevention of environmental pollution and early stabilization of waste. While, the Post Closure Management (PCM) consists of the operation of landfill facilities such as leachate treatment plant, the maintenance of the facilities including soil treatment and the monitoring of environment pollution and stabilization of waste.

2.2 Brownfield

The term brownfield has different definition within countries throughout the world. The Europe’s Sustainable Brownfield Regeneration Network (CABERNET, 2006) defined that brownfield is a site which (i) has been affected by previous uses of the site or surrounding land, (ii) is abandoned or underused, (iii) is fully or partial urban development areas, (iv) may have or to be considered having a contamination problem, and/or (v) requires intervention to reinvigorate the beneficial use.

In Malaysian context, brownfield is defined as an area that has been developed but derelict or neglected, or an area which having a possibility to be contaminated, or an area which is the development is not fully completed or abandoned, or a building structure that are completed but not sold within 10 years, neither on a government land or private land (Department of Town and Country Planning Peninsular Malaysia, 2012).

Therefore, the Department of Town and Country Planning Peninsular Malaysia (2012) came out with Brownfield Areas Redevelopment Planning Guidelines and Environmentally Sensitive Areas Planning Guidelines which emphasizes six categories of brownfield area that should be developed. Taking the Worldwide Landfill Park at Air Hitam Puchong for an example, the expansion of urban area has led the site to be categorized as Category B brownfield (ex-landfill areas that are full of solid wastes or no longer in use permanently) which was located in the urban fringe area to be part of urban image (Simis et al., 2015), as shown in Figure 1.

Based on the guideline, there are several types of development for Category B brownfield, such as (i) recreational area; (ii) golf course, biogas power plant area, and (iii) agricultural area with fertigation system. However, housing, big structure or building should be avoided for development due to the instability of the ground.



Figure 1 : Air Hitam Sanitary Landfill (source: Google Map, 2017)

2.3 Urban Greenspace

According to the Department of Statistics Malaysia (2016), the total population of Malaysia in 2016 was estimated at 31.7 million people, an increment of 0.5 million people compared to previous year, and estimated to reach 32.3 million people in 2020. Malaysia is a developing nation that going forward

into urbanised nation and expected to have 78% of urban population by 2030 (UN-HABITAT, 2012).

Urbanisation creates urban areas or cities. A city is said to be the most suitable habitat for humans as they provide with a variety urban infrastructures and environments for a good quality of life (Sham, 1982). Quality of life usually refers to individual wellbeing and satisfaction and used as a reference in reflecting urban society's quality of life (Burc et al., 2001). According to Burc et al. (2001), there are four keys in creating sustainable urban development that bring positive impact of quality of life among urban society which are physical environment, economic environment, social and transport and communication. Unfortunately, most cities were unprepared in facing the spatial and demographic challenges associated with urbanization and even worst in facing the environmental nature.

Greenspace is an alternative in planning to support the health and wellbeing of urban residents (Barton, 2009, Carmichael et al., 2013, Ambrey, 2016). It plays an important role in providing an ecosystem services, improving the quality of life and welfare of citizens (Latinopoulus et al., 2016; Livesley et al., 2016). According to Carrus et al. (2015), greenspaces or parks give a direct effect on the welfare of local residents and increase the aesthetic value of the green areas. In addition, these natural green canopies could improve the air quality by reducing the presence of polluted gases and particulate matter (Beckett et al., 2000; Dzierzanowski et al., 2011).

In the case of the Worldwide Landfills Park Air Hitam, the residential areas were developed around the landfill site in year 2000 due to the rapid population growth in Klang valley. Several residential areas were developed namely as Taman Lestari Putra, Taman Lestari Perdana, Taman Equine, Taman Sri Indah, Taman Kota Perdana and Taman Desaminium as shown in Figure 1. The development made the landfill an island of brownfield in settlement areas. Thus, the best solution for this situation is to transform the brownfield to be a valuable greenspace or safe public park.

3. METHODOLOGY

3.1 Site of Study

The study was conducted at the Worldwide Landfills Park Air Hitam, which previously called the Air Hitam Sanitary Landfill. It is located at the longitude 101°39'55"E and latitude 03°0'10" N close to the Air Hitam Forest Reserve in Petaling, Puchong, Selangor with. The site was selected due to the fact that it was the only Category B brownfield area turned into a greenspace or public park.

The landfill was the first engineered sanitary landfill in Malaysia which received 6.2 million tonnes of domestic waste in 2006. It was operated by the Worldwide Landfills Sdn. Bhd. which is a subsidiary of Worldwide Holdings Berhad (WHB). It was opened on April 1st 1995 for the 100 acres of land. Air Hitam Sanitary Landfill received 3,000 tonnes of garbage per day from six local authorities of Kuala Lumpur, Petaling Jaya, Shah Alam, Subang Jaya, Ampang Jaya and Kajang.

The landfill was designed for 20 years lifespan with 6 million tonne capacity. Unfortunately, it reached the limits within 10 years after accumulating 6.3 million tonnes of total deposited waste. In year 2000, the development of residential areas started to sprawl around the site. Therefore, it was closed on 31st December 2006 with total 6,207,684.59 tonne of domestic waste and then underwent landfill closure and post closure maintenance activity from January 2007 untill December 2011. The closure was planned and monitored by the highest requirements initiated by the Department of Environment Malaysia. (Worldwide Landfills Sdn. Bhd., 2013).

3.2 Case Study

This is an exploratory research focusing on the case study of the Worldwide Landfills Park Air Hitam, Puchong. Two research methods were adopted for this study. Key informants were selected from the Facility Management officials of the Department of SWCorp Malaysia and from the Management Department of the Worldwide Environment Sdn. Bhd. The informal qualitative approaches were used for the study and the primary information was gathered via direct interviews with an open-ended questionnaire. To validate the above viewpoints as well as deeper understanding on certain details, the secondary data were also gathered and analysed. The secondary data were collected from the Volume 3 Guideline for Safe Closure and Rehabilitation of MSW Landfill Sites and Volume 5 Technical guideline for Sanitary Landfill Design and Operation, Guidebook for Safe Closure of Disposal Site, and Brownfield Areas Redevelopment Planning Guidelines and Environmentally sensitive Areas Planning Guidelines which was provided by Department of Town and Country Planning Peninsular Malaysia, Japan International Cooperation Agency (JICA) and Ministry of Housing and Local Government Malaysia. All the information gathered were used as the means in analysing the management practices of the park.

4. RESULT AND DISCUSSION

The management practices practiced by the Worldwide Landfills Park Air Hitam Puchong are elaborated in this section. It consists of the technical

design for solid waste management, leachate and gas management, landscape management, and sustainable treatment of the site.

4.1 Solid Waste Management

Plan of Air Hitam Sanitary Landfill in Figure 2 shows that the landfill has been divided into 3 parts which are Area A, B and C for management purposes. Based on the Volume 3 Guideline for Safe Closure and Rehabilitation of MSW Landfill Sites (MHLG, 2004a), Air Hitam Sanitary Landfill was classified as sanitary level 4 i.e. sanitary landfill with leachate treatment facilities measured daily. The landfill closure considered as safe closure Level C2, i.e. low closure level that provides final cover and drainage system around the site, addition of dike, controlled slope and gas ventilation system. Based on the interview, it stated that the 100 acre site had produced two megawatt gas power plant that had provided 2000 households with electricity since 2004. The biogas plant in Air Hitam Sanitary Landfill is the first plant in Malaysia that generates electricity using landfill gas in trapping and burning the by-product of decaying waste-methane gas.

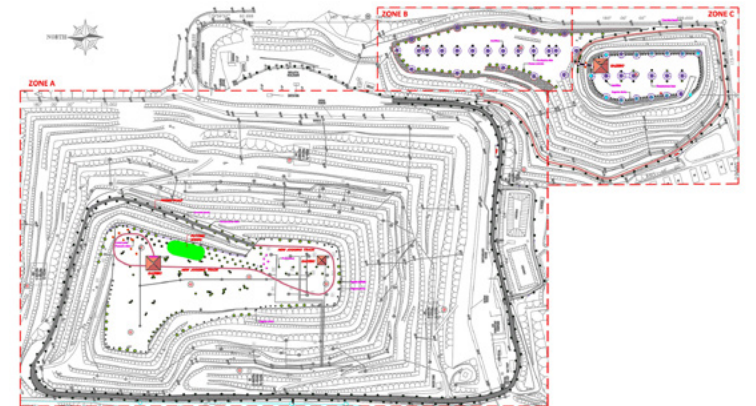


Figure 2 : Plan of Air Hitam Sanitary Landfill
(Source: Worldwide Holdings Bhd., 2010)

According to MHLG (2004a), the classification of group C with low environmental impact risks but having high land utilization potential. Therefore, Worldwide Holdings Bhd. took the initiative to turn the Air Hitam Sanitary Landfill into Worldwide Landfills Park Air Hitam Puchong. Based on Figure 2, several basic facilities such as 5km of jogging track with both permeable pavement and interlocking brick, bicycle track, playground, street lights and gazebos were introduced in the park.

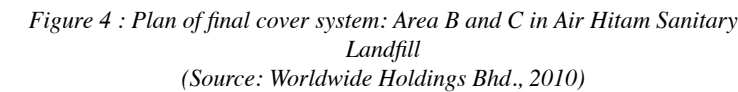
Before regenerating the ex-landfill into a park, it needed to undergo the management of post closure. Based on Volume 5 Technical Guideline for Sanitary Landfill, Design and Operation, Guidebook for Safe Closure of Disposal Site (MHLG, 2004b), there are several factors should be considered and to be taken care in handling the management of post closure, which are (i) the necessity of management of post closure of landfill site, (ii) leachate control, (iii) control of generated gas, (iv) control of land subsidence, (v) monitoring of the degradation and stabilisation of the waste, and (vi) utilization and management of post closure landfill site.

4.2.1 Leachate Management

1. PROPOSED OF NEW TREATMENT PLANT; 2. - 1000
 3. EXISTING DRAINAGE OF EXISTING AREA (EXISTING - 1000)
 4. AREA OF CONCRETE TO BE ESTABLISHED BY THE
 5. AREA OF THE EXISTING NEW PLANT (EXISTING DRAINAGE AND DRAINAGE FOR PLANT)

LINE OF ENCLOSURE
 CONCRETE AREA (APPROXIMATE)

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4.2.2 Gas Management

6mm THK DISPERSED PLATE C/N
600mm sq. SPACING WITH JOINTS

ENTRIFILL

SAND - CORROSION LAYER

SAND - GAS LAYER

ENTRIFILL

EXISTING EARTH

HEAD FLANGE & HOLE 45/8"

#1,000mm IC CULVERT

WELDING BETWEEN PUPC AND GEOMEMBRANE

GAS COLLECTION STRIPS-PROPOSED HOPE 0.75mm THK. GEOMEMBRANE

BARRIER LAYER - PROPOSED : POLYFELT TS 40 NONWOVEN GEOTEXTILES

GAS PRESSURE RELIEF LAYER

110mm SMOOTH HOPE PIPE

110mm PERFORATED PE PIPE

ORIGINAL EXISTING LEVEL

500mm x 600mm TRENCH WITH STONE GRAVEL 2" SIZE

TYPICAL DETAIL - GAS COLLECTION PE PIPE

ENTRIFILL

SAND - CORROSION LAYER

SAND - GAS LAYER

ENTRIFILL

EXISTING EARTH

GAS COLLECTION STRIPS-PROPOSED HOPE 0.75mm THK. GEOMEMBRANE

BARRIER LAYER - PROPOSED : POLYFELT TS 40 NONWOVEN GEOTEXTILES

GAS PRESSURE RELIEF LAYER

ORIGINAL EXISTING LEVEL

500mm x 600mm TRENCH WITH STONE GRAVEL 2" SIZE

TYPICAL DETAIL - GAS COLLECTION TRENCHES

110mm PERFORATED PE PIPE

TYPICAL DETAIL

The gas collection pipe was constructed at the equal pace during the landfilling works progress. The gas collection system includes a network of vertical gas extraction wells, dewatering units and High-Density Polyethylene (HDPE) geomembrane pipelines, as shown in Figure 6. The degassing unit of Air Hitam Sanitary Landfill was installed with equipment that functioned for measuring continually the remote access of the equipment and data. The system connected through a Programmable Logic Control (PLC) tool that operated the unit's main variables. From there, the continuously measured data, such as methane content and flows were monitored.

[illegible]

Table 2 shows that the annual estimation of emission reductions in tonnes of CO₂e was decreasing from 2007 to 2016 equivalent to 10 years after the safe closure operation. The CO₂e is 'a standard unit for measuring carbon footprints'. Therefore, it showed that the Air Hitam Sanitary Landfill had a positive effect where it contributed less CO₂e each year. The greenhouse gas emission or methane reduction in tonnes CO₂e achieved by the gas collection which were combusted or destroyed during the gas flared. However, it was not covered for the whole of the landfill site. Therefore, every reduction achieved above the reductions made by gas collection system was considered additional. Thus, vegetation is still needed in order to reduce CO₂e naturally.

Table 2: Annual estimation of emission reduction after safe closure (Worldwide Environment Sdn. Bhd., 2006)

Year	Annual estimation of emission reductions in tonnes of CO ₂ e
2007	79.395
2008	107.013
2009	99.306
2010	92.196
2011	85.636
2012	79.571
2013	74.014
2014	68.849
2015	63.774
2016	58.806
Total estimated reductions (tonnes of CO ₂ e)	808.559
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO ₂ e)	80.856

4.3 Landscape Management

Based on the Guidebook for Safe Closure of Disposal Site (JICA, 2010), the standard depth of soil on the site ground were based on the site functions, which is 600mm depth for bare area, 1000mm depth for flower and grass area, 1500mm depth for small tree area and 2000mm depth for tree area including 150mm of topsoil and 450mm of compacted soil. The purposes of the final cover were to improve the condition of the site, landscape, post-closure land use, minimize leachate generation, offensive odour, prevention of outbreak fire and serve as vegetation layer. However, as shown in Figure 5 the earthfill after capping system was just 600mm depth of soil was provided for ground covers, trees and palm trees.

Table 3 shows that 671 trees were planted along the road and jogging track, 457 trees in zone A, 60 trees in zone B and 154 trees in zone C. The number of trees per track and road length were considered dense visually (Figure

2), if taking into accounts the maximum size of the matured canopy and the topography of the site.

Table 3: Landscape planting scheme of Worldwide Landfills Park Air Hitam Puchong (Source: Worldwide Holdings Bhd., 2010)

Botanical Name	Overall Height (m)	Trunk Height (m)	Trunk Diameter (mm)	Zone A	Zone B	Zone C	Quantity
Tree							
<i>Bucida molineti</i>	1.5	0.8	25	194	-	58	250
<i>Eugenia oleina</i>	1.5	0.3	25	72	-	78	150
<i>Maniltoa lenticellata</i>	1.5	0.8	25	6	11	6	23
<i>Cinnamomum iners</i>	1.5	0.8 - 1.0	25	38	-	6	44
<i>Podocarpus macrophyllus</i>	1.5	0.3	25	45	-	-	45
<i>Eucalyptus alba</i>	1.5	0.8-1.0	25	16	9	-	25
<i>Plumeria rubra</i>	1.5	0.8	25	14	-	2	16
<i>Hopea odorata</i>	1.5	0.8	25	40	40	-	80
<i>Baphia nitida</i>	1.5	0.8	25	20	-	-	20
Palm							
<i>Wodyetia bifurcata</i>	1.8	1.5m	50mm	2	-	2	4
<i>Cyrtostachys renda</i>	1.8	1.5m	50mm	10	-	4	14
Total Overall Zones							671

Table 4 shows that the exotic species were dominant in the Worldwide Landfills Park Air Hitam Puchong which 7 exotic species and 4 native species. The overall heights of trees during transplant were between 1.5m to 1.8m. Based on the interviews, after 10 years from transplanting, the overall height of the trees was between 2 to 3m. However, the growth rate for each species was different. The fast grower species could reach the optimum height within 10 to 15 years. Meanwhile, the slow grower could reach the optimum height within 20 to 30 years. There are only two fast growing species namely *Bucida molineti* and *Baphia nitida* which achieved their height between 3m to 7m and 3m to 10m respectively whereas the other species were between medium and slow grower which cannot be determined by their range of height. There are many factors need to be looked into in determining the growth performance of each species.

Table 4: Planting list of Worldwide Landfills Park Air Hitam Puchong (Source: Worldwide Holdings Bhd., 2010)

Botanical name	Overall height (m)	Range of height (m)	Native species	Exotic species	Growth speed
<i>Bucida molineti</i>	1.5	3 - 7		■	Fast
<i>Eugenia oleina</i>	1.5	2 - 20	■		Medium
<i>Maniltoa lenticellata</i>	1.5	10 - 12		■	Medium
<i>Cinnamomum iners</i>	1.5	20	■		Slow
<i>Podocarpus macrophyllus</i>	1.5	20		■	Slow
<i>Eucalyptus alba</i>	1.5	18		■	Medium
<i>Plumeria rubra</i>	1.5	8		■	Medium
<i>Hopea odorata</i>	1.5	25 - 30	■		Slow
<i>Baphia nitida</i>	1.5	3 - 10		■	Fast
<i>Wodyetia bifurcata</i>	1.8	6 - 15		■	Medium
<i>Cyrtostachys renda</i>	1.8	16	■		Slow

4.4 Sustainable Management Applied

In general, leachate and biogases are major problems in landfill management. A few strategies or techniques of treatment were applied at the Air Hitam Sanitary Landfill site as it closed, to fulfil requirement of sustainable treatment. These techniques are specific to the site, explained in the following table 5.

Table 5 shows that Air Hitam Sanitary Landfill has practiced the vital factors of sustainable management for environmental protection i.e. leachate and gas managements as well as land development i.e. ecological and social functions as suggested by MHLG (Ministry of Housing and Local Government Malaysia). It also fulfilled three out of four keys suggested by Burc et al. (2001) as stated earlier in this paper, except for the factor of transport and communication, which is irrelevant to the landfill development issue.

The achievement of the Air Hitam Sanitary Landfill to become a public park is summarized in Figure 7. Starting from it closure in 2006, the leachate and gas plant were immediately installed to regulate the environmental and economically benefits. As the soil stabilized, vegetation were then introduced and planted to stimulate the land regenerative process. It is a smart effort in landscape management that benefit to the social as future users as well as to the nature in accelerating the succession process.

5. CONCLUSION AND IMPLICATION

The study indicated that the Worldwide Landfills Park Air Hitam Puchong successfully practised the sustainable management approaches in managing the ex-landfill. This fact is not surprising as the landfill was the first engineered landfill in Malaysia.

Table 5: Summary of sustainable treatment applied at Air Hitam Sanitary Landfill

Treatment Applied	Issue	Applicable Source
a. Leachate treatment plant system has been introduced to remove leachate from the site. A series of piping system has been designed to collect residual liquid from the waste mass and discharged to the plant.	Leachate Removal	MHLG (2004b) Burc <i>et al.</i> (2001)
b. Landfill gas power plant has been built to generate energy i.e. electricity power. This vertical gas extraction wells collect the gasses through intricate and systematic network of collection pipes which eventually transferred to landfill gas power plant.	Landfill Gas Renewal	MHLG (2004b) Burc <i>et al.</i> (2001)
c. Planting of fast growing plants which include trees, shrubs and groundcovers. These plants are important in stabilizing the soil fertility and protecting slopes. As the plant matured, the site can be opened to the public for recreational purpose.	Ecological Engineering	MHLG (2004a) Burc <i>et al.</i> (2001)
d. In order to turn the site into a park, the basic facilities such as walking track using permeable materials, playground, signage, shelter and proper circulation have been provided.	Recreational Functions	MHLG (2004a) Burc <i>et al.</i> (2001)

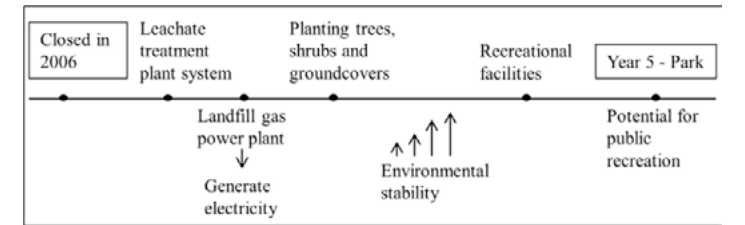


Figure 7 : Summary of Air Hitam Sanitary Landfill rehabilitation process

The landfill park was well planned and managed from the safe closure and post closure throughout the rehabilitation process especially on the leachate management and landfill gas management. The secure liner system, drainage system, pipelines and wells constructed were considered successful and the Worldwide Landfills Park Air Hitam Puchong is the first renewable energy power plant in Malaysia. Consequently, the management company grab the

opportunity of 15 years agreement between the state government and the Tenaga Nasional Berhad (TNB) of the right to extract the gas and generate power from the ex-landfill. The power plant has been able to generate energy with 2MW by converting methane gas to electricity power up to 2000 household and leachate treatment plant. Meanwhile, the HDPE geomembrane pipelines which were used for gas collection system has contributed to the reduction of CO₂e. Therefore, the existing methane gas from the former landfill, one of the pollutant that contributed to greenhouse effect has been reduced.

After 5 years of undertaking safe-closure and post closure planning, Air Hitam Sanitary Landfill was ready to serve as a public park which consists of 5km jogging track made of permeable pavement and interlocking brick, bicycle track, playground and exercise area. After a year of opening, it received 60 to 70 visitors from neighbouring areas such as Lestari Puchong and Taman Equine during weekend (Worldwide Landfills Sdn. Bhd., 2013). On top of that, as the first brownfield transformed into a public park, the management teams took an effort by planting 671 trees with 11 different species of native and exotic species along the road and jogging track as a natural absorber of landfill gas. However, the reduction of the gas cannot be determined by the existing data accumulated. Further studies need to be done and explored for better results of vegetation performance in restoring the nature.

Based on the current distribution of the plants and activities provided, the park is considered as a functional public park and greenspace. However, to become a community public park, further comprehensive landscape design study should be implemented.

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REDEFINING “DOMINATING” AND “CONTRIBUTING” PHYSICAL FACTORS OF INDOOR THERMAL COMFORT IN HOT-AND-HUMID CLIMATE OF MALAYSIA

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ABSTRACT

In many tropical countries, the cause of the thermal discomfort is mostly due to the presence of high humidity and high air temperature. Air movement, on the other hands, has been considered as the best method in improving the thermal comfort level for this region. Many researches had been conducted regarding the factors affecting thermal comfort for tropical countries and as a result several ideas had been introduced on how the factors affecting the thermal comfort. Most of the research conducted on thermal comfort for tropical countries combined two or more factors as a joint factor such as air temperature and humidity. With the combination of two or more factors (joint factors), the dominant factor among the main factors and how people react to each of these factors especially with the presence of other factors are still in question. The research explore on how people react to each of these three main factors which consequently provides the hierarchy of importance among the three factors. The paper exposes the ‘dominating’ factor which is the air temperature that must be presence at all time to affect thermal comfort. The humidity level and air movement are defined as ‘contributing’ factors rather than joint factors in affecting thermal comfort for tropical countries since the presence of both factors can only influence the thermal comfort level depending on the air temperature level.

Keywords: : Thermal Comfort, humidity, air temperature, tropical countries air movement.

1. INTRODUCTION

Thermal comfort in tropical countries has always been a great issue to discuss due to the extreme climatic factors existed in this type of climate especially the high air temperature and high humidity level. Based on the Psychrometric chart, the thermal comfort level is almost impossible to be achieved based on the presence of high air temperature and high humidity that occurred in many tropical countries(deDear and Auliciems, 1993). However, many field studies conducted in tropical countries showed that respondents were able to feel comfortable under certain circumstances. In many cases, the researchers found that the air movement can improve the indoor thermal comfort level. Each of these factors has its own influencing factors under certain circumstances and it varies based on the climate condition. Therefore, it is important for designers and architects to understand how these factors influence indoor thermal comfort to minimize the discomfort through design strategies that can be developed based on the level of importance of these factors.

2. BACKGROUND

The research on thermal comfort had started a long time ago and mostly in evaluating the thermal comfort level in many buildings especially housing. Along with the study, the researchers had also studied the factors affecting the thermal comfort for the tropical climate countries. One of the earlier research had been started by Webb in 1949 which led to the derivation of the Equatorial Climate Index (ECI). Based on the index, the ideal air velocity is 0.2 m/s with the relative humidity of 70% and the ideal temperature of

28.860 Celsius. Another study was conducted in 1978 which corrected the optimum ideal temperature to 26.4o Celsius. The study was conducted at the hawker centres in Singapore and found that the thermal comfort condition is affected by the combination effects of air temperature, relative humidity and roof thermal radiation (Rao and Ho, 1978). In 1990, Busch conducted a study on offices in Bangkok, Thailand. The neutral temperature or effective temperature for the air conditioned buildings and naturally ventilated building is 24.54o Celsius and 28.54o Celsius respectively.

Mallick (1996) in his investigation had also discovered that people are highly adaptive to the surrounding environment by changing the behavioural patterns and lifestyle preferences. The process of acclimatization also had a strong influence in the comfort preferences study. In his 1996 study involving a group of architectural students living in urban housing in Dhaka, Bangladesh, Mallick (1996) discovered that the participants were able to tolerate high relative humidity and temperature for comfort mainly due to the adaptation to the specific climate. The study also found that the estimated comfort temperature was between the range of 240 Celsius and 320 Celsius with the relative humidity between 50% and 90% under still-air condition and with the movement of air at 0.3 m/s, the range increased by 2.40 Celsius for the lower count and 2.20 Celsius for the upper limit. The air movement was a contributing factor in providing thermal comfort environment, on the other hand, according to this study, despite a wide range of recorded relative humidity which ranged from 50% to 95%, the humidity had little influence to the thermal comfort level due to the long term conditioning even though there is a decrease in comfort temperature when the humidity is higher (Mallick, 1996).

Wong and Khoo (2003) conducted a thermal comfort study in naturally ventilated classrooms in Singapore. The study discovered that the neutral temperature derived from the TSV is 28.80Celsius. Earlier studies conducted by Busch(1990) in Thailand and deDear and Auliciems (1993) in Singapore have also found that 28.50 Celsius is the neutral temperature for a naturally ventilated building. The readings obtained are quite close for the neutral temperature in the similar climate region. The study by Wong et al in 2002 in naturally ventilated public housing in Singapore revealed that there is a strong correlation between the thermal comfort perception and wind sensation.

In 2004, Feriadi and Wong conducted an investigation regarding the thermal comfort perception, evaluation of the thermal comfort prediction and the behavioural action that influence thermal comfort perception in naturally ventilated houses in Indonesia. The finding suggested that adaptive behaviour may influence the neutral temperature to be higher than it was supposed

to, however, cooler temperature is still preferable, if possible. Earlier, Karyono(2000) conducted a field study on the thermal comfort, which samples are divided into various categories and groups, for a multi storey office building in Jakarta, Indonesia. The groups are categorized by gender, age, ethnic background and physical characteristics. The study concluded that it is statistically insignificant between the neutral temperature between male and female, subjects under 40 and over 40 years old and between different ethnic backgrounds as well as between thin and normal subjects. The study also revealed that the neutral temperature is increased in the late afternoon compared to the early morning by 30 Celsius.

The majority of the research conducted in tropical countries focuses on predicting the thermal comfort based on the neutral or comfort temperature for specific building types which include residential, offices and schools. The research had also investigated three main physical variables which are air temperature, relative humidity and air movement. They have been proven to tremendously affect the thermal comfort level. However, the interdependent of the variables in influencing thermal comfort for this region has not been investigated. Each of the factors is important but the determination of which factor is more dominant than the others is still unknown.

3. METHODOLOGY

The objective of the research is to acquire the perception of the users on the indoor thermal comfort condition of a naturally ventilated space and their preferences according to the condition experienced. To achieve this, prayer rooms from four naturally ventilated mosques are selected as the experimental spaces. The prayer hall was selected because of the activities conducted and the clothing value are less varied among the users of the space. This will minimize the influences of other thermal comfort factors to the results produced by the respondents. Focus can be given to the three main physical factors which are the air temperature, relative humidity and air movement. 529 respondents whom are randomly selected among the users of the spaces involved in the survey. The main objective of the study is to investigate the thermal comfort condition and the factors affecting the condition as well as other related issues. To obtain this information, two approaches have been chosen. They are the physical measurement of the main factors affecting the thermal comfort and the survey inquiring the perception of the users on the thermal comfort condition. Prior to the actual data collection, a set of questionnaire has been produced and a pilot study has been conducted to inquire the suitability and applicability of the questions and the methods. Adjustments and improvements have been made to the questionnaires to ensure that the questionnaires are clear and they cover the necessary

information required for the study. Before proceeding to the data collection process, permission to sample the buildings is obtained from the authority. It is important to ensure that the activities conducted do not interfere with the activities and users inside the buildings. For the data collection, a set of questionnaires is distributed to the volunteered participants inside the space. The participants are randomly selected among the users. Before the questionnaire is distributed, a brief explanation on the survey objective is given. The time is recorded on the form when the participants start to answer the questionnaire and they are left to answer the questions which may take them about ten to fifteen minutes. The set of questionnaires has been carefully produced to allow the participants to evaluate and select the thermal sensation they experienced while in the space by marking the thermal sensation level based on ASHRAE 7-point scale and the Bedford scale as shown in Table 1. The ASHRAE 7-point scale is used to inquire about the thermal sensation and the Bedford scale is used to indicate the level of thermal comfort that the respondents have experienced while in the space.

Table 1: The ASHRAE 7 Thermal sensation scale and Bedford Scale

ASHRAE	Scale		Bedford
Too Hot	3	7	Much Too Warm
Hot	2	6	Too Warm
Warm	1	5	Comfortably warm
Normal	0	4	Comfortable
Cool	-1	3	Comfortably cool
Cold	-2	2	Too Cool
Too Cold	-3	1	Much Too Cool

Along with these questions, the participants are also asked about the sensation they experienced regarding the level of air movement, humidity level and their preferences to the existing condition. The air movement inside the space is rarely consistent at all time unless mechanical equipment is used. It is therefore difficult to specify the wind condition and the speed at the various space and time during the measurement. Therefore an assumption of wind speed is made to the speed of air felt or experienced by the users at the point of time they answer the question. For the purpose of this study, the wind condition is divided into four categories based on the previous studies which are calm (< 0. 5 m/s), breezy (between 0.5 m/s and 1.5 m/s), windy (between 1.5 -2.0m/s) and very windy (more than 2.0 m/s). The humidity level they experienced is measured by the level of sweating. It is difficult to sense the level of humidity with our bare skin. The only easy explanation to measure the existence of humidity in the air is through the level of sweat accumulation on the skin which is closely associated with the content of humidity in the air. Due to the fact that the air temperature for the country's climate is almost high

and people tend to sweat at all time, the method selected for measuring the perception of the humidity level through the level of sweating is appropriate. Four scales are given which are dry, normal, sweating (humid) and heavy sweating (very humid). In addition, the participants are also asked to choose the condition they would like to be if they were given the chance to change the existing environment. They are provided with three options to change which are to reduce, unchanged or increase to the three physical environmental conditions which include air temperature, humidity level and air movement condition. The survey is only conducted during the specific time which is after each congregational prayer. Even though the mosques are open from as early as 5.00 am in the morning until 10.00 pm in the evening, the occupancy level is better during the congregational prayers. Depending on the size of the mosque, 5% to 20% capacity can be achieved during daily congregational prayer. A full capacity can only be achieved during weekly congregational prayer which is on Friday. There are five congregational prayers conducted each day which are:

- Dawn prayer (subh) – 6.00 am – 7.30 am
- Noon prayer (Zuhr) – 1.00 pm – 4.30 pm
- Afternoon prayer (Asr) – 4.30 pm – 7.00
- Dusk prayer (Maghrib) - 7.30pm – 8.30pm
- Evening prayer (Isya) – 8.30 – until Dawn prayer

For the purpose of the analysis, three periods of time which are the noon (from 1.00 pm until 2.30 pm), afternoon (from 3.30 pm until 5.00 pm) and evening (from 7.00 until 9.30 pm) are established. These are the duration of time that the mosques are mostly occupied.

The analysis of the collected data is intended to provide information regarding the dominating factor and other contributing factors of thermal comfort inside the selected area. Included in the set of questionnaires is the inquiry about the sensation of the factors affecting the thermal comfort that the participants have experienced. The factors include thermal sensation, humidity level and air movement condition. Votes from both of the scales will be compared to determine the response towards the three main factors in relation to the thermal comfort. The votes received are collected and tabulated using the bar chart. Cross tabulation analysis between the votes on the thermal comfort sensation and the votes of the sensation on the other factors described earlier can suggest how thermal comfort can be affected by each factor. It can also suggest which factors are more dominant in influencing the thermal comfort sensation. The votes on the preferences are also investigated to confirm the desired conditions affecting the thermal comfort level.

4. RESULT AND DISCUSSION

Figure 1, 2 and 3 show the votes of the variables in relation to the thermal comfort vote at a selected space during the noon, afternoon and evening time respectively. Based on Figure 1, it shows that the participants who voted 'too warm' for the thermal comfort vote, also experience the thermal sensation as either 'warm' (38%) or 'hot' (62%) with 'humid' condition and 'calm' air movement. This condition indicates that high humidity with relatively no air movement can cause thermal discomfort with either 'warm' or 'hot' categories of air temperature. In this figure, it is also pointed out that the participants feel 'comfortably warm' which is better than the 'too warm' condition when the thermal sensation is either 'warm' (67%) or 'neutral' (33%) with 'neutral' level of humidity (100%) and 'breezy' air condition (67%). However, 33% still votes the condition to be 'comfortably warm' even though the air movement is in the 'calm' condition.

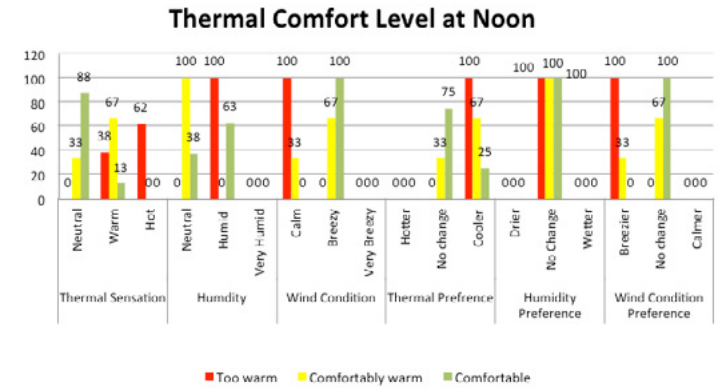


Figure 1: Thermal Sensation and comfort vote at noon

This is possible because the thermal sensation they experience is 'neutral' and with no air movement it is still considered 'comfortably warm' due to the acceptable thermal sensation. This suggests that the thermal comfort level improves with the reduction on the air temperature. In many cases the reduction in the humidity level also helps to improve the thermal comfort level depending on the air temperature and wind condition. When the air temperature is considered 'warm', the reaction to cooling down the body by sweating is more likely to happen. When the humidity level is high the ability for the evaporative process of the sweat may not be efficient enough to cool down the body. The reduction of the humidity level in this case, helps the evaporative process by increasing the ability of the air to contain more humidity. When the air temperature is at the 'neutral' level, the ability of the

body to react and produce sweat is slower or at minimal rate. The high level of humidity may not be very significant in influencing the thermal comfort level at this condition, however, in some cases that have been discussed earlier it affects the thermal comfort perception especially when there is little air movement. The increment in the air movement has certainly helped to improve the thermal comfort condition which can be clearly evidenced in the votes received by the 'comfortable' condition in which the increment in the wind condition along with the reduction of the air temperature has help the thermal comfort condition even though it shows an increment in the relative humidity. This also suggests that the humid condition can be tolerated when the condition of the air is 'breezy' and the thermal condition is 'neutral'.

The preferences vote has also suggested the importance of the variables to the thermal comfort condition. For examples, all of the participants who felt 'too warm' preferred the air temperature to be cooler as most of them feel 'hot'. Similarly, for those who feel 'warm' also vote the air temperature to be cooler. Only those who feel 'neutral' choose the thermal sensation to remain. This suggests that only 'neutral' thermal sensation is acceptable since there is no change requested for this condition. Similarly, breezier condition is preferred for all thermal comfort conditions which is shown in Figure 5.5. The 'no change' votes on the air movement is from those who have experienced the condition to be breezy. Therefore, it can be assumed that the wind movement is a variable that is important in providing thermally comfortable indoor. In the case of the relative humidity, regardless of the condition felt, all the participants prefer the condition to stay the same. This reflects that the influence of the humidity in the air may not be very critical in influencing the thermal comfort condition. Another assumption that can be made is that the level of sensitivity of the human body to react to the change in relative humidity is very poor. Therefore, the presence of the humidity in the air may not be realised.

Figure 2 shows the relation of the variables to the thermal comfort vote during the afternoon time at the same space. Based on the figure, it is obvious that respondents feel 'comfortable' when the thermal sensation and humidity level are at 'neutral' level and the air condition is 'breezy'. This is the ideal situation that makes the majority of the respondent feel 'comfortable'. With the change in the thermal sensation from 'neutral' to 'warm' as shown in Figure 2, the thermal comfort vote has also changed to 'comfortably warm' when the other two variables remain unchanged. The 'warm' thermal sensation however, may have resulted in poorer thermal comfort condition as shown in the Figure 2 when the humidity level is increased and with relatively little air movement. As expected, 'breezier' wind condition is preferred not only by those who experienced 'calm' air condition but also by some of those who

have considered the condition to be breezy. Again, for those who have sensed the thermal condition as ‘warm’ or ‘hot’, they prefer the condition to be cooler and similarly, the humidity level to be drier for those who have experienced the condition to be ‘very humid’.

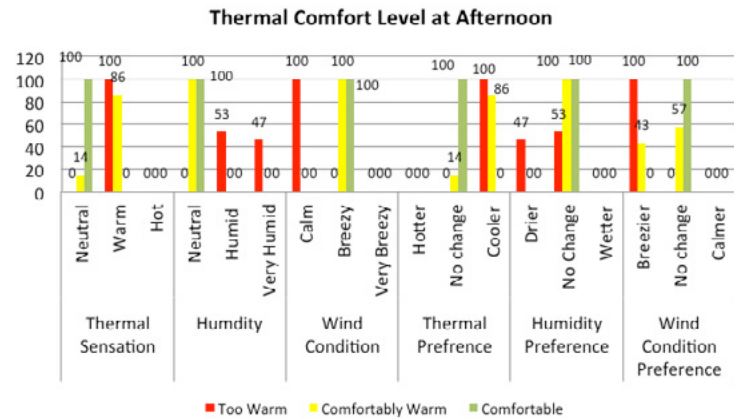


Figure 2: Thermal sensation and comfort vote at afternoon

A similar result is obtained in Figure 3 which shows the percentage of votes of the variables in relation to the thermal comfort perception during the evening time. In Figure 3, all of the respondents who feel ‘too warm’ experience the thermal sensation to be ‘warm’. However, with the ‘humid’ and ‘very humid’ condition and little air movement, the thermal comfort condition cannot be tolerable. It is also shown here that when the air temperature and the humidity level are considered ‘neutral’ and the wind condition is ‘breezy’, the majority of the participants will considers this condition as ‘comfortably warm’. The major difference among Figure 1,2 and 3 is that the survey taken for both Figure 1 and 2 is during the daytime, whereas the survey for Figure 3 is taken during the evening time. With the outside temperature lower than the indoor air temperature during the night time, there is a possibility that this condition may have influenced the result. The reduction of the outside temperature creates smaller differences between the inside and outside air temperature and this condition may have reduced the movement of air through the temperature difference between the inside and outside. Less air movement means less humidity is transferred from the inside to the outside and this may cause the effect of stuffiness.

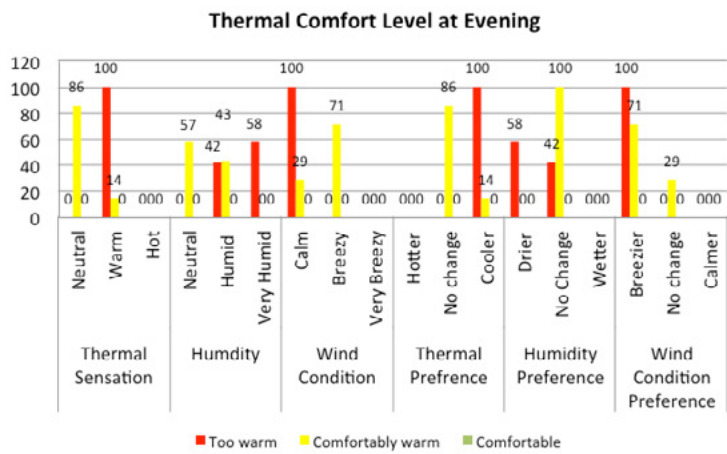


Figure 3: Thermal sensation and comfort vote at evening

Note: Seven levels of Bedford scale are used for the thermal comfort level but only the three levels are shown because no vote is received for comfortably cool, too cool, much too cool and much too warm.

ASHRAE 7-point scale is used for the thermal sensation but only three points which are neutral, warm and hot are shown because other points do not receive any vote for the period of time investigated

Based on the analysis conducted, it can be summarized that the air temperature and wind movement are important factors in influencing the thermal comfort condition for the countries in the hot and humid region such as Malaysia. The relative humidity too, plays a significant role depending on the condition of the previous variables. The high temperature throughout the day, to a certain extent is tolerable due to the process of acclimatization. It is also undisputable that the high temperature throughout the day triggers the body to produce sweat in reaction to cooling it down naturally. Whenever this happens, the presence of the humidity in the air and the air movement plays enormous role in influencing the thermal comfort condition. For examples, with the abundance of humidity in the air, the sweat produced is incapable of reducing the heat through the process of evaporation which is hampered by the high content of humidity in the air. It is also evidenced that when the air temperature falls, the relative humidity increases. This may explain why many participants feel more uncomfortable during the night time compared to the day time even though the air temperature is the same.

The presence of air movement also helps to improve the thermal comfort condition. It assists the cooling down process by transferring the humidity from the body to the air which involves energy exchanges. For the country that has high air temperature and relatively high humidity content, the breezy air condition is favourable. Continuous and strong air movement is required to help to cooling down the body. Figure 4 shows the flow of influences in thermal comfort based on the three main factors which are air temperature, relative humidity and air movement.

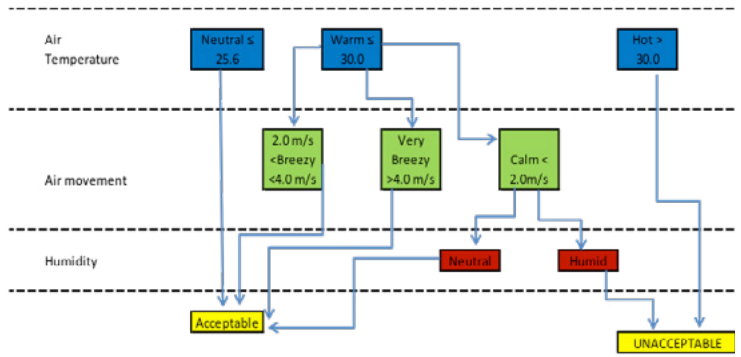


Figure 4: The filtration process to show the importance of physical factors in affecting thermal comfort

5. CONCLUSION

The investigation using the survey on the thermal comfort perception of prayer hall users in Malaysia has revealed that the three main physical factors of thermal comfort have various impact on the indoor thermal comfort depending the condition of each factors. For examples, the users feel thermally comfortable when the air temperature is in the neutral level of heat sensation regardless of the condition of relative humidity and air movement. At this range, it can be assumed that the influence of other variables such as humidity and air movement does not affect the thermal comfort perception. Humidity, however, will become effective in influencing the thermal comfort perception after the air temperature exceeds the neutral temperature making the air temperature as the ‘dominating’ factor in influencing thermal comfort. Similarly, air movement, is only needed when the air temperature is exceeding the neutral level. In some cases, the presence of air movement is only desirable when the air humidity is higher than normal. Based on the finding, it is clear that the air temperature is the ‘dominating’ factor which the indoor thermal comfort is highly dependent on the air temperature condition. The

relative humidity and air movement, on the other hands, are only assisting in the presence of air temperature in influencing the indoor thermal comfort. They are the “contributing” factors as their influence can only be effective depended on the condition of air temperature.

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THE CHALLENGES IN FAÇADE TRANSFORMATION DESIGNS OF
JONKER MELAKA HERITAGE ZONE

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ABSTRACT

The Jonker Melaka Heritage Zone is a tourism site with its own unique heritage value: a row of old buildings and shop houses with the architectural quality and building layout rich with colonial relics. However, changes in the function of the area have altered the exact nature of the building facade and caused some problems in the building in the area. Therefore, this study was conducted to identify the problems and factors affecting the building façade changes. Field studies, document analyses, literature reviews, and interviews were conducted to collect and analyse research findings. Four main problems that are the causes of the Jonker Heritage Zone building facade transformation were identified: (i) impairment on facade element, (ii) changes and current lifestyle effects, (iii) requirements and effect of consumer's will, and (iv) heritage building conservation approach which is not in accordance with the Guidelines for Heritage Building Conservation. This study contributes to the knowledge and helps local authorities make guidelines in addressing issues pertaining to urban heritage, particularly in preserving the facade of the building in the Jonker Heritage Zone.

Keywords: : Jonker Heritage Zone, Facade, Lifestyle, Consumer Needs, Preservation.

1. INTRODUCTION

The recognition of Melaka and George Town, Penang by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as world heritage sites on July 7, 2008 has made the Jonker Heritage Zone (Figure 1) a more popular place to be visited.



Figure 1: Jonker Melaka Heritage Zone.

Choy (2013) stated that the perception of a traveller generally involves five senses, namely sight, hearing, taste, touch, and smell, to evaluate the hospitality and services of the tourism products offered. In addition, Zuraidi et al. (2011) reported on the importance of building conservation because it has an invaluable value of emotion, culture, and history. According to Choy et al. (2014), the main component of tourism development in most parts of the world is based on heritage elements. So, the unique Jonker Heritage Zone with its own unique architecture needs to be maintained. Otherwise, the value of architecture, the country's historical resources, educational resources, and interesting locations for travellers will vanish, as emphasized by Ahmad (1994) and Zuraidi et al. (2011). A study conducted by Ramli et al. (2015) showed that 142 respondents or 19.3% were very satisfied with Melaka as a travel site while 378 respondents or 51.4% were satisfied. Thus, the facade of existing heritage buildings in the Jonker Heritage Zone must be preserved to attract more tourists. According to Saleh and Che Leh (2012), the maintenance and conservation of facade elements of legacy buildings are very important. A study conducted by Mohd Baroldin and Mohd Din (2012) showed that there are 9 facade categories in the Jonker Heritage Zone (Figure 2). However, after nearly 300 years, various problems exist in maintaining the facade of the Jonker Heritage Zone (Samadi et al., 2007).



Figure 2: Typology of Melaka Shophouses (Samadi & Mohd Yunus, 2012).

The facade design of the heritage building is the result of the art of significant architecture from a cultural and historical perspective. Heritage buildings also possess the same quality as human beings. Syed Idid (1995) stated that each building has its own unique personality, history, character, and architectural style in its day. In addition, legacy buildings also have unique and symbolic aesthetic, documentary, archaeological, economic, social, political, and spiritual values (Feilden, 2000). Building structures that are

still well maintained can illustrate and prove an era or event (Ahmad, 2009). In addition, the structure of the heritage building also preserves the history of a monument, area, architectural technology used as well as individuals or historical figures.

Based on the study, one of the identified problems is that many of the heritage buildings are not well preserved, unoccupied, and damaged. Some of the building elements (roofs, doors, windows, poles, and carvings) are deteriorating, caused by biological agents such as fungi, insects, and living plants, as an effect of poor building conservation. Samadi et al. (2007) also agreed and explained that the facade of the building is easily damaged by termites, fungi, moss, and promotion of idle plant life on the roofs and walls of the building. Ahmad and Abdul Rahman (2010) asserted that the facade elements can be damaged by salt attacks and rising humidity. Besides that, the equatorial weather in Malaysia and the age of the buildings themselves, some of which are over 200 years, also contribute directly to the destruction of existing heritage buildings. Not only that, the quality of the facade of natural buildings also declines gradually with the increase in age. This statement is supported by Johar et al. (2011), who stated that biological agents such as fungi and insects cause a lot of disabilities, especially to wooden structures. Fungal damages include soft decay fungi, decayed war, and white rot; while insect damages are caused by beetles, termites, ants, and bees. Mokhtar (2006) in his study entitled 'Damage and Degradation of Concrete Structure In Malaysia', emphasised that biological actions caused by moss, algae, and plant roots entering concrete through cracks and weakened points may result in increased force and cause cracking of the building.

Another problem is that many legacy buildings are renovated and the facade of the buildings are changed to fit the function. For example, when residential buildings are converted to commercial buildings, small doors have to be converted into larger openings. During an interview with Azimin Tazilan on 12 February 2016, one of the shopkeepers at Jonker Street explained that the need and influence of consumer demands also caused changes to the facade of the building. Azimin Tazilan affirms that many legacy buildings are renovated to meet the needs of different users according to their background, culture, purchasing power, and taste, thus neglecting the historical and aesthetic values of the buildings.

2. METHODOLOGY

The study on Jonker Melaka Heritage Zone involved qualitative methods such as field studies (such as observations, surveys, taking pictures and notes), document analyses (such as documents, journals, books, and articles),

literature reviews, and interviews (owners and operators of shop houses; Erne Hamsah, the Conservation Architect at Historic Melaka City Council; and tourists). Creswell (2013) also emphasises that qualitative research studies such as early surveys, case studies, and observations of events are also more natural and require long analysis of human involvement. This study involved five phases which were (i) identifying the problem that affects the façade of a building in the Jonker Melaka Heritage Zone, (ii) identifying the objective of the research, (iii) identifying the methodology, (iv) collecting the data, and (v) analysing the data, as emphasised by Naoum (1998), Ismail (2016) and Tazilan (2014). The framework for the study is summarised in Figure 3.

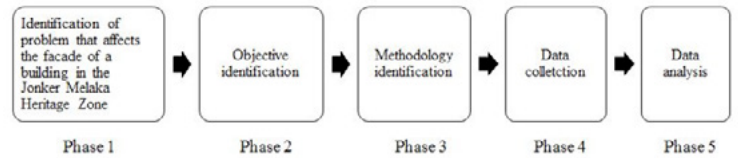


Figure 3: The framework of the study

An overall field study of Jonker Melaka Heritage Zone was conducted in May 2013 until November 2017. The criteria for the field study is shown in Table 1: (i) Usage of building (Used or Unused), (ii) Deterioration of building facade elements: roofs, doors, windows, pillars, and carvings (Yes or No), (iii) Influence of current lifestyle changes (Yes or No), (iv) Influence on user requirements (Available or Not Available) and (v) Approach to conservation work (Available or Not Available). The study focused on the façade elements such as roofs, doors, windows, pillars, and carvings, and also the function of each building.

Table 1: List of criteria for field study

Item	Criteria	Survey/ Observation
1	Usage of building	Used / Unused
2	Deterioration of building façade elements – roofs, doors, windows, pillars & carvings	Yes / No
3	Influence of current lifestyle changes	Yes / No
4	Influence on user requirements	Available / Not Available
5	Approach to conservation work	Available / Not available

Three roads were selected for samples in this study. The selected roads were Jalan Tun Tan Cheng Lock, Jalan Hang Jebat, and Lorong Hang Jebat. The three roads were selected based on the criteria outlined in Table 2. Some or all of the buildings from the chosen streets have an early architectural style or neo-classical style, the same criteria, and the same typical category. They also have ornaments with fine granules on the facade of the building, giving a prominent look for the building and making the building look more attractive.

Table 2: Street names, building criteria and building number.

Number	Name of Road	Building Criteria	Number of Building/ Population
1	Jalan Tun Tan Cheng Lock	Early Shophouses / Neo-Classic/ Art Deco	33
2	Jalan Hang Jebat	Early Shophouses/ Eclectic/ Neo-Classic/ have an interesting ornament on the building	83
3	Lorong Hang Jebat	Early Shophouses	87

The detailed study of each building along the three selected roads, which were Jalan Hang Jebat (83 units), Jalan Tun Tan Cheng Lock (33 units), and Lorong Hang Jebat (87 units), was conducted from 2013 until 2017. All data were collected, checked against, and compared with the early inventory data from the Historic Melaka City Council, literature review, and document analyses. The differences of the façade elements were also checked with the Malaysian conservation rules and regulations imposed by the local authority and also the guidelines by UNESCO.

3. RESULT AND DISCUSSION

In general, many building facades are changed to maintain business activities, but there are also shop owners who let deterioration and visual impairment happen (Samadi & Mohd Yunus, 2012). Based on the research, the researchers classified the problems affecting the facade of buildings in the Jonker Heritage Zone to be as follows: (i) impairment on facade element, (ii) changes and current lifestyle effects, (iii) requirements and effect of consumer's will, and (iv) an approach to heritage building conservation approach which is not in accordance with the Guidelines for Heritage Building Conservation (Department of National Heritage, 2016). Table 3 shows the objective, problems, methodology, analysis method, and results of the study.

Table 3: Objective, problems, methodology, analysis method and results of the study.

No	Objective	Research Question	Methodology	Analysis Method	Result	Percentage
1	To identify the problem that affects the façade of a building in the Jonker Melaka Heritage Zone	What are the problems that affect the façade of a building in the Jonker Melaka Heritage Zone?	Qualitative Approach: 1. Field study 2. Document analyses 3. Literature review 4. Interview	Frequency Matrix Table	Result 1: Impairment on façade element Result 2: Changes and current lifestyle effects Result 3: Requirements and effect of consumer's will Result 4: An approach to conserve heritage buildings which is not accordance with the Guidelines for Heritage Building Conservation (Department of National Heritage, 2016)	Result 1: 1. 59.0% (49 units) at Jalan Hang Jebat 2. 51.5% (17 units) at Jalan Tun Tan Cheng Lock 3. 86.2% (75 units) at Lorong Hang Jebat Result 2: 1. 94.0% (78 units) at Jalan Hang Jebat 2. 84.8% (28 units) at Jalan Tun Tan Cheng Lock 3. 82.8% (72 units) at Lorong Hang Jebat Result 3: 1. 96.4% (80 units) at Jalan Hang Jebat 2. 87.9% (29 units) at Jalan Tun Tan Cheng Lock 3. 79.5% (66 units) at Lorong Hang Jebat Result 4: 1. 91.6% (76 units) at Jalan Hang Jebat 2. 78.8% (26 units) at Jalan Tun Tan Cheng Lock 3. 96.9% (84 units) at Lorong Hang Jebat

3.1 Impairment on Facade Element

Lorong Hang Jebat has the highest percentage of deterioration on the facade element of the building, which is 86.2% (75 units). It is followed by Jalan Hang Jebat at 59.0% (49 units) and Jalan Tun Tan Cheng Lock by 51.5% (17 units). The deterioration of facade elements such as roofs, walls, doors, windows, pillars, and carvings on buildings is significant. The decline is due to (i) damaged and abandoned buildings and (ii) natural factors (equatorial weather in Malaysia, the age of the building that exceeds 200 years, pests, idle plants, etc.).

a) Damaged and Abandoned Buildings

Defection and abandonment caused major damages to the building facade. Buildings No. 22 and No. 163 at Jalan Tun Tan Cheng Lock (Figure 4) were found to have suffered a lot of damage and left idle. A similar condition was seen for Buildings No. 97, No. 125, and No. 127 at Jalan Hang Jebat (Figure 5). In October 2013, Building No. 127 was abandoned. In April 2017, there was no change in the maintenance and conservation process on the building.

b) Natural Factor

Natural factors such as hot and humid weather conditions encourage plant growth in the walls of the building. Furthermore, pest infestation such as termites accelerates the decaying process on the structure of woodwork (Figure 4 and Figure 5).



Figure 4: Abandoned and damaged buildings without occupants. Building No. 22 and Building No. 163 at Jalan Tun Tan Cheng Lock (2016).



Figure 5: Buildings No. 97, 110, 125, and 127 at Jalan Hang Jebat (2016).

3.2 Changes and Current Lifestyle Effects

Table 3 illustrates the percentage of buildings influenced by the current lifestyle. At Lorong Hang Jebat, 82.8% (72 units) of the buildings have changed, while 84.4% (28 units) of the buildings have changed at Jalan Tun Tan Cheng Lock. The highest changes in building facade is at Jalan Hang Jebat, which is 94.0% (80 units).

Figure 6 shows Building No. 33 at Lorong Hang Jebat which was built around 1851–1870. There has been a significant change in the overall structure of the building. The original building was only two levels high but it was modified to five levels. The building has been run by a traditional food company since 2002. It is clear that the renovation of the building did not follow the conservation guidelines outlined by International Council on Monuments and Sites (ICOMOS) (1987) and the Heritage Building Conservation Guidelines (Department of National Heritage, 2016).

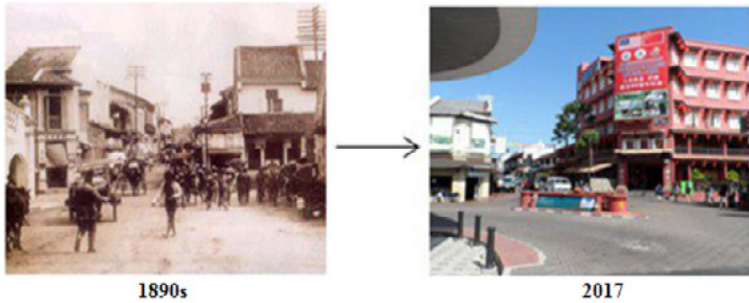


Figure 6: Differences of Building No. 33 at Lorong Hang Jebat in the 1890s and 2017.

In addition, the construction of a Hard Rock Café (HRC) at Jonker Melaka Heritage Zone entrance (Figure 7) is a modern lifestyle influence and is less in line with an environment that comprises historic buildings. Zuraidi et al. (2011) emphasised that the construction of new buildings around the site of the heritage building is not suitable at all. However, when Erne Hamsah from the Conservation Architects Department of Building Control Division, Malacca Historical City Council was interviewed on April 30, 2014, the reason given was that the HRC design still has the features of old architecture. The results prove that lifestyles changes in the community also affect the appearance of the building facade.



Figure 7: Hard Rock Café (HRC) Melaka (2017).

3.3 Requirements and Effect of Consumer's Will

Jalan Hang Jebat has the highest number of buildings affected by the impact of consumer needs, which is 80 units (96.4%). Meanwhile, the number of buildings affected at Jalan Tun Tan Cheng Lock is 29 (87.9%) while at Lorong Hang Jebat is 66 (75.9%). Starting from 2014, Melaka has undergone rapid changes in development. If a business is unable to meet the needs and requirements of consumers or buyers, its business activities and the services offered may be affected. Consumers have a great influence in determining the types of businesses and services offered. If consumer needs are ignored, the business and services offered cannot raise the trader's economic status. For example, Building No. 45 at Lorong Hang Jebat (Figure 8) was built around 1851–1870 and is under the Early Period category. The main door was renovated by the previous owner and is different from the original building (Figure 9). Other elements are still maintained. In 2013, it operated as an art gallery and guest house but became a traditional food shop by 2016. Likewise, Building No. 64 at Jalan Hang Jebat operated as an antique store in 2005 but became a Chinese restaurant in 2015 (Figure 10). The facade elements are maintained but the interior layout was modified according to the suitability of business activities.



Figure 8: Building No. 45 at Lorong Hang Jebat, Melaka

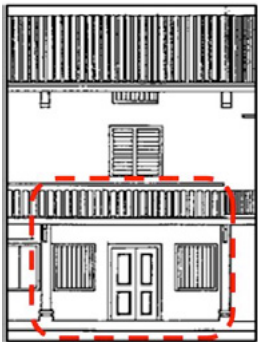


Figure 9: Building façade in Early Period (1851–1870s), Syed Idid (1995).



Figure 10: Building No. 64 at Jalan Hang Jebat, Melaka.

3.4 Approach to Heritage Building Conservation which is not in accordance with the Guidelines for Heritage Building Conservation.

Table 3 shows that 96.6% (84 units) of conservation work approaches at Lorong Hang Jebat do not follow conservation guidelines, 91.6% (76 units) at Jalan Hang Jebat, and 78.8% (26 units) at Jalan Tun Tan Cheng Lock. Hamilton and Md Ali (2002) stated that the damage and renovation of the heritage building were ignored by the original owner and demolished because of the insistence of developers and lack of community concerns. Ahmad (1994) explained that most people lack the understanding of the term conservation and consider the conservation of heritage buildings to be just like the usual renovation. A proof of principle study conducted by Kamal and Ahmad (2008) found that 87% of legacy buildings need conservation efforts while 78% of the buildings do not use appropriate conservation approaches. Harun et al. (2010) listed some conservation approaches for reference during conservation work on legacy buildings, as shown in Table 4.

Samadi et al. (2007) pointed out that the factors driving this situation are the difficulty of shop owners to get qualified consultants in the retention and conservation work of buildings and the high cost of conservation compared to the renovation of new buildings. The cost of handling regulatory agencies for the preservation and conservation of historic buildings is higher by 30% compared to normal buildings (Yung & Chan, 2012). Many building maintenance and conservation works in the Jonker Heritage Zone are not in accordance with the ethics of conservation works set out in the 2016

Heritage Building Conservation Guidelines issued by the Department of National Heritage Malaysia. Figure 11 shows five key ethics that need to be applied in conservation work under the 2016 Heritage Building Conservation Guidelines.

Table 4: Conservation Approach (Harun, et al, 2010)

Concept of Urban Conservation	Description
Conservation (Pemuliharaan)	Work on repairing the building condition using materials that are almost as likely as when the building was first constructed.
Restoration (Pembaikan / Pengembalian Semula)	Repairing works by maintaining the authenticity of the architecture and its material to a certain time as thought fit or as good as the original and subsequently to the original use.
Reconstruction (Pembinaan semula)	Reconstruction is done on historic buildings that have been destroyed due to human and environmental factors. The construction uses original materials and techniques in their original form.
Preservation (Pengekalan/ Pemugaran)	Works to ensure that a place is in its original state and prevented from any obstruction or damage.

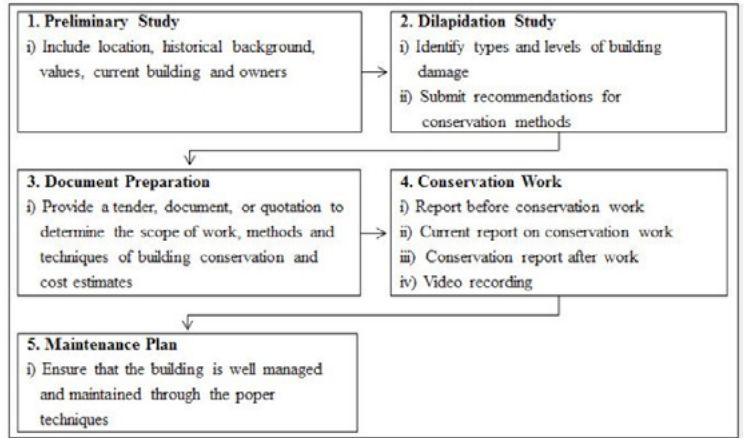


Figure 11: The process of conservation of heritage buildings (Department of National Heritage, 2016)

Building conservation works must follow the guidelines issued by the Heritage Building Guidelines 2016 (Figure 12). The six processes include

(i) preservation, (ii) identification and maintenance of the building element, (iii) replacement of the damaged element, (iv) care and maintenance, (v) modifications and additions, and (vi) new additional or new building, must follow to ensure that all conservation work is done according to the correct procedure.

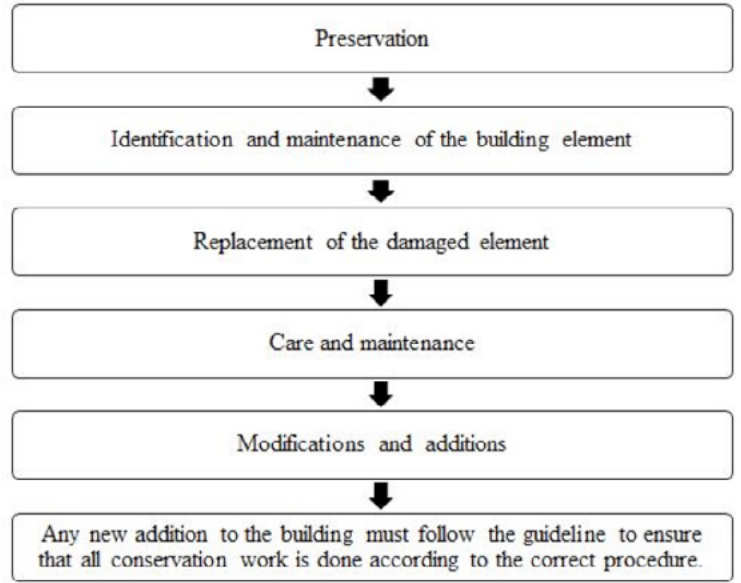


Figure 12: Department of National Heritage Documentation Requirements (Department of National Heritage, 2016)

At the Jonker Heritage Zone, many buildings were renovated according to the tastes and wants of owners or building operators. Furthermore, there are also additions to the original building such as veranda, stairs, shop signage, etc. (Figure 13).



Figure 13: Addition of signage, veranda and stairs on buildings.

Restoration work in the facade of Building No. 82 at Lorong Hang Jebat (Figure 14) was done and no signs for conservation work were shown.



Figure 14: Building No. 82 at Lorong Hang Jebat (2013).



Figure 15: Differences in Buildings No. 46 and No. 48 at Jalan Hang Jebat (2005 and 2016).

Based on Figure 15 and Table 5, we found many changes to the facade elements of buildings, such as doors and windows, between 2005 and 2016. Also, there are additions of windows and physical changes of doors and windows.

Table 5: Facet transformation of building facades No. 46 and No. 48 at Jalan Hang Jebat for 2005 and 2016.

Element	2005	2016	Description
Door			2005 Arc-shaped door 2016 Glass door with wooden frame
Window level 1			2005 The entire window is wooden and there is an air hole 2016 Glass window with wooden frames
Window Ground Floor			2005 No window 2016 Additional glass window with wooden frame
Door and Window Ground Floor			2005 Arc-shaped door and window 2016 Glass doors and windows and there is an additional glass window

4. CONCLUSION

The findings show that many problems affect the facades of the building at Jonker Heritage Zone, even after being declared World Heritage City by UNESCO in 2008. The deterioration of the facade elements gives a poor visual impression and shows that the maintenance of the building is not done well and weak. This may affect the image or character of the building and may affect the tourism industry in the Jonker Heritage Zone. The emergence of modern buildings in the study area, if not adequately controlled, also impacts the legacy buildings. In terms of openings such as doors and windows, there are significant changes. The old opening element has wooden doors and windows while new elements use glass material. The height of the old building was only one storey but the new building has been renovated to five floors.

This review can help the authorities to provide appropriate and specific guidelines for the best conservation and maintenance strategies of buildings

to protect existing heritage buildings. The findings suggest that complete documentation and reports such as recording the condition of the building before, during, and after the maintenance work should be done for future reference. This information is important as a reference for the maintenance and restoration process of the building in the future. A more in-depth and detailed study is required to address the problem of faulty forms of building facade in Malaysia and a more detailed conservation procedure may be suggested based on proper conservation principles and ethics.

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THE ROLE OF CULTURAL ARTEFACTS AS A TOOLS TO MEDIATE COMMON CULTURAL PRACTICES IN A MULTI- ETHNIC SOCIETY

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ABSTRACT

The concept of sustainability is not only associated with the environment, but includes cultural aspects. Whereby cultural artefacts help in the sustainability of any culture or cultural practice. Thus, cultural artefacts are believed to be the identity of a culture. On the other hand, cultural artefacts have become a mediator in developing common practices in diverse cultures. However, in a multi-ethnic and multi-cultural country like Malaysia, the plural and the autonomous cultural systems are seen as an obstacle in various common forms. As such this study aims to identify the commonly used cultural artefacts and the reasons for their preferences. The nominal group technique (NGT) was used in this study to identify the commonly used cultural artefacts. NGT is a qualitative data collection technique based on discussions among various categories of stakeholders and multi-ethnic group members. The study has justified the existence of common elements in multi-cultural practices which could reduce ethnocentrism and promote social integrity and unity among Malaysia's multiethnic society.

Keywords: : Culture, Cultural Artefact, Cultural Practices

1. INTRODUCTION

The daily practices and interactions of human being are sustained by culture; perhaps helps in forming new cultural practices. Grazuleviciute (2006) has highlighted that the concept of sustainable development is not only associated with the environment, but includes cultural aspects. Thus, it has proven that human interactions, daily routines and norms influence their behavior and transform them into a culture (Hsu et al., 2012). Therefore Schein (2004) has expressed that culture undergoes adaptations and also merges with other cultures. On the other hand, Zivanovic (2014) and Bennett (2013) have claimed that culture is in form of fluid that keeps transforming. The daily practices of human beings are essential in determining the strong bound and integrations in a multiethnic society like Malaysia. Malaysians have been exposed to various cultures and practices but have maintained certain common cultural values since the colonial period (Rahman, 2010).

Scholars have classified cultural artefacts as instruments especially those that can be handled or carried by a person (Md Ishak, 2016; Kasim, 2004). The British colonials in Malaya clustered the cultural artefacts into nineteen types. However, currently the Malay Ethnography Museum and Department of Museums of Malaysia have divided these cultural artefacts into eight types (Ahmad, 2015; JMM, 2014). Cultural artefacts are believed to be a part of heritage and the identity of culture itself. It enhances the understanding of human behavior and preserves humanity (Ismail et al., 2014). The uses of cultural artefacts are similar within the various cultures in Malaysia. However, images of artefacts differ mainly due to materials and fabrication methods

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(Md Ishak et al., 2015). This is because all the artefacts or instruments are designed and fabricated based on certain levels of cultural influences (Moalosi et al., 2007). Thus, researchers have commented that cultural artefacts are dynamic, fluid and active (Zivanovic, 2014; Bennett, 2013).

According to Schein (1999) the use and impact of cultural artefacts in a society are easy to explain but it is difficult to understand the logic and reasons behind their behavior. Thus, to understand a culture, one should understand the values behind these artefacts that caused the behavioural changes (Schein, 1999). According to Hamat et al., (2014) cultural artefacts were analysed and interpreted to indicate the culture, system of economy, lifestyle and patterns of settlement of the people of Malaya. Hence, the Malaysian culture and living pattern have proved the remarkable adaptation and acceptance of multi-cultural values (Ismail et al., 2014). However, in Malaysia, due to the diversity of cultures, it is difficult to recognize the commonly preferred cultural artefacts in a multi-ethnic society (Zainal et al., 2015). In addition, ethnocentrism’s attitude widens racial polarization gaps among people who feel that their culture or ethnicity is far superior to other groups (Gill et al., 2012; Baharuddin, 2007). This leads to the question of whether it is possible for the existence of common cultural practices among the multi-ethnic groups.

2. METHOD

This study attempts to identify the role of cultural artefacts as a mediator for common cultural practices among Malays, Chinese and Indians in Peninsular Malaysia. Literatures reported that Delphi techniques and Nominal Group Technique (NGT) are suitable methods in idea generation, determining priorities or solving problems. However, Van de Van and Delbecq (1971) stressed that NGT can be used to explore the consumer and stakeholder views while the Delphi technique is used to develop guidelines. Thus, although the NGT and Delphi techniques are suitable for cultural related study, it has been concluded that the NGT is most appropriate techniques to identify the role of cultural artefacts in generating common cultural practices. Besides, Hofstede (2011) and Prabowo (2014) recognized NGT as a tool for a valid data collection process especially by putting forward a single research question in reasonably short time.

The NGT provides an opportunity to achieve a substantial amount of data in a relatively short period of time (Potter et al., 2004; Prabowo, 2014). The NGT is recognized as a useful research method and valid data collection process in identifying the role of cultural artefacts as a tool to mediate common

cultural practices and their attributes. However, to generate reliable findings the NGT respondent should have some basic criteria such as knowledge on the subject matter, atleast five years of experience or exposure in Malaysian culture (Perumal, 2017; Prabowo, 2014; Lloyd-Jones et al., 2012). The NGT procedure has flexibility in choosing the sample size. As suggested by Lennon et al., (2012) and Harton (1980), the number of respondent can be between five and ten individuals. Whereby Hervey and Halmas (2012) suggested six to twelve participants.

This study was conducted with six respondent who were selected using the snowball sampling method, based on their experience in cultural and social as proposed by Merriam (2016). Two respondents were selected to represent each major ethnic group of Peninsular Malaysia namely Malays, Chinese and Indians. They have more than five years of using cultural artefacts, working or conducting research in the field of culture. However, the selection of respondents were not based on their experience in using specific artefacts to avoid bias in research findings. There were two main activities conducted with the participants in the research, as recommended by Potter et al., (2004).

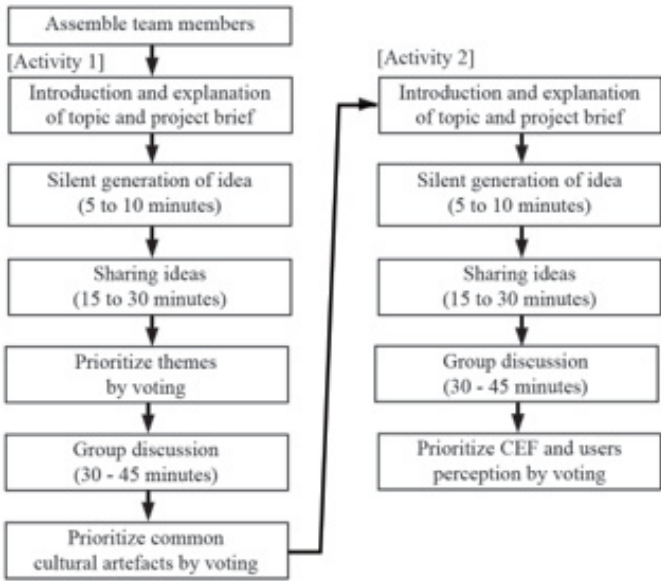
Activity 1:

The first activity was to select and list the cultural artefacts. The participants were asked regarding the cultural artefacts that were used commonly by the major ethnic groups in Peninsular Malaysia. Participants were also requested to answer the questions based on their experiences.

Activity 2:

The participants were asked for their opinions on the common activities or practices performed with the selected common artefacts. Activities 1 and 2 were guided by open ended questions and were conducted by following the instructions shown in Figure 1.

The information derived from Activity1 and 2 were based on the ideas of experts in their area of interests (Arokiasamy et al., 2014). Thus, the participants were equipped with a clear understanding of the artefacts and multi-cultural life style and practices (Prabowo 2014; Potter et al., 2004). At the beginning of this activity, the researcher projected the image of the mortar set on the LCD screen. It was to ensure the respondent had similar understanding and imagination about the mortar set. 15 flip cards were distributed to each participant and the participants were asked to write a common cultural practices of the mortar set. The common practices were finalized by following the steps shown in the Figure 1.



Source: Adapted from Potter (2004)

Figure 1: Flow of Nominal Group Technique

3. RESULTS

3.1 ACTIVITY 1

The respondent in this study had listed the names of 40 cultural artefacts. The mean rankings that was shown in Table 1 represent the total votes (total sum of individual assessment in each cultural artefact) divided by the number of NGT participants. The lowest mean indicated the most important attributes in this study, while the highest mean indicated the least important attributes of the commonly used cultural artefacts among Malays, Chinese and Indians.

Through filtering, names of repeated artefacts were omitted, leaving only 23 artefacts that were commonly used by the three major ethnic groups; Malays, Chinese and Indians. The mortar set was accepted as the most common artefact with the mean score was 1.50, as shown in Table 1. It was universally used by human beings, and was also used among Malaysians without the boundary of ethnicity.

Table 1: Mean ranking of commonly used cultural artefacts

Artefacts	Total Vote	Mean Ranking	Artefacts	Total Vote	Mean Ranking	Artefacts	Total Vote	Mean Ranking
Mortar Set	9	1.50	Basket	65	10.8	Chicken Chop	100	16.7
Coconut Grater	10	1.67	Tiffin Carrier	65	10.8	Wooden Bushel	104	17.3
Wok	17	2.83	Earthenware Pitcher	75	12.5	Rice Winnow	107	17.8
Plate	38	6.33	Rice Grinder	79	13.1	Steamer	107	17.8
Food Cover	40	6.67	Coconut Milk Filter	80	13.3	Wooden Tray	115	19.1
Ceramic Bowl	43	7.16	Jug	85	14.1	Betel Leaf Box	115	19.1
Drinking Set	45	7.5	Putu Mold	88	14.6	Spatula	125	20.8
Large Tray (Talam)	47	7.83	Wooden Mortar	95	15.8			

Items rated on a scale of 1 to 23 (1=most common to 23= least common)

The lower the mean, higher the rank

3.2 ACTIVITY 2

The respondent listed a total of 35 common practices that were classified as a reasons for using the mortar set. However, more than half of the practices were repeated and removed from the list with the respondent consent. In Table 2, it showed that mortar is the common artefact among the 12 cooking practices

In this study, lower mean values indicate higher common practices among Malay, Chinese and Indian ethnic groups. Therefore, cultural artefacts or common cultural practices especially in cooking that are ranked low indicate they have high preference among the multi ethnic groups.

Table 2 showed that the descriptive statistics for all the common practices in the use of the mortar set among Malays, Chinese and Indians. Out of these 12 common practices, ‘Pounding Chilli’ was identified with the highest mean (M=1.16) and this was followed by ‘Pounding Onion’ with the M value equivalent with 1.83). The common cultural practice in using mortar set with M=3.16 was ‘Blending Ingredients for Cooking’ followed by ‘Producing Traditional Sauce’ (M=4.00), Pounding Dry Fish’ (M=4.83) and for the purpose of ‘Enhancing food taste traditionally pounding’ (M=6.10). ‘

In the latter stage, Preparing Traditional Fast Food’ was detected with the mean value equivalent with (M=7.33) followed with ‘Pounding Coconut’ (M=7.83). Besides that, ‘Manual Pounding to Save Energy’ was detected with mean value M=8.83, ‘Pounding Traditional Herbs’ (M=10.3), ‘Medicine Preparation’ (M=11.0) and ‘Decorating Kitchen (M=11.5) All these practices

are considered as the most common cultural practices in a multi ethnic society among Malays, Chinese and Indians.

The findings have shown that the multi ethnic Malaysian society is bonded together by cultural practices. The cultural artefacts functioned as tools to mediate the common cultural practices in a multi ethnic society. The research findings have strongly highlighted that food related artefacts are used in the preparation of cooking ingredients that transcends the boundaries of races and life styles. Radzi et al., (2009) have stressed that cultural artefacts not only mediate the common practices but have helped in good integration and interaction among the ethnic groups namely Malays, Chinese and Indians for centuries.

Table 2: Mean Ranking of Common Practices

Common Cultural Practices	Total Vote	Mean Ranking	Common Cultural Practices	Total Vote	Mean Ranking
Pounding Chilli	7	1.16	Preparing traditional fast food	44	7.33
Pounding Onion	11	1.83	Pounding Coconut	47	7.83
Blending ingredients for Cook	19	3.16	Manual Pounding to Save Energy	53	8.83
Producing Traditional Sauce	24	4.00	Pounding Traditional herbs	62	10.3
Pounding Dry fish	29	4.83	Medicine preparation	66	11.0
Enhancing food taste traditionally by pounding	37	6.10	Decorating Kitchen	69	11.5

Items rated on a scale of 1 to 12 (1=most common to 12= least common)

The lower the mean, higher the rank

4. CONCLUSION

This study has revealed that common practices exist and sustained because of the similar use of cultural artefacts among the major ethnic groups in Malaysia. This is a proof of Malaysian cultural practices that can reduce ethnocentrism and promote social integrity and unity. The author recognizes the importance of studying the common practices through cultural artefacts that can preserve nation's harmony. Thus commonly used cultural artefacts can become mediatory tools of unity among people of a multi ethnic society.

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USERS’ EMOTIONAL RESPONSES AND PERCEIVED PRODUCT QUALITY
TOWARDS SUSTAINABLE DESIGN

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ABSTRACT

Emotion of a product has influenced the user interaction and enhanced the value and quality. Also, the quality performs as a cognitive response influencing the user in distinguishing the quality of a product. Nowadays, many product designers have trouble in interpreting potential meanings and perceiving the quality of a product in product development process that should be contributed for sustainable design. The strength of this study emphases not only in identifying and verifying the variable of user's emotional responses and perceptions in the product quality, but also focuses in developing a new theory of sustainable product design method towards sustainable design. A survey with the involvement of the end users (consumer product) was conducted in this study. The results recognized certain variables of user's emotional responses and perceptions towards the product quality, which is a significant contribution towards product sustainability and as well as increasing its success in the market. In addition, a new theories of Sustainable Product Design Method (SPDM) has been introduced.

Keywords:New product development, Emotional responses, Perceived product quality, and Sustainable design

1. INTRODUCTION

In recent years, the characteristics of a product produce reflective consequences in the way that the products being perceived and sustaining its existence in the market. A product design regulates from a user's first impression and determines how it can communicate about function. The design of a product would build a user's interpretation regarding the product attributes (Bloch, 2013; Alli & Mohd Rashid, 2018) and would directly apply to their product choice (Sundar et. al., 2014). An interpretation that is based on physical characteristic of a product could influence the product sustainability and its robustness as well as creates emotional connections with the user (Blijlevens, 2012). Characteristics such as shape, form, texture and color would be looked as the function and aesthetic elements and are often related to a person's exposure to the influence of the product and understanding of product meaning (Taha et. al., 2012; Taha et. al., 2013; Sundar et. al., 2014; Alli, 2018).

The importance of understanding the user has increased over the years. Thus, a common practice on many design industries would include involving user in product development. The users can positively contribute in creating a product that satisfies the expectations and thus, increasing the product quality and the probability of the success of the product on the market. However, the involvement of the user in the early stage of product development process has been identified as a critical success factor for new product development (Taha et. al., 2012; Taha et. al., 2013; Alli, 2018). As a result, many product designers often face difficulties in integrating potential meanings and perceived quality of a product in the early stage of product development process (Bloch, 2013;

Sundar et. al., 2014; Alli & Mohd Rashid, 2018; Alli, 2018). This had caused the users to misunderstanding the assessment of the product, appreciate less of product, and do not know and have difficulties in recognizes of product meaning and function and consequently, produce less sustainability factors. Previous study done by Taha et. al., (2013), Alli & Mohd Rashid (2018) and Alli (2018), stated that one of the reasons of the aforementioned problem is lack of awareness to be included in the variables of user's emotional responses and perceptions towards product quality during the product planning and development process.

Hence, a new design philosophy should be familiarized to reach towards designing a long-lasting product desire, and have a deep affection between users and the product. The main objective of this paper was to study which elements of users' emotional responses and their perceptions towards product quality contributing in design sustainability. This study is valuable in providing a good understand of product meaning and develop an appropriate guideline for product designer in establishing the product requirements and as well as increasing its success in the market.

2. RESEARCH BACKGROUND

2.1 User Emotional Responses

User emotional responses have been essential for product design study since late 1980s. User emotional responses are described as feeling that result in psychological and physical changes that stimulate behavior and contemplation. It also seems to rule human beings' everyday lives due to the fact that it could make the users' choices primarily based on their moods either happy, unhappy, indignant, bored or even frustrated. Emotion is normally described as a complex state of response that ends in physical and psychological alterations that have an effect on thought and behavior. Whilst, user emotional responses in design can build a strong emotional attachment and empathy between user and products that can also influence user behavior (Chapman, 2015). According to Laurans & Desmet (2012), there are 14 emotions that are used to describe the product users with pictorial illustrations used in PrEmo2 software and associated to product characteristic are illustrated (see Figure 1).

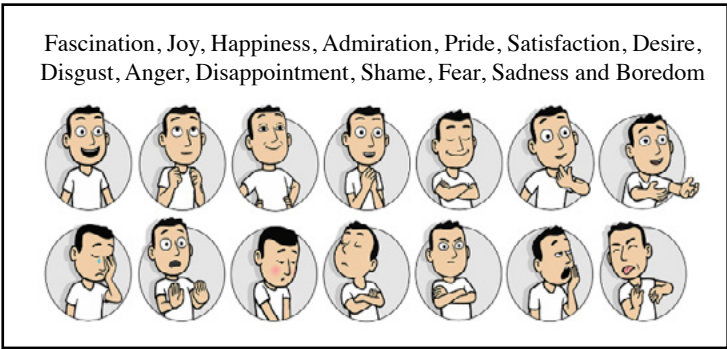


Figure 1: Pictorial Illustration in PrEmo Software (Laurans & Desmet, 2012)

2.2 Perceived Product Quality

Perceived product quality is different from actual or objective quality, product-based quality and manufacturing quality. Perceived product quality is more towards users' evaluation regarding the excellence of a product that meet the individual's expectations. User's perceived product quality could be defined as judgment on how a product or services as quality could be described in terms of the moment at which the users receive information about the characteristics of the products (Tamimi & Sebastianelli, 2016). Ultimately, the quality of a product is related to the users' experiences and personal taste, and not the opinion of the product designers or anyone else in the manufacturing company. Moreover, the users' decision making is also considered as a perceived quality that has become an option within a given category that the product features that could become indicators for the users; aesthetic, functional, and emotional. A study by Garvin (1987), identified that there are eight dimensions of product quality, as a framework-conceptualizing user needs (see Table 1).

Table 1: Dimensions of Quality Use for Strategic Evaluation (Garvin, 1987)

Product Quality	Description
Performance	Product's primary operating characteristics. It is involved measurable attributes; brands can usually be ranked objectively on individual aspects of performance.
Features	Secondary characteristics that develops basic function of the product to user.
Reliability	It reflects that a product will not fail within a specific time period. Reliability are also the mean time to first failure, the mean time between failures, and the failure rate per unit time.
Conformance	This dimension is a product's design and operating characteristics that meet specified standards, which physical and performance characteristics of product meet design specification.
Durability	The item will be used until it is no longer able to operate. It measure the length of a product's life.
Serviceability	It indicate the speed, which the product is ease, courteousness, and competence of repair when it breaks down.
Aesthetics	It specifies a personal judgment and a reflection of user preference to a product. It appeals to our five senses; looks, feels, sound, taste, or smells.
Perceived Quality	The quality attributed to a product based on indirect measure or subjectively assessed.

2.3 Sustainable Product Design

Sustainable product design is understood as a collection of approaches, which generally contain product design for ease of disassembly, product life cycle, recycling, and product materials to enhance energy consumption and reduction in environmental effect that considers longer-lasting products in relation to the physical and emotional endurances. The idea of sustainability has become progressively important all over the world because of the incorporated approach indicators that link a community’s economy, environment, and society. A study by Amekudzi, et. al., (2015), defined sustainability as the interaction of its three main parts, and example of features intersection as constraints to any two parts in their three-dimensional “sustainability footprint” metric (see Figure 2). This concept can be integrated to the design field where product designers examine the aspect in the product development process to be fulfil with the principles of social, economic, and environmental sustainable.

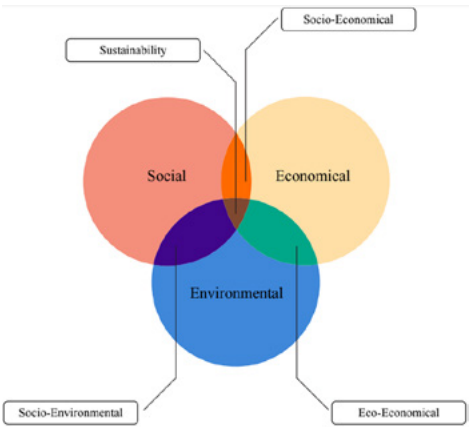


Figure 2: Three-Dimensional of Sustainable Intersection (Amekudzi, et. al., 2015)

According to Eizenberg & Jabareen (2017), the elements of social sustainability are constructed into four interrelated concepts (Eizenberg & Jabareen, 2017). Each performs a specific function within the social sustainability framework including perceptions of safety, equity, eco-prosumption, and sustainable urban forms. Then, an economical sustainability is also important to produce products and services. It contains product life cycle, product innovation, productivity cost, and durability (Gupta et. al., 2015). Meanwhile, environmental sustainability involves an approach to the engineering processes, products, and structure that provides a less negativity or effect on environmental systems related to resources availability and technology (Pappas, 2012).

2.4 Users’ Emotional Responses and Perceived Product Quality Approach

Numerous different methods have been developed to assist the product designers in understanding the end users. Most were introduced from areas, such as economic, marketing, operation management, and manufacturing. The approach exercise attempt to evaluate the quality of a product such as manufacturing-based approach, product-based approach, transcendent or judgmental approach, user-based approach, value-based approach, and quality characteristics. According to Metso (2016), the manufacturing-based approach focuses on producing a product with a predetermined quality level, while user-based approach is based on needs and expectations. The product that satisfies the users’ needs are considered to have superior quality.

A study by Kaplan et. al., (2013) stated that the proposed for measuring emotions responses are identified by four types of evaluations. First, emotions are referred to as sentient and individuals’ reflection on the feeling states. Questionnaires were being used to measure emotions in scales. Second, emotions cause physiological reactions from peripheral nervous system. Emotions are measured by physiological changes in body, for example, measuring heart rate and other variables that vary during emotional stimulation. Third, emotions are cognitive evaluation and labeling process. It can be measured from attribution and judgment. And fourth, emotions reflected facial expressions and response, which helped the researchers to find methods by measuring behavioral observations such as facial and vocal expressions. Whilst, many people including product designers and manufacturers are unintentionally concentrating on physical appearance (visceral level) and functionality (behavioral level) of a product that are easily replenished, then on an emotional way (reflective level), to produce and maintain continuing emotions (Aftab & Agustin, 2017). Norman (2007) established three levels of emotional design attachment and used as approaches towards the ability for a design object to elicit intended user emotions (see Figure 3).

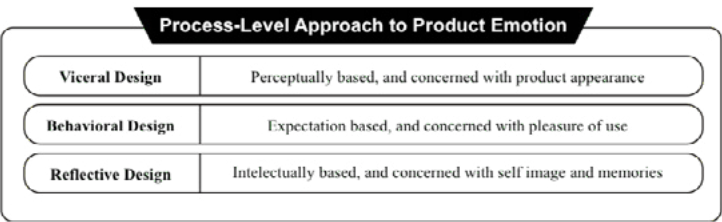


Figure 3: Process-level Approach to Product Emotion (Norman, 2007)

2.5 Strategy for Sustainable Design

Sustainability aspects is crucial in increasing demands in the design. Sustainable design is introduced to change conservative design and manufacturing practice, and considerate with environmental essentially. Sustainable design is understood as a collection of approaches, which generally contain product design for ease of disassembling, product life cycle, recycling, and product materials to enhance energy consumption and reduction of the environmental effect (Gant, 2017). It is important to have an understanding on relationship

between users and product that can improved its sustainability. In addition, the key for a sustainable value of products lays with the users by the constant interactions in how they provide a meaning to the things. A well-defined user as being important for sustaining and contributing in product success (Taha et. al., 2012; Taha et. al., 2013; Alli & Mohd Rashid, 2018; Alli, 2018). However, users’ decision regarding a product is crucial towards its sustainability and success in the market. This is necessary to inspire the product designers to establish the product characteristic based on the variables of users’ emotional responses and perceptions towards product quality. In addition, the product designers also need a guideline that could be used at the early stage of the design process or product assessment study.

3. METHOD

Sixty (60) respondents had participated in a survey to gather the data for the research. They represented the end users of product consumer. A kitchen appliance or more specifically, electric kettle with three designs had been chosen to epitomize a product that needed to be evaluated by then end users (see Figure 4). These electric kettles were carefully selected based on the sales reputation and seemingly numerous feedback from the users. The survey was directed by means of a questionnaire distributed among the end users in some of the established electrical store, Harvey Norman located in several urban locations in Selangor, Malaysia. The questionnaire was intricately designed around the expected respondents’ background and information to be gathered from them since they are the end users of the product being investigated by the study. The results were analysed using the statistical Package for Social Science (SPSS). The results were gathered and presented as conclusion to the study.



Figure 4: Kitchen Appliances (Electric Kettle A, B, and C)

4. RESULTS

4.1 User Satisfaction

User satisfaction has become the source of innovation success in the market. Figure 5, illustrates the analysis of user's emotional responses evaluation within kettle A, B, and C. According to positive emotion value, fascination of kettle C has the highest score (70.8%) followed by kettle B (64.3%) and kettle A (59.1%). Joy value of kettle C scoring (66.3%) followed by kettle B (64.3%) and kettle A (61.4%). Meanwhile, the happiness of kettle C scoring (69.3%) followed by kettle B (65.9%) and kettle A (61.0%). When it comes to admiration, kettle C scores the highest with (67.9%) followed nearly by kettle B (67.0%) and kettle C (66.3%). Conferring to pride, the scores set kettle B first with (66.5%) followed by kettle C (64.4%) and kettle A (57.5%). By satisfaction, kettle A scores the highest value (71.1%) followed by kettle C (65.0%) and kettle B (63.5%). Lastly, the values of desire set kettle A scores (61.0%), kettle C with (60.5%) and lastly kettle B (57.5%).

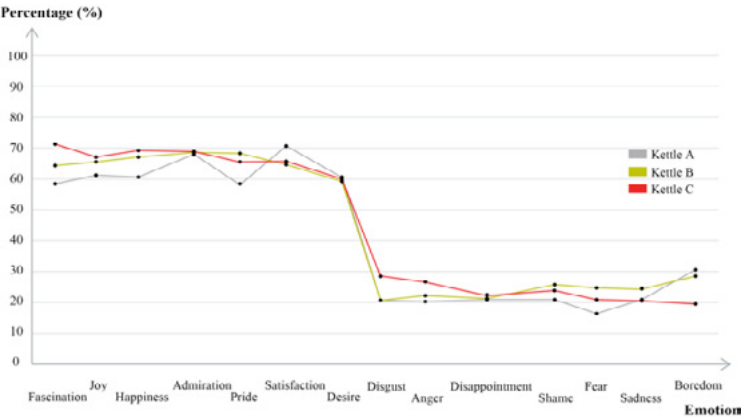


Figure 5: Analyses of Emotions Within Kettle Appearance

Whilst, the negative user's emotional responses through kettle A, B and C, disgust emotion set (21.0%) for kettle A and (21.4%) for kettle B followed by kettle C (28.0%). Anger indicates kettle A has the lowest value (20.4%) followed by kettle B (22.6%) and kettle C (26.5%). Regarding to disappointment emotion, kettle A (21.3%) has the lowest score followed closely by kettle B (21.6%) and kettle C (22.0%). When it comes to shame, kettle A has the lowest point with (21.3%) followed by kettle C (23.1%)

and (25.6%) for kettle B. Fear emotion indicates kettle A (17.3%) has the lowest point followed by the score from kettle C (21.6%) and kettle B (24.0%). Sadness tells kettle C (21.4%) has the lowest point followed closely by kettle A (21.6%) and kettle B (23.3%). Finally, boredom emotion shows kettle C (19.9%) as a lowest score followed by kettle B (28.3%) and kettle A (30.5%).

4.2 Aesthetic and Function Elements of Product Design

Both figure below provide an overview of aesthetic and function elements of product design. The results in Figure 6 show the aesthetics elements of product design, which were specify that appearance and color (83.3%) as the most importance of the aesthetics elements followed by shape (82.1%), form (80.8%), material (72.9%), texture (67.9%), interface (66.7%), emotion (59.2%), semantic (57.5%), and semiotic (53.8%).

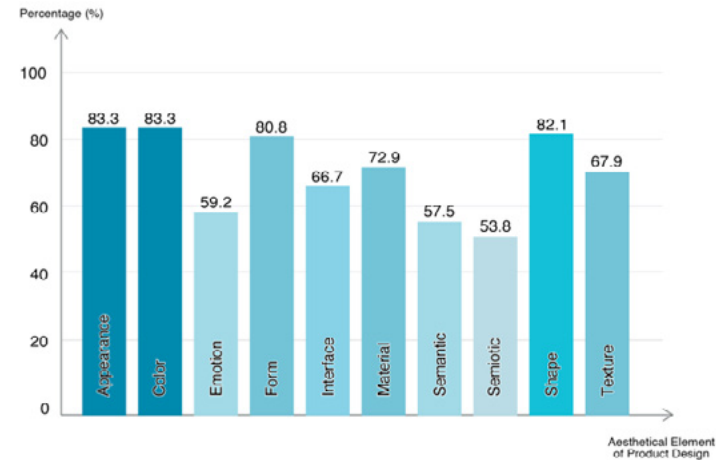


Figure 6: Aesthetics Elements of Product Design

While, Figure 7 shows the function elements of product design. The results identify usability (85.8%) is the mostly prioritized, followed by safety (84.6%), quality (82.9%), effectiveness (82.5%), reliability and technology (81.7%), ergonomic (77.9%), lifetime (71.7%), components (68.3%) and size (67.5%).

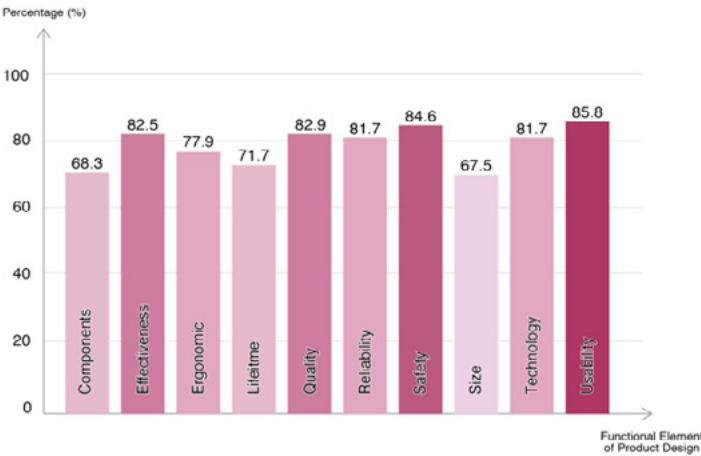


Figure 7: Function Elements of Product Design

4.4 Product Quality Characteristics

Figure 8 demonstrates the characteristics of product quality. A results indicate durability (87.8%) is the most significant for product quality followed by perceived quality (85.9%), performance (85.6%), aesthetics (85.5%), conformance (85.0%), serviceability (84.8%), features (84.4%), and lastly reliability (82.8%).

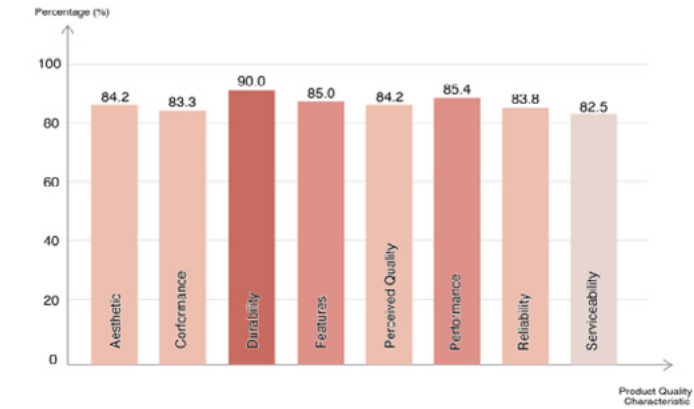


Figure 8: Product Quality Characteristics

4.5 Elements of Sustainable Design

Figure 9 illustrates elements of the three dimensions of sustainable design. Based on these levels, social, economical, and environmental most importance elements are performance (82.1%), followed by accessibility (81.3%), reuse (80.8%), material (80.4%), resource (79.2%), development (75.4%), value (74.6%), cost (70.8%) and lastly equity (67.1%).

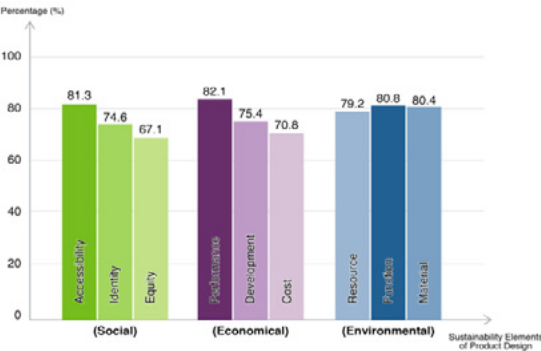


Figure 9: Elements of Sustainable Design

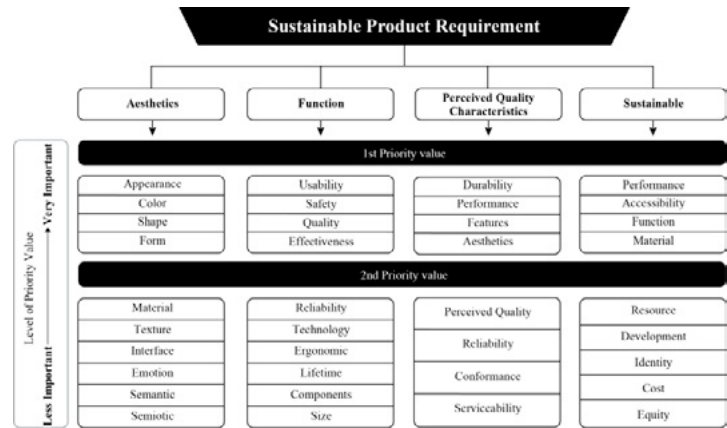
5. DISCUSSION

Sustainability aspects are becoming important in product design and increasing its demand. Sustainable design is introduced to change conservative design and manufacturing practice and be more considerate towards the environment. In this study, the results have shown that the user is a key for a sustaining value of products by the constant interactions, which how they gave a meaning to things. The users' emotional responses and perceptions towards product quality have significantly a huge impact on sustainable designs. To introduce a new product, it is necessary to have a good understanding between the relationship of the user and the product to improve the sustainability and as well as increase its success in the market.

Table 2 demonstrates the elements of sustainable product requirements of the electric kettles. These elements were gathered from the users' emotional responses and perceptions towards quality and sustainability of the products. Sustainable product requirements from the first priority value are identified from the mapping process of twenty (20) elements of product design, eight (8) elements of perceived quality characteristics and nine (9) elements of

sustainable design, which have been identified by the users. The elements were set based on the high priority to low priority value. It is shown that the appearance is mostly the highest priority for aesthetics elements followed by color, shape and form. While, the highest priority for function elements are usability, safety, ergonomic, and quality. Therefore, perceived product quality has identified that durability, performance, features and aesthetics are the highest priorities. As shown by the results, elements like performance, accessibility, functions and materials have been established as the top priorities for the end users to their definition of a sustainable product.

Table 2: Sustainable Product Requirements



Hence, the Sustainable Product Design Method (SPDM) has been developed in conjunction to the responses collected through the information gathered from the figure above (see Figure 10). The figure explains on product assessment as a decision-making as attempt to identify the main priority elements of sustainable product design specifications (SPDS) in fulfilling the requirements of the user, and which, can be integrated with the elements of sustainable product design (ESPD) to produce a sustainable product requirements (SPR) that contribute to sustainable product (SP). Hence, it would also provide success for the product in the market.

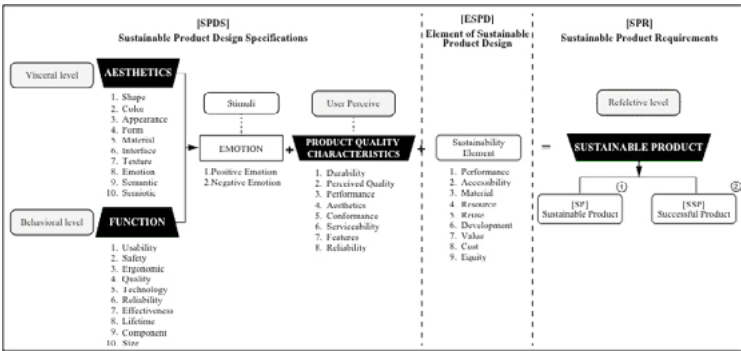


Figure 10 : Sustainable Product Design Method Process

In addition, a recommended formula is also has been projected (see Formula 1.0 below). The aforementioned formula would be utilised in an assessment process in identifying and verifying the sustainable product design specification (SPDS) and ultimately, establishing the sustainable product requirements (SPR). This process is divided into two steps. The first step is set in identifying the sustainable product design specification (SPDS) where both elements of emotional aesthetics (EAs) and emotional function (EFe) need to be incorporated with the product quality characteristics (PQC) in determining a sustainable product design specification (SPDS). Meanwhile, the second step is integrating sustainable product design specification (SPDS) with the elements of sustainable product design (ESPD), and thus, it will be determined a sustainable product requirements (SPR). Towards the end, the selected sustainable product requirements (SPR) should be able in the establishment of sustainable and successful products.

$$\text{Formula:} ([EAc] + [EFc] + [PQC]) = \text{SPDS} \quad (1)$$
$$([EAc] + [EFc] + [PQC]) = (\text{SPDS} + \text{ESPD}) = \text{SPR} \quad (2)$$

6. CONCLUSION

This study has introduced a new method namely Sustainable Product Design Method (SPDM). The SPDM is a process to identify and verify the three variables of users' emotional responses, perceived product quality and elements of sustainability in the early stage of the design process. SPDM is a design guideline that attempts to establish the sustainable product requirements (SPR) towards sustainable and successful product in the market.

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DEVELOPING GOAT FARM WASTE MANAGEMENT TOOL TO PRODUCE ORGANIC FERTILIZER

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ABSTRACT

In agriculture, the 'organic fertilizer' or popularly known by its trade name, 'Black Gold' is the result of livestock faeces that are processed or recycled as manure. This project aimed to develop a specific product for collecting goat manure while cleaning the pen. The clean-and-collect criteria of this product was created to complement the farm worker's task in working efficiently. The major target of this project was to identify existing cleaning products that can be enhanced for clean-and-collect purpose in the animal pen. Both primary and secondary research data were used in this study. The primary data were collected by interviewing the farm worker and farm officer; both shared information, experiences, and problems during the process of cleaning the goat pen. Data were also collected from observation of the cleaning tools used in the pen. The secondary data were collected from literature review and patents from previous studies including articles, journal, websites, and other documented sources. These data were described and analysed qualitatively in this research. The cleaning process in the pen will become easier with the clean-and-collect product that has been explored in this study. The time spent to clean the pen will be improved as well. In conclusion, the product will clean the pen effectively by collecting goat faeces efficiently. It is therefore feasible to be developed as a waste management tool that can aid in the production of organic fertilizer. Subsequently, this product is also beneficial in terms of income and labour requirements in the farm.

Keywords: : Product design, cleaning tools, animal pen, farm management, manure

1. INTRODUCTION

Manure-based compost is a source of side-income that can be generated in a goat farm. The organic fertilizer, also popularly known by its trade name, Black Gold, is produced from plant or animal sources that do not have any chemicals or hormones compound. With only 50 goats, farmers can already cultivate the organic fertilizer and thus increase revenues to replace the original main source of income. (Anem, 2012).

The easiest and cheapest method of composting is the process of incubation using EM (Effective microorganisms), where the bacteria will accelerate the elaboration process of faeces to fertilizer composition that is organic and not harmful. This can help the natural composition of soil fertility in the long term. Other available mixture is a fruit palm rest, which is buffeted palm branches and PKC (Palm Kernel Cake) that can be easily obtained. In terms of the law on the use of goat droppings as fertilizer, mainly as fertilizer for vegetables, the Malaysian Standard clause 5.6.4.2.3 states that nutrients and fertility products shall be applied in a way that does not harm soil, water, and biodiversity. Indeed, the direct use of goat manure without its elaboration process is not allowed, as stated in clause 5.6.4.2.6, where the mineral fertilizers shall only be used in a programme addressing long-term fertility, and together with other techniques such as organic matter additions, green manures, crop rotations, and nitrogen fixation by plants. Their use shall be justified by appropriate soil and leaf analysis or diagnosed by an independent expert (Department of Standard Malaysia, 2015). However, the animal stool or faeces that have been fully resolved through the proper process is required because it is good for soil fertility and safe to be used as fertilizer.

As the secondary product in the farm, manure composted from the goat faeces can serve as another source of income for the farmer.

2. LITERATURE REVIEW

The literature review is based on previous studies that relate to cleaning tools. In addition, this literature review also investigates the factors and effects of organic farming.

2.1 Books/Journal/Articles

a) Farmyard Manure (FYM)

Referring to the relation between soil organic matter and yield levels of non-legume crops in organic and conventional farming systems, (Migliorini et al., 2014) farmyard manure is the decomposed mixture of excreta (dung) and urine of farm animals like cow, horse, goat, and sheep, along with leftover hay and fodder. They are ready-made manures and contain nitrogen, phosphorus, and potassium. Farmyard manure that is collected in the field and stored in an exposed condition over a long period shows a considerable loss of ammonia, which signifies a loss of fertilizing value. To prevent this loss, the dung is stored in pits which are about a metre deep. When the pits are filled to the top, the surface is sealed with mud slurry. The manure is ready for use in about 4-5 months. Microbes play an important role in decomposing the dung and converting it into manure.



Figure 1: Farmyard Manure
Source: (AgriFarming, n.d.)

b) Effects of organic farming or organic fertilization on soils

Soils displayed higher microbial biomass (Cmic), with lower metabolic quotient (qCO₂ = CO₂: Cmic); (Reinhardt et al., 1996); (Fließbach, Oberholzer, Gunst, & Ma, 2007), as well as lower soil bulk density (Dominici et al., 2006). There were higher root colonization with arbuscular mycorrhiza fungi (AMF) and higher AMF spore density in the soil (Becskei et al., 2008); (Katzenberger et al., 2006). However, other trials showed unclear results or no difference with AMF (Bedini, Turrini, Rigo, Argese, & Giovannetti, 2010); (Vienna, Freyer, & Vienna, n.d. 2014). Under organic cultivation (and favourable weather conditions) soils have a high potential for short-term nutrient delivery. Organic farming is the best technology for poor site conditions.

c) Malaysian Standard

According to the Malaysian Standard, clause 5.6.4.2 material of microbial, plant, or animal origin shall form the basis of the fertility program. Maintenance of fertility may not rely solely on off-farm.

d) Patent research

Besides literature search, a patent search for similar products also needed to be done. It is because patents are very important to be identified to prevent similar products having claim in patent. Moreover, existing similar products cannot be used as the new product. Patent claims can occur in various aspects such as:

- i) the design
- ii) the function
- iii) the technology

This research also explored on patent search where a lot of claims has been identified for a product. This patent documentation helps to identify which claims have been used. Thus, it will guide the research on which claims should be applied to the final product.

Furthermore, there is a lot of information on existing stool cleaning technology products and how the technology has been applied to collect animal faeces. Seven similar products have been identified to be patented so far.

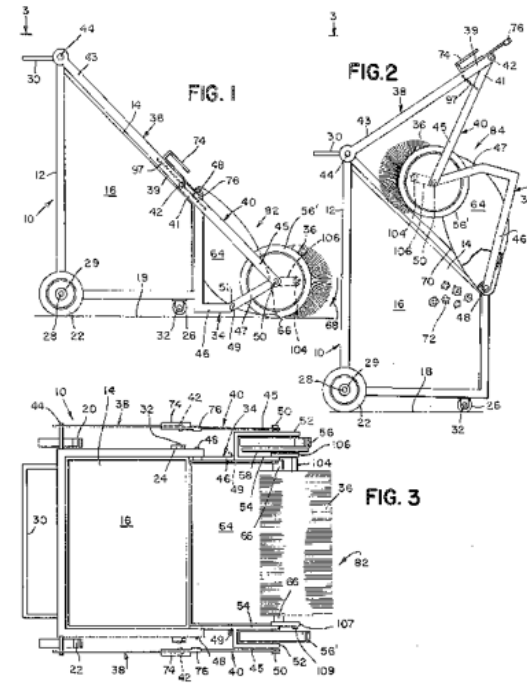


Figure 2: Existing patent products
Source: (Abraham Micheals, 638 Spruce St., Philadelphia, 1976)

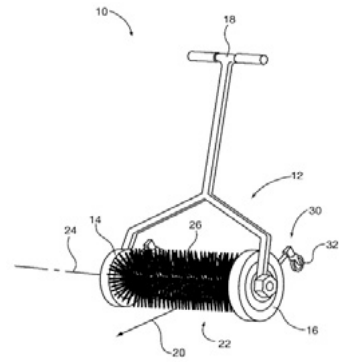


Figure 3: Existing patent products
Source: (Brian Rose, Sanford, 2012)

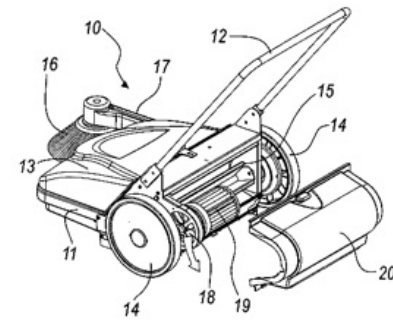


Figure 4: Existing patent products
Source: (Renato Scremin, Tezze Sul Brenta (IT): Gianfranco Lago, 2006)



Figure 5: Product used at Ladang 16 UPM

3. METHODOLOGY

Data collection for this research employs both primary and secondary research data. Primary data collection in the research have been conducted by interviews and observation. Meanwhile, the secondary data were collected from literature review and patents from previous studies such as articles, journal, websites, and other documented sources.

3.1 Conceptual Framework

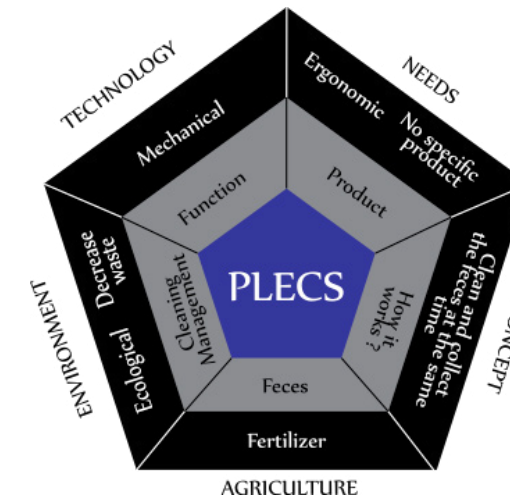


Figure 6: Research Process

Figure 6 shows a conceptual framework that follows three problem statements. All keywords are in the purposed group of the conceptual framework. Five factors have been indicated as the gaps for the conceptual framework. The gaps come from relevant issues and existing products.

a) Environment

One problem based on relevant issues is the effects of cleaning the pen from the waste, that can cause harm to the environment. Usually, a lot of water is used during pen cleaning, which could affect the environment and increase the expenses of water consumption. Moreover, the workers would use self-modified tools that are ineffective. Product incompatibility has been identified

as the gap for this issue. This is because not many suitable products are readily and commercially available to clean a goat pen. Therefore, the target product should have a combination of clean-and-collect purposes to solve the problems of the target users.

b) Needs

The problem statement is the appearances of existing products which have low appeal in design. From the observation, most of the existing products are not for cleaning purposes. The farm workers usually use farming tools like a scoop and a wheel barrow to clean the pen. Furthermore, the design of existing products is not attractive. Thus, the design specification of dual functional cleaning tools must be guided by style to attract potential users.

c) Technology

The concepts of simplicity and feasibility have become the guide to develop the target product. The product will be designed based on specifications, criteria, and functions that adhere to both concepts. The product must be easy to use, portable, and compact. Most of the design specifications and criteria of existing tools make them difficult to use, due to lack of any storage compartment, leaving farm workers without access to a specific product for the intended task.

3.2 Summary

The conceptual study has been narrowed to the factors that influence goat breeders, farmers, and farm workers, as target users. All the information lead to the identification of appropriate design specifications, criteria, and concept for a cleaning tool in a goat pen. The combination of the ability to clean the pen while collecting the faeces will benefit the target users.

3.3 Primary Data

a) Interview

The interview was conducted at Ladang 16 UPM in three sessions with a farm worker, a farm officer, and a postgraduate student. Each respondent was interviewed separately, and a lot of information were obtained from the separate interview sessions. The respondents shared their experience and relevant information throughout the interview. Data were analysed qualitatively. The result of the survey will further be discussed in Section 4.

b) Questionnaires

A set of questionnaires was prepared and answered by 15 farm workers as the target respondents in this research. The aim of this questionnaires is to investigate their basic knowledge and experience in using farming tools to clean the goat pen. These are the list of question scopes that were asked:

- i. their experience
- ii. the frequency of cleaning the goat pen
- iii. actions done to the goat manures after the cleaning process
- iv. the main problem during the cleaning
- v. the function of tools
- vi. the product commonly used to clean goat faeces
- vii. opinion on existing products

c) Observation

From the observation, it was clear that the farm workers have been struggling to clean the goat pen. Therefore, a good cleaning tool is needed to help them work efficiently. The observation result will be discussed in the next section. These are the main situations that had been observed:

- i. how existing products are used
- ii. the problems that may occur during and after the cleaning process
- iii. the effects after the cleaning process has been completed

3.4 Secondary data

a) Journal

Secondary data was obtained from articles, journals, and books. The journals and articles were derived from various sources such as websites from the Internet, and library indices. More details of the journals will be further discussed in the next section. These are the information collected:

- i. general information on organic farming
- ii. amendments and updates in organic farming
- iii. existing products relating to organic farming

4. DATA ANALYSIS AND FINDINGS

The results of this research will be discussed in this section. The results are separated based on primary data and secondary data. The primary data includes observation, questionnaires, and responses from the interview sessions, whereas the secondary data includes findings from journals, internet websites, and a video. The findings from Section 3 will be discussed and summarized in this section.

4.1 Data Analysis

a) Interview

The first session of the interview had been conducted for about an hour with a farm worker known as Mr. Yono, and these are the responses from the interview:

Mr. Yono said that he encountered many problems during the cleaning process. He said that the use of the self-modified product was not effective because it did not clean the pen properly. The factor of this problem was attributed to the fact that the product was not specifically designed for cleaning.

The second session of the interview was held with Mr. Abdul Rahman, the farm officer at Ladang 16 UPM. The findings from the interview are as follows:

Mr. Abdul Rahman said that they had no specific product for cleaning and collecting faeces. They need a product that can simplify the cleaning process, so that they can minimize the time spent to clean the pen. He suggested a conveyer to be put below the pen, so the faeces can be transferred into sacks. Furthermore, he suggested the observation of the machine being used to clean chicken coop as an idea for the development of the target product in this present study.

The third session of the interview was made with Mr. Abdul Mu’in Hassan Basri. He is a postgraduate student of Animal Science in UPM and is currently conducting a research in Ladang 16 UPM. Other problems have also been discovered during the interview session with him.

He said that goats or sheep can easily fall ill if there are kept in a dirty environment. The pen must be cleaned at least once a day and the water for drinking must be changed daily.

b) Summary of the interview

From the interview, the respondents already possess knowledge on organic farming. They seemed dissatisfied with the management of organic farming in Malaysia and they need proper tools that can help them to work efficiently. Since they have no specific tool to clean the pen, the respondents have been suffering back pains, which could be harmful for their well-being in the long run. Moreover, due to inappropriate tools and insufficient time, faeces cannot be processed into manure and fertilizer. Instead, the faeces were treated as waste product to be thrown away or burnt.

c) Questionnaires

- i. Survey - Basic knowledge and experience of cleaning the goat pen from faeces

In this section, there is only one correct answer for each question. The aim of this survey is to test the respondents’ basic knowledge and experience of cleaning the goat pen.

Question No. 1, “Have you ever cleaned the goat pen?”; the correct answer is:

A. Yes

From 15 respondents, 100% have experienced cleaning the goat pen (shown in Table 7).

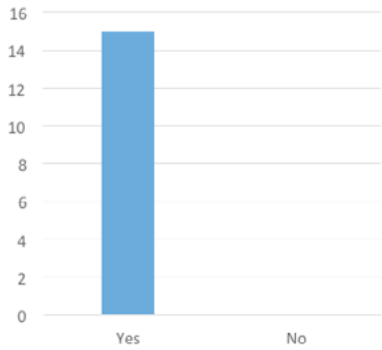


Figure 7: Experience of cleaning the goat pen from faeces

Question No. 2, “How often do you clean the goat pen?”; The correct answer is:

A. Very often

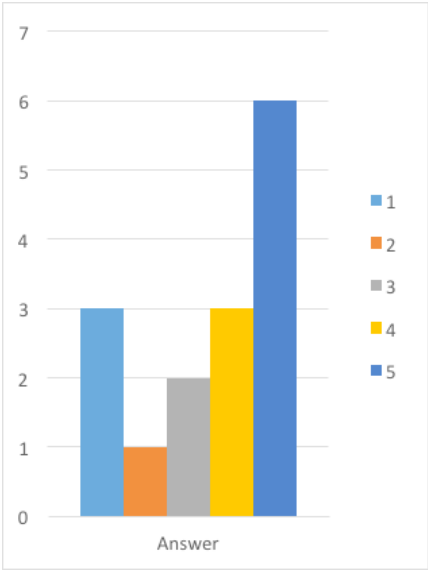


Figure 8: Answers of Question No.2: “How often do you clean the goat pen?”

All the respondents are farm workers, so most of them clean the goat pen on a regular basis (illustrated in Figure 8).

Table 1: Data analysis for the frequency of cleaning the goat pen

Correct answer (%)	Mean	Variance	Standard Deviation
40	3.53	2.55	1.60

From Table 1, 40% of the respondents cleaned the goat pen very often and only 20% did the job very rarely.

Question No. 3, “After the cleaning process, what is done to the goat faeces?”; The correct answer is:

B. Most of them are thrown away, which may harm the environment.

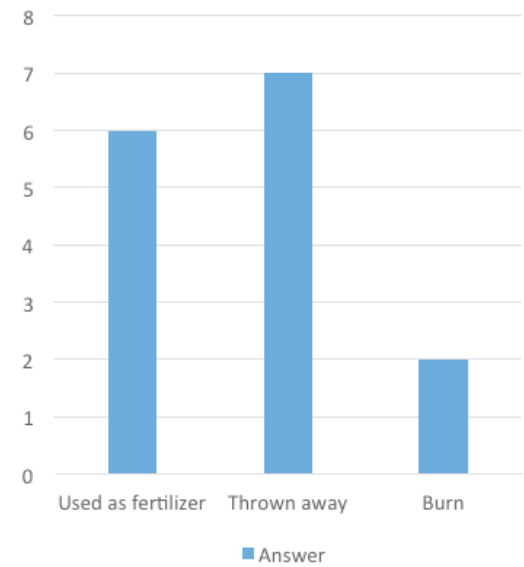


Figure 9: Answers to Question No.3: “What is done to the goat faeces?”

Table 2: Data analysis for what is done to the goat faeces after the cleaning process

Correct answer (%)	Mean	Variance	Standard Deviation
40	1.73	0.50	0.70

The percentage of the correct response for this question is 40%, which is to be “used as fertilizer,” but most faeces were thrown away and burnt, which may harm the environment. The mean from this question is 1.73, and the variance of this result is 0.50.

Question No. 4, “What is the main problem during the cleaning process?”; The correct answer is:

A. Too much waste, such as water, time, energy, etc.

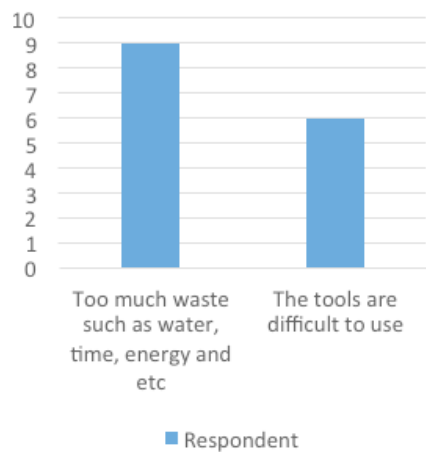


Figure 10: What is the main problem during the cleaning process?

Table 3: Data analysis for the main problem encountered during the cleaning process

Correct answer (%)	Mean	Variance	Standard Deviation
60	1.4	0.26	0.51

60% agreed that there were so much waste during the cleaning process. Most respondents chose different answers.

Section II: Design and function

For the design and function, all respondents had used cleaning tools to clean the goat faeces.

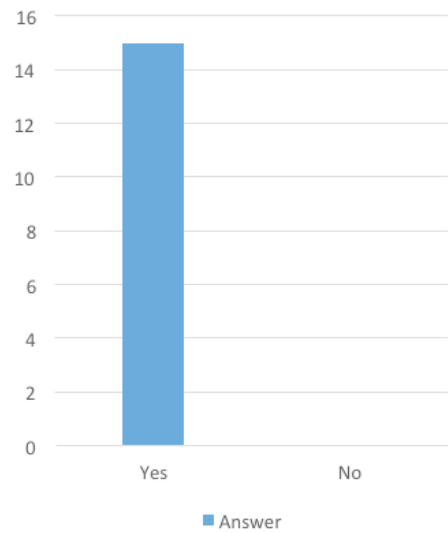


Figure 11: Answers to Question No.5: “Do you use any machine/tool to clean the goat pen?”

In Figure 11, 100% of respondents had used cleaning tools to clean the goat pen.

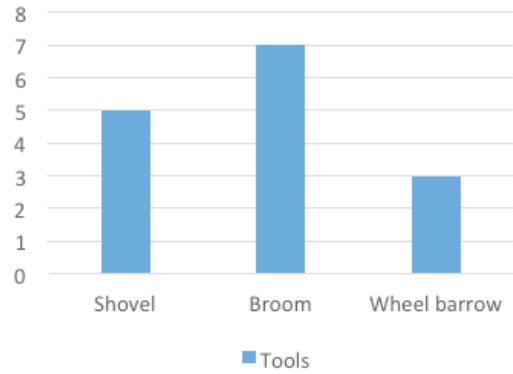


Figure 12: Tools that are normally used for cleaning the goat pen

Table 4: Data analysis of products that are normally used for cleaning the goat pen

Items	Frequency	Percentage (%)	Mean	Standard Deviation
Shovel	5	33.30	1.87	0.74
Broom	7	46.70		
Wheelbarrow	3	20.00		

The tools commonly used by the respondents to clean the goat pen are broom (46.70%), followed by shovel (33.30%), and wheelbarrow (20%).

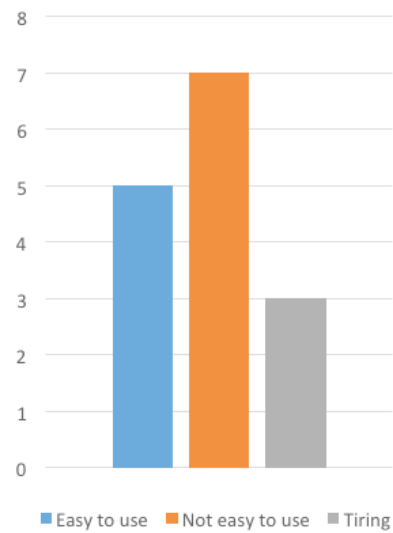


Figure 13: Opinion on existing products

Table 5: Opinion on existing products

Tools	Frequency	Percentage (%)	Mean	Standard Deviation
Easy to use	5	33.3	1.87	0.74
Not easy to use	7	46.7		
Tiring	3	20		

Most of the respondents said that existing products are difficult to use (46.70%). However, 33.30% of the respondents felt that existing cleaning tools are easy to use.

From the observation, it clearly seems that the respondents encountered many problems during the cleaning process. At the farm, they have been using too much water and the goat faeces are thrown away even though the manure can be processed into fertilizer. The respondents also complained about back pains during and after the cleaning process. The existing cleaning tools could be harmful to the respondents' well-being in the long term if they are continuously used.

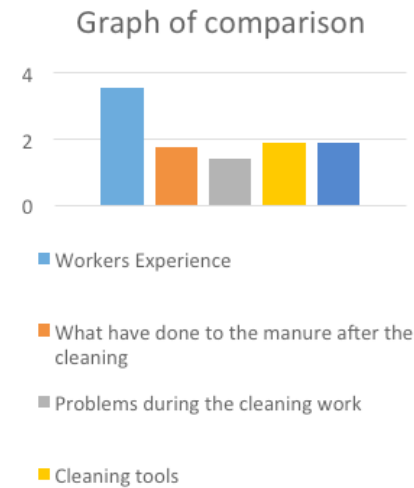


Figure 14: Graph of comparison among all the question scopes

4.2 Summary

The information obtained during data collection was used to design a product based on the guideline of product design specification (PDS). The idea development of the product will be discussed in the next section.

5. PRODUCT DESIGN DEVELOPMENT

In this section, the shape and the design of the farming tool will be shown. The product must undergo several phases before reaching the final design, for instance the design concept, idea sketches, mock-ups, idea development, and sampling/modelling.

5.1 Product Design Specifications

Product design and development involves several processes to increase the chances of success once in the market. To do this, the process of product design is initiated with the creation of a product design specification (PDS). PDS for farming tool includes location, appearance, ergonomics, size, materials, packaging, and safety.

This farming tool is specially designed to clean the goat pen while simultaneously collecting goat faeces. This farming tool must be built according to the location that it will be used. In this study, the goat pen must be built to the standard height of six feet (two metres) from the ground for easy collection of goat faeces. Furthermore, the ground must be a smooth cemented surface because the cleaning process will be difficult should the ground is naturally grassy or sandy or has a rough surface.

The appearance of the product is one of the important aspects in the cleaning process. The product must be hardy, easy to handle, and have a robust look. Thus, strong materials like steel or iron and hard plastic with a sturdy look and aesthetic design must be used to build this product. The tool should have a handle bar for easy handling.

For ergonomics considerations, a machine must be easy to operate, handled, adjusted, maintained, and so on. The height, posture, and strength among target users must also be considered considering the above criteria. This farming tool should have a compartment to store the faeces, which should be separately designed and moulded. This compartment must be well designed for easy and quick accessibility of contents.

The size of the machine must be suitable with human size and ergonomics; the size of the compartment must be enough to store 5kg of goat faeces.

5.2 Design brief

The design concept of this product is to “Clean-and-Collect.”

This product is designed for farm workers to make their job much easier. It will benefit them in terms of minimizing time to clean the pen, as well as preventing serious injury on the spine. Besides, time, energy, and water consumption can be spent wisely. Fertilizer made from goat faeces can be a source of side-income for the farm as well.

The farming tool has several parts including a frame as the structure, compartment to store the faeces, and a duct for the faeces to enter the compartment. The tool was designed to be operated manually, so it must have wheels and mechanical components.

The design of this farming tool for cleaning goat faeces was inspired by the ‘suckermouth catfish’. Green was the colour of choice for this tool as this colour dominates the agriculture industry’s logos. Popular pairing colours include black, white, and blue (99designs, n.d.).

5.3 Idea development

The sketches below show the idea development of the cleaning tool scope.

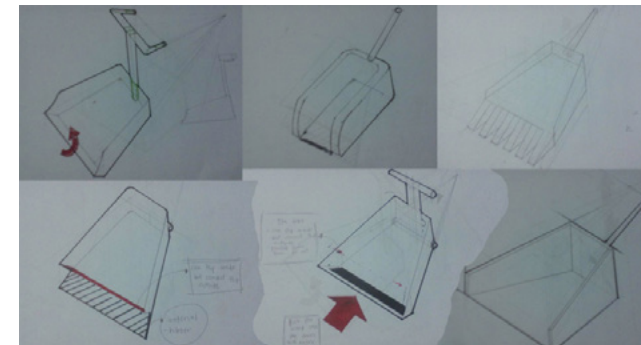


Figure 15: Idea Developments 1

Figure 15 shows this project’s first idea development, which was also the first concept to design a tool to clean the goat pen and collect goat faeces at the same time. The targeted faeces collection must be aimed at the scoop. The faeces are collected as the scope is pushed forward.

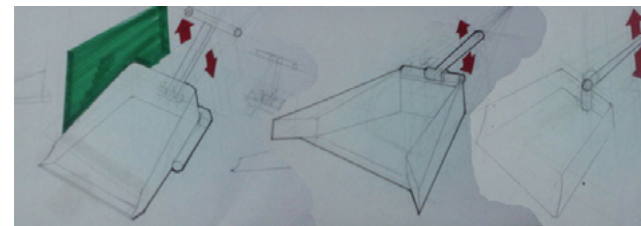


Figure 16: Idea Development 2

Figure 16 shows that the handle was adjustable and supported by bearings for easier handling and smoother movement.

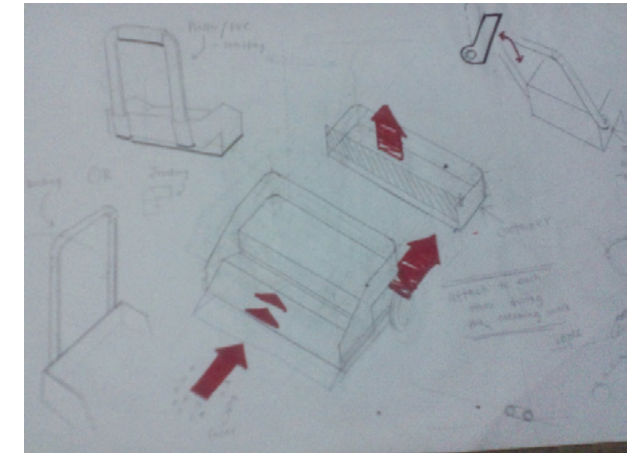


Figure 17: Idea Development 3

Figure 17 shows a new design of the cleaning tool, which had an additional compartment. The function of the compartment is to store the faeces to be processed into manure, that can be commercialized as organic fertilizer. However, the design was still not suitable.

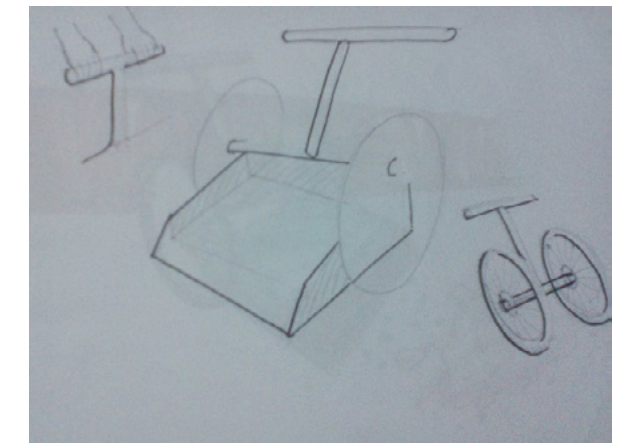


Figure 18: Idea Developments 4



Figure 19: Idea Developments 5

Figure 18 and Figure 19 show the idea development design of the tool for cleaning goat faeces. This design has wheels for easy handling. This concept has come from a wheelchair. It also has an adjustable handle, as well as a compartment to store the collected faeces. It works manually, employing chain and sprocket mechanism.

5.4 Visual proposed design

Figure 20 shows the final design of the tool for cleaning goat faeces, with actual colour and materials.

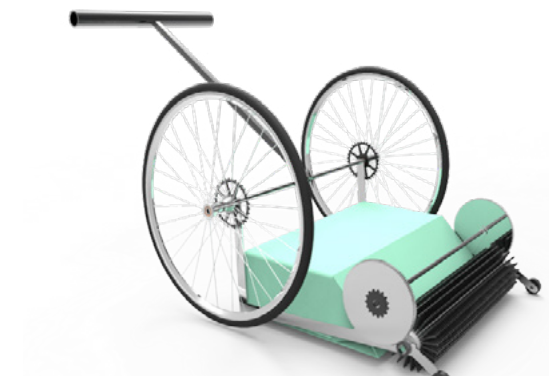


Figure 20: The final design of the tool for cleaning goat faeces

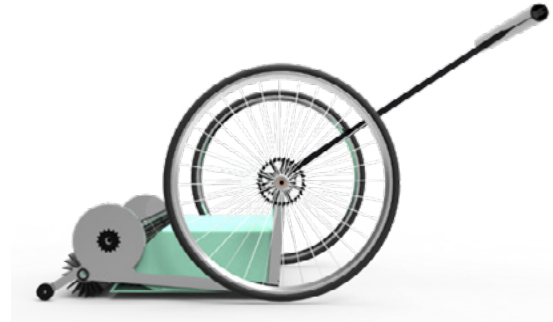


Figure 21: The side view of the tool for cleaning goat faeces

5.5 Validation

In this section, validation of the actual product is discussed, as obtained from the rendering form. The main questions include:

- How does it work?
- How much faeces can be stored in the compartment?
- Why is the colour chosen as such?

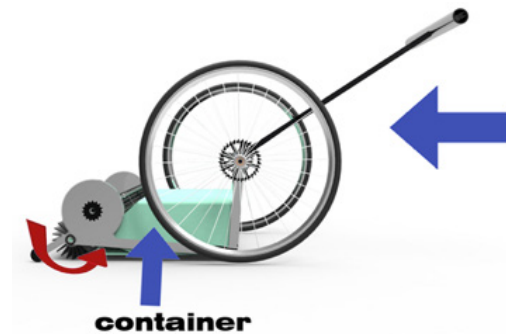


Figure 22: How the tool works in cleaning goat faeces

Figure 22 shows how the tool works in response to Question No. 1. The tool will be pushed forward and the broom roller will sweep the faeces through the duct and then into the compartment.

The compartment can store about 5kg of faeces at one time, answering Question No. 2. The compartment can be replaced with another compartment when the previous one is full.

As for the choice of colour from Question No. 3, it has been researched by MH Design that although most farmers have their own colour preferences, 64% choose green for an agriculture product.

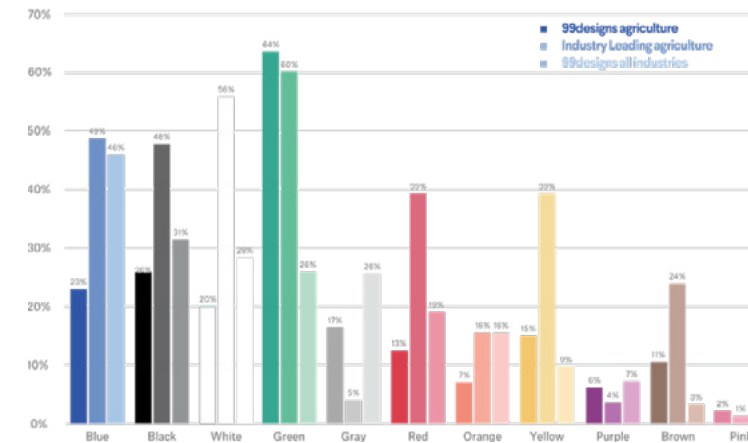


Figure 23: All data visualizations designed by MH Designs.
Source: (99designs, n.d.)

Figure 24 illustrates the results obtained from an online questionnaire, where 40 took part.

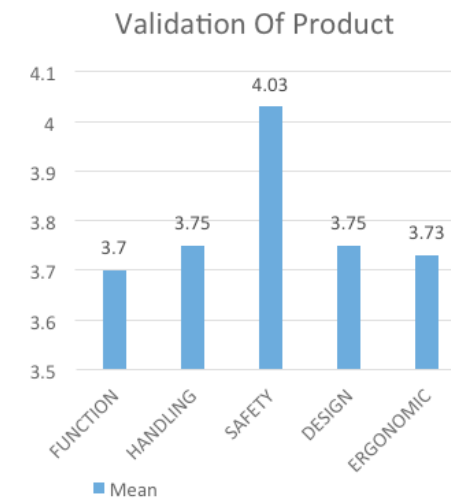


Figure 24: The Means of the Plecs

Figure 24 shows that the aspect of safety has the highest mean (4.03). It is followed by the aspects of handling and design (3.75), ergonomics (3.73) and function.

5.6 Intellectual Property

The intellectual property form has been submitted for registration. It can also detect whether the design has been patented before. This approach will protect the design idea from being stolen by outsiders. The list of intellectual property claims of the design Plecs is as follows:

- The design of the product includes its shape, dimension, and features.
- It is made of steel, with a sturdy appearance.
- The tool for cleaning goat faeces is suitable for farm work.
- It does not easily break, and it is heavy duty.
- It is manually operated using chain and sprocket mechanism, so there is no issue with power source.

5.7 Summary

In conclusion, from the idea development to the validation, there are numerous factors to obtain the best tool design for cleaning and collecting goat faeces, such as functionality, safety, ergonomics, design, and handling capability. Respondents' experiences and opinions were recorded and summarized for this design, which reflect the current and future needs in agriculture, particularly in the prospect of livestock farming industry in Malaysia.

6. CONCLUSION

The answers to the research questions will be explained in this section. In addition, contribution of the knowledge regarding the product from end users, and recommendations for future research will be discussed in this section to improve the product's design and function.

6.1 Discussion

The research questions are shown below:

- What are the specifications of the farming tool that can be used to clean the goat pen and collect goat faeces?

From the research and product design specification, a farming tool that features a compartment and a roller broom is convenient and easy to be used for goat pen cleaning. The roller broom will sweep the goat faeces into the compartment and pass them through the duct. Besides, the goat pen must be designed according to the standard height of six feet (two metres) from the ground for an easier collection of goat faeces, as well as to prevent back pains among the tool's operators during the cleaning process. As for the preference amongst farm workers, some of them may be afraid to use this new tool because they have already adapted comfortability with other existing tools. Furthermore, some of them may not want to change the operation system during the cleaning work. Hence, the appearance of this farming tool should also appear suitable for the cleaning purpose and should appear easy to be handled.

- II. What are the criteria that the clean-and-collect product can be used for among farm workers?

From the research, most of the high positions at the farm needed new tools for the cleaning job. Not all of the farm workers wanted to try the new tool because they have already been accustomed to existing tools they have been using daily. Thus, presumably it will be quite a challenge to convince farm workers to use this new farming tool.

Therefore, a clear instruction regarding the tool and its system of operation must be provided to solve this reluctance. The tool is multi-functional; to collect-and-clean. Hence, farm workers can complete two tasks at once. Furthermore, the tool is made of steel, which makes it long lasting and durable. Additionally, the collected faeces in the compartment can be readily processed into organic fertilizer.

6.2 Contribution of knowledge

This research concerns organic farming in Malaysia. As organic products are highly rated, organic farming provides many benefits such as the contribution to economic growth. Moreover, it provides a healthier lifestyle because organic food does not have added chemical substances. The product/tool developed in this study has met the need to produce organic fertilizer in the farming industry.

6.3 Future research

There are some limitations in this study, thus future research is needed to enhance the application of technology and materials used for the farming tool.

The main materials can be replaced by other new materials, if they have more suitable properties to the product in the future.

6.4 Summary

In conclusion, with the clean-and-collect tool developed in this research, goat or sheep faeces can now be the source of side-income in farms, which previously depended solely on primary products such as meat and milk. Moreover, the environmental pollution caused by animal waste can be reduced, if not prevented, as the waste can be collected at ease to be processed into organic fertilizer. Furthermore, with this new tool, ergonomic hazards such as back pains among workers due to repetitive usage of inappropriate cleaning tools can be reduced drastically, if not entirely avoided.

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WOMEN’S PERCEPTION TOWARDS INTERRELATION BETWEEN PLANTS’ ATTRIBUTES WITH RESTORATIVE EFFECTS IN URBAN PARKS OF TABRIZ, IRAN

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ABSTRACT

This study explores women’s perceptions preferences towards plants’ attributes as a step towards sustainable development of urban parks. A photo questionnaire survey was conducted among 178 women in urban parks of Tabriz, Iran. The results indicated that women’s preference has a strong correlation with spreading (r= .726) and circular (r= .701) forms of plants in the urban park. Women are most familiar with circular form (r= .632), and spreading form is the most attractive one (r= .512). The preference for plants had a strong correlation with rough texture (r= .747). Among the shrubs containing different colours, preference has a strong correlation (r= .711) with pink flowering shrubs. The results illustrated that familiarity had a relatively strong correlation (r= .642) with light green foliage meanwhile preference was strongly correlated (r= .812) with light green foliage. Shrubs containing light green leaves, pink flowers, rough texture, and circular or spreading forms might contribute to the higher preferences in the urban parks. At a more practical level, the findings of this study will contribute to the sustainable development of urban green spaces and particularly urban parks.

Keywords: : Familiarity concept, landscape stimulus, Sustainable landscape, photo-questionnaire

1. INTRODUCTION

People display emotional and physiological responses to scenes of urban and natural landscapes (Kaplan, 1977; Talbot, Bardwell, & Kaplan, 1987; Talbot & Kaplan, 1984; Ulrich et al., 1991). The promotion of social interactions (Konijnendijk et al., 2013), and improvements in mental and physical health (Berman et al., 2012) are among the subsequent benefits of the physiological responses. Gaining the benefits is only possible with various management practices. Designing the urban parks with desirable elements and features may be the first step. In developing countries such as Iran, public perceptions and preferences received less attention by experts, except for some recent works by Hami (2013). Attention to public perception and preferences is a paradigm to approach with this issue. It causes increased knowledge of landscape designers and managers about sustainable design of urban parks.

Women constitute the largest population of park users in Iran. There are not enough studies regarding women’s preferences and perceptions towards plants’ attributes and its relation with restoration and attraction. Thus, the attributes which can release mental fatigue have not been included in urban parks of cities. In addition, the relation between perception and landscape sustainability have not received enough attention. In a previous study, researchers were advised to evaluate the impact of colour, form, and texture on women’s perceptions and preferences in the urban parks of Tabriz, Iran (Hami & Tarashkar, 2018). Therefore, the current study aims to explore and determine the impact of plants’ attributes on women’s preferences and perceptions. However, the other attributions of plants such as ecological effect, growing zone, water needs, etc. will not be included in the current

research sine they seem not to be effective on restoration, aesthetic, and familiarity as well.

1.1 Preference for plants’ attributes

Preference for plants’ attributes were the subject of some previous studies. For instance, Zhao et al., (2017) explored the impact of trees’ attribute on public preferences using a photo questionnaire. The results of their study revealed that seasonal changes are important features for the vegetation used in landscape design. Some previous studies have been focused on public preference towards plant form. Lin (2000) demonstrated that people prefer trees with conical or spreading forms. Other studies have evaluated the preference for plants’ form, measuring the width-to-height ratio. Orians & Heerwagen, (1992) found that people are willing to see trees with a greater width-to-height ratio. According to Nelson et al., (2001) trees with healthy canopies are preferred to trees containing damaged canopies. Polat and Akay, (2015) explored visual preferences for landscape elements in public urban parks in Konya, Turkey. The results revealed that colour composition can enhance the visual quality of urban parks. In addition, other studies show that foliage color significantly affects people’s landscape preferences (Kendal et al., 2008, White & Gatersleben, 2011), and colorful foliage is preferred to green one (Hitchmough, 2004). Kaplan (1985) stated that shape, line, color and texture are the elements contributing in landscape perception. Among these four elements, form has the greatest interference in landscape perception process.

The urban parks located at different cities of Iran do not fulfill residents ‘expectations and women’s preferences. Thus, identifying women’s preferences can be counted as an important step towards developing sustainable urban parks. According to a previous study, establishing residential area with a sustainable protection of urban open green space provides a great opportunity for residents, particularly if they are announced for public use (Rakhshandehroo et al., 2017). The perceived values of plants are numerous such as; improving life quality, producing fresh air, aesthetic aspect, rejuvenation of human spirit, metal restoration, and preservation of urban ecosystems (Hami, 2013).

Ecological services and natural environments have been continuously threatened by human activities (Chapin III et al., 2011). Sustainable development is a comprehensive approach to deal with a numerous environmental, economic, and social issues (Rakhshandehroo et al., 2017). For example, some of the predominant environmental problems correlated with urban green spaces are: species death, re-plantation of green spaces,

noise pollution, losing territories etc. Thus, it is important how authorities can manage green infrastructure development such as urban park landscaping. Planting trees, shrubs, and flowers with desirable attributes in urban landscape can reduce manipulating and re-plantation of urban landscape. Also, longer sustaining of green areas in an environment contributes to atmospheric balance, reduction of air pollutions, and comfort ability of the environment where these are as important key factors for having sustainable environments.

1.2 Familiarity with plants

Familiarity has been detected as an important factor on public perceptual preferences (Hami & Tarashkar, 2018). A previous study has shown that perceived familiarity affects individuals’ preferences for landscape biophysical components (Howley et al., 2012). Van den Berg and Koole (2006) investigated the visual preferences towards nature. They claimed that familiarity with rural landscapes is an effective factor on displaying higher preferences. Van der Wal et al., (2014) examined the impact of familiarity on people’s preferences. They found that sense of familiarity leads to more robust preferences towards the woodland. Ingold (2000) stated that people prefer the woodlands which they are more familiar and emotionally connected with.

1.3 Restorative impact of plants

Empirical studies have shown that nature provides more physiological and emotional restoration, compared to urban built environments (Hartig et al., 2003). Attention restoration theory (ART) first proposed by environmental psychologists Stephen and Rachel Kaplan (1989). The attention restoration theory shows that people are better able to focus their attention after spending time in nature, or even after looking at scenes of nature. It proposes a series of attributes for a restorative environment; being away (being distinct from the aspects of usual and routine environment), extent (physical or conceptual environment that is of sufficient extent to remain engaged), fascination (containing patterns that hold individual’s attention effortlessly), and compatibility (an environment that meets the preferences and needs of a person) (Kaplan, 1995). According to Ulrich’s psychophysiological stress reduction framework (Ulrich, 1983) landscapes containing vegetation, water, modest depth, and complexity reduce negative thoughts and thus reduce the psychological and physiological symptoms of stress.

The restorative impact of natural environment has been explored in previous studies. A previous study has found a positive correlation between tree cover density and self-reported restoration (Jiang et al., 2014). Several previous

studies showed that more tree cover density is associated with greater stress reduction (e.g. Roe et al., 2013; Tyrvainen et al., 2014; van den Berg, Hartig, & Staats, 2007; Thompson et al., 2012). The plants within urban landscape lead to perceived restoration (van den Berg et al., 2014). Wang et al. (2016) compared the restorative impact of natural and built environments using seven videotaped photographs. The results of the study revealed that scenes of natural environments are more restorative, compared to scenes of built environment.

1.4 Attractiveness of plants

Gordon Orians and Judith Heerwagen contributed to Kellert and Wilson’s Biophilia Hypothesis, in a chapter titled “Humans, Habitats, and Aesthetics” (Kellert and Wilson, 1993). The study was looking for aesthetic judgements from 102 participants using a black and white photo questionnaire. Trees with broad canopy, short trunks, and horizontal branch clusters were most attractive ones. Individuals’ selective perception helps to estimate landscape attractiveness (Gold, 1980). Previous studies have found that people’s preference for a specific landscape is related to perceived attractiveness (Carvalho-Ribeiro & Lovett, 2011). Van den Berg and his colleagues (2003) have found that plants with light green foliage perceived more attractive, compared to dark green ones.

What is seen across these studies is that most of them point to the impact of plants’ attributes on perceptual preferences, perceived attractiveness, mental restoration, and familiarity. This study seeks answers to how plants’ attributes affect women’s preferences, and how these indicators relate to perceived restoration, perceived familiarity, and attractiveness. It is assumed that plants’ attributes affect women’s preferences and perceived restoration and attractiveness. Also, it is assumed that perceived familiarity affects women’s preferences and perceptions.

2. METHODOLOGY

2.1 Landscape stimulus

For designing a photo questionnaire, fifty representative scenes for plants’ attributes were prepared from local electronic books and journals. The plants’ attributes were divided into three categories: a) Form, b) texture, and c) colour. Plants with spreading, circular, columnar and oval forms were taken into account and totally twenty representative scenes (five for each one) were prepared. Fifteen scenes were prepared to explore the preference for texture (five rough, five soft, and five medium). Plants with violet, pink, and white flowers (five pink flowering shrubs, five white flowering shrubs, and five

violet flowering shrubs) were selected for the preference study. Image size was adjusted to 8.7cm ×13.4cm, contrast, and color and other features were adjusted for all images using Adobe Photoshop CS software.

2.2 Questionnaire structure

The questionnaire contained two sections. The first part of the questionnaire contained demographic information. The participants had to indicate their personal socio-demographic information; marital status, age, education level, monthly income, and city of residence. The second part was allocated to images for familiarity, restoration, attractiveness, and preference assessments. The selected scenes for the dependent variables were presented in a booklet. There were forty nine images in the booklet. The respondent may not be able to concentrate on the initial questions and may also be tired in the final questions and answer the question without regard to the image. Therefore, to increase the accuracy of the research, two photos of the beginning of the booklet and two final pictures were not considered in the analysis. The respondents were asked to answer questions related to familiarity, preference, attractiveness, sense of restoration. Participants were asked to evaluate the images on a Likert scale (scored between 1 and 5).

2.3 Questionnaire survey

Mitra and Lankford’s formula (1999) was used to determine sample size. We assumed the standard deviation to be equal to 3.74, with the sampling size amounting to 178 persons. Over the duration of July and August 2017, 178 female public open space users, aged above 19, were systematically selected to answer a questionnaire, using the booklet. The systematic sampling for this study meant the participants were picked according to a multiple of 10 among the park visitors. The questionnaire was distributed every day at 10am to 2pm and 4 pm to 8 pm. These hours constitute most frequently visited times of the urban parks. The distribution of the questionnaire was done by three university student at the same time. First, the participants were asked whether they wanted to answer the questions. After this, in order to ensure the accuracy of the work, the purpose of the study and the structure of the questionnaire were explained to them. After completing each questionnaire, the necessary checkups were carried out by the researcher. In the case of incomplete replies, the respondents were asked to complete their response.

2.4 Study area

This research was conducted in the city of Tabriz, Iran, which is the capital of East Azerbaijan, located at the extreme north-west of Iran. The questionnaire was distributed in two famous and beautiful parks in the city of Tabriz. Shams

Tabrizi Park is located in the central part of the city. This park benefits from traditional Iranian architecture.

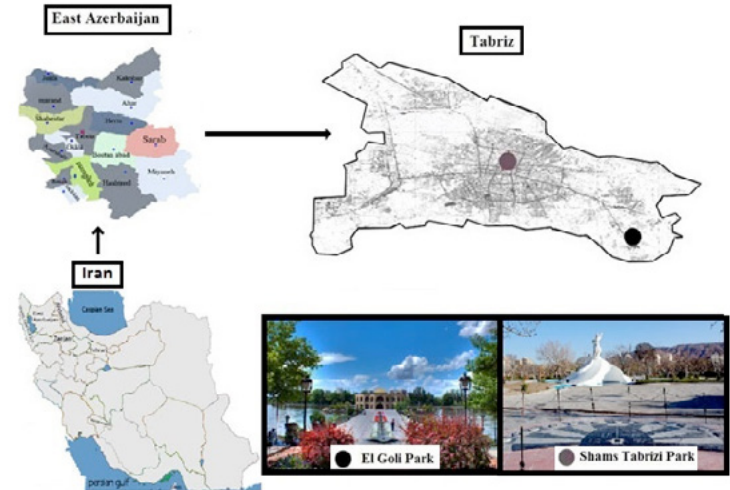


Figure 1: Map of the study area

Traditional pools and water paths with sound of water purling and numerous wooden and concrete pergolas throughout the park are illustrations of traditional architecture. A statue of Shams Tabrizi, the 13th century Persian poet, is located in the park. El Goli Park is one of the most important places for recreation in the city, and it is located in southeast of Tabriz. An artificial rectangular lake is located at El Goli historic park, and it is surrounded by four sidewalks. In the middle of lake a building representing the traditional architecture of Tabriz is located. El Goli Park was registered in Iran’s National Heritage list on February 15, 2009, under the registration number of 24774.

3. RESULTS

3.1 Participant’s background information

As seen in table 1, 178 participants were involved in this study. Most of the participants were in the age group 19 to 29 (n= 75, 42.1%). Average 39.9 % of the participants were single and 60.1 % married. These are in line with the report of Iran’s Statistics Organization in 2016, which announced the age of marriage of women to be 23 in urban areas. The educational status of the majority of the participants (n=72, 40.4%) lay at the level of high school diploma and the majority of them (n= 84, 47.2%) had a monthly income of 300 to 900 USD.

Table 1: Distribution of the Participants’ Socio-demographic Information

Participants	Number	Percentage
Total	178	100
Category	Number	Percentage
Age	75	42.1
	54	30.3
	22	12.4
	15	8.4
	12	6.7
Marital status	71	39.9
	107	60.1
Education	10	5.6
	72	40.4
	35	19.7
	41	23.0
	20	11.2
Income	20	11.2
	84	47.2
	43	24.2
	31	17.4

3.2 Ranking of landscape plants based on women’s perception

Figure 2 shows six most preferred scenes for the urban parks. The two most preferred scenes (scene one & two) include sceneries of pink flowering shrubs with circular forms. Third scene of this category is dedicated for Salix babylonica, which has light green foliage, spreading branches, and soft texture. In general, the scenes include plants with spreading (Scenes 3 and 5) and circular forms (Scenes 1, 2, 4, and 6), pink flowers (Scenes 1 and 2), and light green foliage. Majority of the scenes except for one scene (scene 3) represent rough texture.

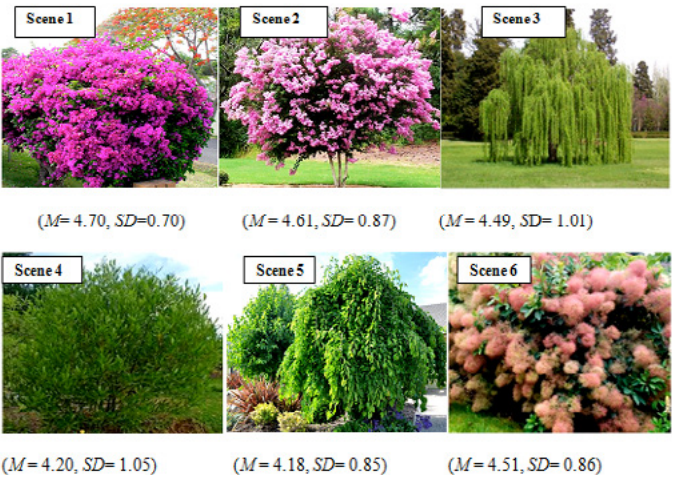


Figure 2: Six most preferred scenes for the urban parks

Figure 3 shows six most familiar scenes for women in the urban parks. The two most familiar scenes (scene one & two) are the plants with columnar forms. Third scene of this category is dedicated to Mirtus occidentalis, containing a rough texture and oval form. Scene 4 illustrates a tree with oval form and light green foliage, with scene 5 and 6 illustrating circular form plants.

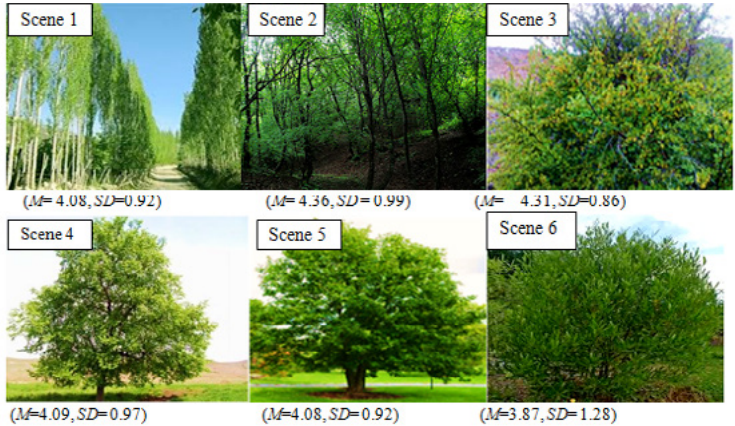


Figure 3: Six most familiar scenes for women in the urban parks

Figure 4 illustrates the three most restorative scenes for women in the urban parks. The first scene contains a plant containing oval form, light green foliage, and soft texture. The second scene of this category contains pink flowering circular shrubs. The third scene contains Eucalyptus tree, with circular form, light green foliage, and rough texture.

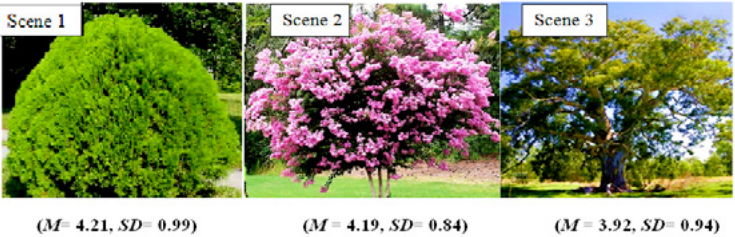


Figure 4 : The three most restorative scenes for women in the urban parks

Figure 5 illustrates the three most attractive scenes. The first scene contains a plant with oval form, light green foliage, and soft texture. The third scene contains Eucalyptus tree, with circular form and light green foliage. The second scene of this category contains pink flowering circular shrubs.



Figure 5 : The three most attractive scenes for women in the urban parks

3.3 Analysis of women's preference for plants' form

The result of B-variate correlation (table 2) illustrates moderately strong correlation between preference for plants and spreading form ($r= 0.726$, $\alpha= 0.00$). This correlation is followed by circular form ($r= 0.701$, $\alpha= 0.00$), oval form ($r= 0.665$, $\alpha= 0.00$) and columnar form ($r= 0.664$, $\alpha= 0.00$). The result of mean analysis reveals the similar results, and shows that women prefer spreading form ($M= 3.80$, $SD= .75$), circular form ($M= 3.52$, $SD= 1.13$), respectively. Spreading form is most attractive one ($r= 0.512$, $\alpha= 0.00$). Oval form contributes to restoration ($r= 0.574$, $\alpha= 0.00$), followed by columnar form ($r= 0.428$, $\alpha= 0.00$). Also, the reliability analysis demonstrates that all the reliability indices for each category are close to 0.7, recommended by Vaus (2002).

Table 2: : The B- Variate Correlation between Plants' Form and Preference/ Attractiveness/ Restoration

	Circular	Spreading	Columnar	Oval
Preference	.701** .000	.726** .000	.664** .000	.665** .000
Attractiveness	.119 .114	.512** .000	.307** .000	.305** .000
Restoration	.305** .000	.299** .000	.428** .000	.574** .000
Familiarity	.632** .000	.532** .000	.415** .000	.357** .000
Mean analysis	3.52 1.13	3.80 .75	3.24 1.17	3.34 1.06
Reliability	.666	.702	.736	.775

Spearman correlation coefficient: <0.3 negligible correlation, 0.3 - 0.5 weak correlation, 0.5 - 0.7 moderately strong correlation, 0.7-0.9 strong correlation, 0.9< very strong correlation (Hinkle, Wiersma, & Jurs, 2003).

3.4 Analysis of people preference for plants' texture

According to table 3, women's preference for plants is strongly affected by plants' texture (e.g. soft texture, $r= 0.628$, $\alpha=0.00$; medium texture, $r= 0.639$, $\alpha=0.00$; rough texture 0.747 , $\alpha=0.00$). As seen in table 3, women most prefer the plants containing rough texture ($r= 0.747$, $\alpha=0.00$; $M= 3.91$, $SD= .851$), followed by medium ($r= 0.636$, $\alpha=0.00$) and soft texture ($r= 0.625$, $\alpha=0.00$). Rough texture is most effective in inducing sense of restoration ($r= 0.589$, $\alpha=0.00$) and attraction ($r= 0.585$, $\alpha=0.00$). Same as the previous section, the reliability analysis demonstrates that all the reliability indices for each category are close to 0.7, recommended by De Vaus (2002).

Table 3: The B- Variate Correlation between Plants' Texture with Preference/ Attractiveness/ Restoration/ Familiarity

	Preference for plants' form		
	Soft	Rough	Medium
Preference	.625** .000	.747** .000	.636** .000
Attractiveness	.166 .027	.585** .000	.373** .000
Restoration	.385** .000	.589** .000	.315** .000
Familiarity	.526** .000	.550** .000	.383** .000
Mean analysis	2.88 .879	3.91 .851	3.60 .875
Reliability	.736	.726	.728

Spearman correlation coefficient: <0.3 negligible correlation, 0.3 - 0.5 weak correlation, 0.5 - 0.7 moderately strong correlation, 0.7-0.9 strong correlation, 0.9< very strong correlation (Hinkle, Wiersma, & Jurs, 2003).

3.5 Analysis of people preference for plants' colour

Among the plants containing various colors, pink flowering plants ($r= 0.711$, $\alpha= 0.00$) are preferred features of urban parks (See table 4). Light green foliage ($r= 0.812$, $\alpha= 0.00$) is preferred to dark green foliage ($r= 0.361$, $\alpha= 0.00$). Light green foliage seems most familiar for women ($r= 0.642$, $\alpha= 0.00$), and this correlation is followed by dark green foliage ($r= 0.435$, $\alpha= 0.00$). Among flowering plants, pink flowering shrubs are familiar for women ($r= 0.363$, $\alpha= 0.00$). Perceived familiarity for white and violet flowering plants is negligible. It can be mentioned that with increases in familiarity, preference for plants goes up. Correlation analysis was performed to prove the statistical significance. The results shows that preference is positively correlated with familiarity ($r= 0.564$, $\alpha= 0.00$).

Table 4: The B- Variate Correlation between Preference for Plants' Colour and Preference/ Familiarity

	Preference for plants' texture				
	Flower color		Foliage color		
	Pink flower	White flower	Violet	Dark green	Light green
Familiarity	.363** .000	.145 .054	.231** .002	.435** .000	.642** .000
Preference	.711** .000	.358** .000	.679** .000	.361** .000	.812** .000
Mean analysis	4.02 .69	3.87 1.10	3.38 .84	3.51 1.18	3.17 .88
Reliability	.744	.764	.712	.702	.782

Spearman correlation coefficient: <0.3 negligible correlation, 0.3 - 0.5 weak correlation, 0.5 - 0.7 moderately strong correlation, 0.7-0.9 strong correlation, 0.9< very strong correlation (Hinkle, Wiersma, & Jurs, 2003).

4. DISCUSSION

4.1 Women's preference for plants' attributes

Preference for plants' attributes was the subject of interest in some studies. Previous studies have revealed that people are more interested to observe spreading trees (Lin, 2000; Legg and Hicks, 1978). Lohr and Pearson-Mims (2006) studied preference for plants' form at Washington State University. The results of their study showed that people have higher preference for spreading trees, compared to rounded or columnar tree forms. Circular trees were the most preferred forms in Turkey (Muderrisoglu et al., 2006). According to the result of this study women prefer plants with spreading and circular forms, respectively. The results showed that women have an interest to observe pink flowering shrubs. Previous studies have shown that flowering plants always gain more attention and preference (Todorova et al., 2004; Kaplan, 2007). Gender differences lead to changes in the specialization of visual pathways that allow women to discriminate red wavelengths better than men (Silverman & Eals, 1992). Previous studies have revealed that the plants with light green foliage seem healthier, and dark green foliage usually displays the water stress, and people always prefer a healthy plant with green foliage and abundant flowers, with regular management (Nassauer, 1995; Orians and Heerwagen, 1992). The results of the current study illustrated that women prefer the plants containing light green foliage.

4.2 Women's familiarity with plants' attributes

Previous studies have proven that people prefer the landscapes that they are more familiar with (Gundersen et al. 2017). Ryan, (2012) maintained that

landscape quality indicators, such as color, shape, depth, and horizontal and vertical structure, are profoundly engraved in our existence; which somehow refers to perceived familiarity. So, preference for plants’ attributions might supported by perceived familiarity. The strong correlations between perceived familiarity and preference for plants’ attributes in the current study are the evidence of this statement. Previous studies have stated that African people are willing to see the trees with a high ratio of width to height, and concluded that their tendency is due the growing of this kind of plants in the east African savannah’s fertile habitats (Kaplan, 1987; Orians, 1980).

4.3 Women’s perceived restoration

The results of this study showed that plants’ form and texture contribute to women’s mental restoration. van den Berg et al. (2014) examined the restorative effect of urban spaces differing in degrees of naturalness. They found that psychological restoration in urban landscapes depends on perceptions in relation to physical characteristics. Rough texture and oval form are the most restorative plant characteristics. A previous study has revealed that people do not respond in the same manner to all forms of plants (Zube, Pitt, & Evans, 1983). So it is justifiable why different plants have different abilities to induce sense of mental restoration.

4.4 Women’s perceived attractiveness

According to the results of this study spreading shape is the most attractive plant form. Kellert and Wilson (1993) explored perceived attractiveness using black and white photographs of various tree shapes. They found that attractiveness is based on low trunk height, canopy layering and a high ratio of tree canopy width to tree height. In other words, broad canopy trees with short trunks and horizontal branch clusters were most attractive. The results of the current study are in line with the findings of Kellert and Wilson (1993). In addition, a previous study has shown that the green elements in a city lead to perceived attractiveness (Borst et al., 2008). Another study has revealed that landscape types would have a significant influence on aesthetic preference judgment (Wang, Zhao, & Liu, 2016). Therefore it is justifiable that why plants with rough texture and spreading form perceived more attractive, compared to other forms and textures.

4.5 Sustainable landscape design

The results of the current study confirmed the importance of public cooperation in urban parks development. It is deeply believed that creating a sustainable city

is not only related to economic growth and environmental quality of city, but it also has a tight relation to social aspects such as perception and experience (Hami et al., 2011). Environmental preference studies can affect planning and design of urban parks. A recent study has also emphasized the importance of understanding women’s preferences for sustainable development of urban parks (Khairussalleh & Hussain, 2017). Landscape design of urban parks plays a significant role in usability and sustainability of parks. For example, a better design of park landscape may prevent re-planting issue as common problems in urban parks, which leads to establish sustainable green spaces (Hami et al., 2009).

5. CONCLUSION

Plants’ attributes such as color, form, and texture affect women’s preferences and perception. Selecting landscape plants significantly depends on design approaches and objectives. Spreading and circular forms are most preferable for the urban parks. Spreading form is most attractive for women, and will encourage women to spend more time in the urban parks. Columnar and oval forms are most effective in inducing a sense of restoration and tranquility, and are therefore appropriate selections for restorative landscapes and healing gardens.

Vegetation containing rough texture is preferred by women. Perception of plant texture usually depends on the distance with a plant. Plants which placed in closer distance to viewers may perceive rough. Therefore, in order to increase the efficiency of the urban parks, the viewer’s distance with the plants must be controlled. This might also lead to higher sense of familiarity, which in turn leads to a greater sense of restoration. Adherence to this instruction might also result in greater perceived attractiveness.

The bushes in the public urban parks of the city usually have white (e.g. Spiraea, Viburnum, and Sambucus), pink (e.g. Cotinus coggygria), and violet (Syringa) flowers. That is why three colours were taken into account in the current study. Shrubs with rough texture, light green leaves, pink flowers, and circular or spreading form, might better contribute to women’s restoration and satisfaction. Lagerstroemia indica and Cotinus coggygria have most of the mentioned attributes, and are recommended for sustainable development of the urban parks of the city. Designing the parks with considering the introduced principles might provide a suitable place for social interaction, which in turn helps solving the less-use problems.

Women’s perceptions and preferences have been known an important step towards sustainable development of urban landscapes. So, the instructions regarding form, color, and texture in the current study might help sustainable landscaping in the urban parks of the city.

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REVIEWS OF EDUCATIONAL TOYS DESIGNS IN CULTIVATING SOCIAL COMPETENCE OF PRESCHOOL CHILDREN

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ABSTRACT

There is a need to embed social development attributes in educational toys design to cultivate children acquire higher competency personalities. The purpose of this paper is to analyse the attributes of social development through educational toys design in cultivating social and emotional development among preschool children. This study uses Literature Review to analyse the attributes of social skills development for educational toys designs. Prior investigation is carried out on methods in promoting positive social development towards young children and to understand the influence of educational toys design on children's play environment. Additionally, this paper also uses Literature Review to document social behavioural aspects of pre-school children in Malaysia. The results are expected to lead towards the theoretical framework or guidelines in designing educational toys for the social development of children. This review will serve as a decree for consumers and product manufacturers to have a deeper understanding towards the social and emotional development of children, which would nurture the growth of their moral compass and improve their attitudes. Lastly, this paper is expected to contribute to the sustainable development in human ecology.

Keywords: : Play, Social Development, Educational Toys, Designs, Preschool Children, Social Skills

1. INTRODUCTION

Education is important for every child during the process of their growth as this will educate them towards knowledge and experiences in their future. Educational toys have become one of the tools that are used to teach children in many aspects, bit by bit. Besides that, educational toys also have become important tools for the development of children since they are important in stimulating and prolonging play (Goldstein, 2012). The careful selection of toys can lead children to play with others, to cooperate, or to develop particular skills. Moreover, the development of children included their mental and physical growth that was influenced by playing with educational toys. In the market, there are various types of education toys that serve different purposes regarding the attributes that needs to be learned by the children. Višnja Đorđić, Tubić, & Jakšić (2016) stated that development is a lifelong process, and different aspects of development (physical, motor, cognitive, emotional, etc.) are correlated and interdependent in multiple ways. The complex interaction of our genes, and our social, cultural, and physical environment, is what defines us.

The designs of toys contribute to the type of toys itself. The method of categorizing educational toys varies, due to the nature of the designs and functions of the toys. A toys supplier organization, The Lakeside Collection, have listed and categorized five types of educational toys which include The Basics, Constructive Play, Emerging Artistry, In Touch with Technology and also Fun with Science. Each of the categories serves different purposes in the educations, according to types of development. On the other hand, The Lakeside Collection has stated that the current toy trend is focusing

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on STREAM, which is about Science, Technology, Robotics, Engineering, Artistic and Mathematics. This shows the lack of educational toys in developing the social development of preschool children. However, there is a need to implement attributes of social development in educational toys to cultivate preschool children with higher social skills. Concepts of play are able to contribute in sustainable development as well as education.

2. PLAY AND EDUCATIONAL TOYS

Lowe (1988) stated that toys and games are synonymous with play. Almost everyone likes to play and such a desire continues throughout an individual’s life. Psychologists inform us that play is not just a filling in of an empty period, or just a relaxation or leisure activity, but it is an important learning experience. Play is also part of the children’s routines and activities, as “play” play a significant role in children’s cognitive, social-emotional, and self-regulatory development. Therefore, it can be said that play is essential to development because it contributes to the cognitive, physical, social, and emotional well-being of children (Milteer, Ginsburg & Mulligan, 2012).

The value of play is increasingly recognised, by researchers and within the policy arena, for adults as well as children, as the evidence mounts of its relationship with intellectual achievement and emotional well-being (Whitebread, 2012). This shows the importance of play as it can be used as a medium to understand children and having a role in children’s growth and development. Play allows children to experience, express, regulate and learn about their emotions in genuine, self-directed ways. Hence, it can be justified that play is essential for learning in children where toys as used as the tools of play. Play materials are provided and how they are used is equally important. Therefore, it is significant for kids to have play in their daily life during their early childhood.

By having play, children are able to create new learning experiences, and these self-created experiences enables them to acquire social, emotional, and intellectual skills they could not acquire in any other way (Elkind, 2008). Elkind highlighted the trilogy of play, love, and work—three basic drives that power human thoughts and actions, three drives essential to a full, happy, and productive life. And while play, love, and work may constitute separate and distinct dispositions, they function most effectively when they operate together.

In a previous publication, three concepts were considered to develop an educational toy, namely aimlessness, empathy and play value, which could contribute to the professional in terms of the toy quality (Gielen, 2010).

These three components serve as the key roles in designing a toy. However, his study did not specify development of the concepts mentioned into any types of development of children. In order to design relevant toys to fit certain learning objectives, the toys must come with relevant play value that enables children to feel pleasure thus able to learn from continuously playing. Eberle (2014) has stated that is difficult to define play as the concept of play is ambiguous and complex. He highlighted that play is a roomy subject, broad in human experience, rich and various over time and place, and accommodating pursuits as diverse as peek-a-boo and party banter, sandlot baseball and contract bridge, scuba diving and Scrabble. However, he classified play into six elements which are anticipation, surprise, pleasure, understanding, strength and poise in his study, as to cover the field of play. Parten (1932) has classified play into six stages based on the social behaviours of children (see Table 1). As stated, each stage changes based on the growth as it portrays different characteristics in conjunction with the social development of preschool children. Each of the stages show that children go through positive development by having more social interaction towards the others and their surroundings. During the cooperative or named social play, children show their ability in understanding others by having empathy. This study will focus on the methods that will develop the social skills of preschool children through play.

Table 1: Parten Stages of Play (1932)

PLAY	DEFINITION	EXAMPLE
UNOCCUPIED	Child is observing, not playing.	Juan stands near the sandbox, counting children and buckets.
SOLITARY	Children play alone.	Lori completes a puzzle, plays with a doll, or rides a bicycle.
ONLOOKER	Child watches, but does not engage in play.	Mari and Will watch two classmates negotiate the use of a balance scale.
PARALLEL	Children play independently, but side by side.	Jen and Carlos read books or build blocks next to each other with no interaction.
ASSOCIATIVE	Children share materials, make their own projects, and tell stories about them.	Margo and Lynn share crayons at the art table and make their own pictures and talk about them, or pretend to run a restaurant in the dramatic play area.
COOPERATIVE	Child is engaged in the activity and with other people involved.	Emily, Austin, and Ashlyn invite others to join a game of hide-and-seek after negotiating and sharing the game rules and goals.

From the social stages of play, cooperative play will be the focus in-conjunction with preschool children, since cooperative play starts in the later period for that age group. This can be generalised that preschool children undergo cooperative play most of the time before they grow into the next stage of their lives. It is important to make sure the children have the ability to play and interact with others.

Therefore, it can be summarised that the relationship of play, educational toys and learning into process, equipment and purpose are integrated and contributing between one another in producing a relevant educational toy design. By referring to Figure 1, play is required as the process for children in order to gain skills, knowledge for their further development. On the other hand, the equipment used to achieve the learning purpose are the educational toys. Educational toys can be used as the tools to develop particular skills in terms of the cognitive development, motor development, social development and emotional development. These three components serves as the significant role in the growth and development of children, which should always be considered for its relationship with intellectual achievement and emotional well-being of the children (Elkind, 2008).

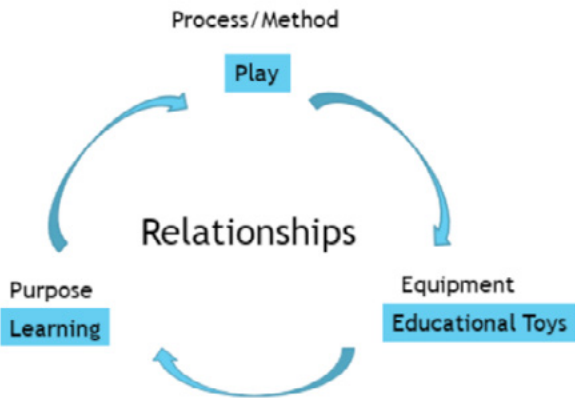


Figure 1: Relationships of Play, Educational Toys and Learning

4. DEVELOPING CHILDREN SOCIAL SKILLS

In this sub-topic, the authors reviewed the concepts of the methods in developing the social skills of preschool children. Throughout the readings on some of the research studies before, the authors were able to summarize the methods used significantly to develop social skills of preschool children. In this research, the authors have reviewed and will discuss the use of pretend play, parental involvement and peer interaction which will benefit the social development of preschool children.

4.1 Pretend Play

Bergen, (2001) has reviewed the research and concepts of pretend play and young children’s development. In his study, he synthesized the latest research on the role of pretend play in children’s social and linguistic competence and discusses challenges and policy directions suggested by these research findings. His paper highlighted that the findings of many recent studies of pretend play shed light on the social and linguistic competence vital for school success because pretending involves language use and takes place in social contexts. Lillard et al (2013) stated that the impact of pretend play is claimed to be crucial for children’s healthy development. The article highlighted that pretend play is one of the many routes to positive developments (equifinality), and pretend play is an epiphenomenon of other factors that drives development. The study summarizes those social skills correlations inconsistent with both solitary and social pretend play. Role-play contributes to educating about sustainable development as well as educating for sustainable development (Blanchard & Buchs, 2015)

4.2 Parental Involvement

Playing with children establishes and strengthens bonds that will last forever. Xing et al. (2017) studied Chinese preschool children’s socioemotional development: the effects of maternal and paternal psychological control where it examined the predictive power and combined effects of maternal and paternal psychological control on the socioemotional development of preschool children aged between 2–5 years in China. The study highlighted

that higher maternal psychological control could predict more behavioural problems significantly and less prosocial behaviours marginally significantly. Hosokawa & Katsura (2017) studied about marital relationship, parenting practices, and social skills development in preschool children. Their study examined the pathways by which destructive and constructive marital conflict leading to social skills development in preschool children, are mediated through negative and positive parenting practices. The findings provide preliminary evidence of the need to explore negative and positive aspects of family relationships. Thus, it can be summarized that the needs of positive parental involvement in the play of preschool children will provide advantages to their development.

4.3 Peer Interactions

Martin, Brady, & Williams (1991) stated that social and isolated toys have impacts on the social behaviour of integrated and non-integrated groups of preschool children during free play time. The article highlighted that under social toy conditions, children engaged in social behaviour more often than during any other condition. In addition, the incidence of social play was higher in integrated groups than in non-integrated groups. Coelho et al. (2017) examined the relation between children's play behaviour, social acceptance in the peer group, and number of reciprocal friendships. The study highlighted playing with peers is one of the most important contexts for the acquisition of social competencies in early childhood. They have identified the greatest number of significant correlations between reciprocal friendships and positive play interaction were found at age three and four, suggesting that already at an early age, behaviour during play is a concern in the choice of friends.

Therefore, it can be summarized that there are few aspects of methods and techniques which are relevant to be considered as the criteria in designing an educational toy with the intentions to develop the social skills of preschool children. For this research context, the concepts of pretend play, parental involvement and peer interaction is classified as prior methods in developing the social development or social skills of the preschool children. The three concepts reviewed will serve as the factors for further analysis on the existing educational toys in the market. When it comes to designing a toy for social skills development, the product features should consider the three concepts mentioned.

5. FINDINGS AND DISCUSSIONS

The authors have discussed the understanding of Play, the need of educational toys, the role of social skills in children and methods in developing children's

social skills. From the review, the authors have come up with a proposition by linking all the related components of knowledge and have assisted to develop a conceptual framework for this research. They agreed that educational toys play an important role in making sure preschool children develop their social skills at the earlier stages of their growth. Therefore, the authors arrived with a proposition of the applicable design concepts (pretend play, parental involvement, peer interaction) in educational toys designs which can cultivate preschool children to have a better social competency (social cooperation, self-control, assertion) through cooperative play (see Figure 2). The figure shows the components and the subcomponents of the overlapping keywords to identify their relationships in terms of design considerations. The link is being made to determine the relationships of social skills learning, elements of play and the theories of educational toys designs. This will further serve as the guideline in setting up the future research methodology design.



Figure 2: Conceptual Framework of Play, Educational Toys and Social Development

Additionally, the authors that the social skills of preschool children are crucial and significant and can be developed through the application of play with certain types of educational toys. From the reviews, the authors acknowledged the importance of role play in contributing to the development of social skills.

This can be stated that the designs of educational toys which applied the use of pretend play are able to encourage the children to express the role they are imagining while playing. Thus, this enables the children to think and communicate by implementing their thoughts while associating towards certain environments. At the same time, social interactions among their peers within the same age group will be beneficial to the development of their social skills, as well. By having peer interactions in the toy designs applications, preschool children are able to communicate and thus, understand each other with the similar level of thoughts. Lastly, parental involvement is one of the key factors in developing the social skills of preschool children. Every play that involves parents will definitely providing advantages in guiding their children to have more confidence in expressing and strengthening their bond.

6. CONCLUSION

This paper has reviewed and discussed the importance of social skills in preschool children as it should be one of the considerations and criteria when designing an educational toy. Researchers or designers could gain a better understanding about social skills of preschool children to implement the attributes of social development in child play. This research could be explored in future studies with the application of the theoretical proposition by any parties who are interested in this topic. The theoretical proposition may serve as the guide in developing framework for sustainable toy designs through play. However, as this research is still ongoing, the designs theories and elements of the educational toys' studies will be examined and explored by validating processes with the behaviors of preschool children in their holistic real-world environment.

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REVISITING THE ‘SILICONISATION OF ASIA:
INDUSTRIAL POLICIES AND CREATIVE CLUSTER IN MALAYSIA

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ABSTRACT

This paper explores the relationship between industrial policies and creative cluster in Malaysia. While most developed countries have leveraged the benefits of creativity and innovation for high-income economy, developing countries, like Malaysia, otherwise have been struggling to replicate the same success. Responding to this polemic, the article first frames the discussion on industrial policies and creative cluster with a reference to the spatial concept called, ‘the geography of innovation’. It is later followed with a specific historical review on the industrial policies and creative cluster in Malaysia since her independence in 1957. The review then becomes a basis for further reflecting the development of Cyberjaya city, a newly city aimed to be the national model of creative cluster. The article calls for more specific and contextualized researches on the issues of spatiality between the industrial policies and creative cluster, particularly in Malaysia as well as in the regional level of Southeast Asia that can benefit policy practitioners, economists, urban planners, academics and researchers alike.

Keywords: : Industrial policies; Creative cluster; Geography of innovation; Siliconisation of Asia; Urbanisation.

1. INTRODUCTION

[T]he production, reproduction and reconfiguration of space have always been central to understanding the political economy of capitalism. For us [as geographers], the contemporary form of globalization is nothing more than yet another round in the capitalist production and reconstruction of space. [...] The question is not, therefore, how globalization has affected geography but how these distinctive geographical processes of the production and reconfiguration of space have created the specific conditions of contemporary globalization. (Harvey, 2001: 23-24).

The advancement of disruptive innovation renegotiates the habitual understanding of creativity. In the text Creativity on Demand: Historical Approaches and Future Trends, published in 2010, the psychologist Gerard J. Puccio and his colleagues argue that by the year 2015, technology will change the field of creativity in “unimaginable ways” (2010: 156). They were right. Since 2010, drone becomes very popular, opening up new horizons in the field of photography and videography. Drone technology disrupts traditional delivery business system while inviting heated debate on the issues of privacy and surveillance activities. The messaging application WhatsApp was released in January 2010 followed by Instagram ten months later. The technology company Google Inc. (now Alphabet Inc.) was awarded the intellectual property (IP) rights for self-driving car in 2012, and since then more radical experiments have been conducting (BBC, 2012). In 2014, Apple Inc. introduced the designs of the Apple Watch thus paving the way for the advancement of wearable technologies (Apple, 2014). And, in the end of 2015, the tech entrepreneurs Elon Musk of Tesla and Mark Zuckerberg of

Facebook invested \$US 1 billion for the development of open-source artificial intelligence (Del Prado, 2015). Most recently, Netflix launched a global on-line media streaming service covering more than 130 countries worldwide (Netflix, 2016). These are some stories which describe an unprecedented moment of what some scholars might say the Fourth Industrial Revolution, partly, due to the rampant technologies of the Internet of Things (IoT), 3D printing, augmented reality and cloud computing.

The dramatic boom of information and communication technologies (ICT) since the early 21st century has acknowledged creativity as a global commodity. Celebrating the economic diversity of choice, creative industries expand the market value of local culture and talent in response to global demands. The American economist Tyler Cowen refers to this as ‘creative destruction’. As he puts it, “[w]e receive a desirable menu of choice because many cultural producers and consumers place intrinsic value on difference” (2002: 132). Cowen goes on to emphasize that the creative destruction may improve small and medium enterprises (SMEs) while attracting foreign direct investment (FDI). From a policy perspective, such creative destruction highlights the importance of creativity for boosting economy particularly in today’s increasingly global and urbanizing world. Responding to this, prominent urban theorists such as Manuel Castells, Edward Glaeser, Andy Pratt and Richard Florida suggest strategic initiatives to bind together the relationships between creativity, innovation, urbanisation and economic development. Their ideas and concepts like Castells’ Network Society, Pratt’s Creative Industries and Florida’s Creative City celebrate the relationships by focusing on the advantages of digital economy, cultural diversity and urban density. Creativity as such is considered not simply about visual aesthetics and art performance. Rather, it speaks of an interrelated field of technology and development studies that includes the issues of copyright, patent, trademark and multidisciplinary designs. It is within this context that the creativity of the 21st century suggests a major shift from cultural policy to an industrial policy framework, which becomes a key concern for this article. As such, I conducted a narrative review on selected policy documents and publications that relate creativity with the broader issues of urbanization and national development. Bridging the relationship between creativity and industrial policy, I frame the following discussion with a reference to a spatial concept called ‘the geography of innovation’.

2. THE GEOGRAPHY OF INNOVATION

The term ‘the geography of innovation’ was coined by the American policy scholar Maryann P. Feldman back in 1994 (Feldman, 1994). It refers to an idea that geographic spatialisation plays an important role for promoting

innovation culture. For Feldman, “innovation is in itself a geographic process—a function of the knowledge resources that are embodied in the technological infrastructure of specific places” (ibid: 93). Feldman argues that the concentration of business firms, companies, and research and development (R&D) institutes may efficiently mobilize technical resources and knowledge that are essential to the innovation process. Such a concentration in turn provides a large incubatory space for pooling together researchers, inventors, scientists, artists, entrepreneurs, venture capitalists and other agents of innovation. They work together; communicating and exchanging their expertise and findings while encouraging new ideas to flourish. Ideally, the geography of innovation optimizes benefits both intellectually and economically through systematic networks and proximal organizations between creative individuals, business enterprises and educational institutions. In this respect, Feldman instantiates the successful models of the geography of innovation in the 1980s, namely, Silicon Valley in California, Route 128 in Massachusetts and Research Triangle Park in North Carolina. Feldman’s studies thus open up a new perspective in understanding innovation: in terms of spaces and places instead of simply the heroic narratives on innovators and spectacular products.

In recent years, numbers of studies have been conducted to investigate the benefits of the geography of innovation. In the United States, for instance, the policy researchers Bruce Katz and Julie Wagner of Brookings Institution published a 2014 report entitled The Rise of Innovation Districts: A New Geography of Innovation in America (Katz & Wagner, 2014). As the title suggests, the report highlights the burgeoning emergence of innovation districts across the states besides promoting innovation culture as an engine for economic growth. The report also emphasizes the diversity of innovation districts in the United States that goes beyond the archetypal reference to Silicon Valley. “Innovation districts”, Katz and Wagner assert, “constitute the ultimate mash up of entrepreneurs and educational institutions, startups and schools, mixed-use development and medical innovations, bike-sharing and bankable investments—all connected by transit, powered by clean energy, wired for digital technology, and fueled by caffeine” (2014: 2). The statement seems to offer a comprehensive outlook, covering at once the aspects of planning, social nature and sustainable lifestyle in the design of innovation district.

Katz and Wagner suggest three current models of innovation districts in the United States. First, the “anchor plus” model which refers to the downtowns and mid-towns of central cities. The model describes large scale mixed-use development that is centered around major anchor institutions and a rich base of related firms, entrepreneurs and spin-off companies involved in the commercialization of innovation. Some examples of the model include

Kendall Square in Cambridge near to the ‘major anchor’ of the Massachusetts Institute of Technology (MIT), Philadelphia’s University City anchored by three universities: The University of Pennsylvania, Drexel University and the University City Science Center, and Midtown Atlanta around Georgia Tech University. The second model is the “re-imagined urban areas”. It is often found near or along historic waterfronts where industrial or warehouse districts are undergoing a physical and economic transformation. Early startups prefer to settle in this area due to high rent and expensive cost of living in central cities. The re-imagined urban areas is best exemplified by San Francisco’s Mission Bay. The bay is home for successful startups like Pinterest, Zynga, Yelp, Square, and Salesforce. The third model is “urbanized science park” which commonly found in suburban and exurban areas. Most old research parks in America, according to Katz and Wagner, were designed based on ‘isolated’ car-dependent environment. Such design is no longer relevant today for spurring innovation. The old research parks are then ‘rejuvenated’ so as to attract younger entrepreneurs and highly talented workers. An example is the new development of masterplan for the historic North Carolina’s Research Triangle Park in 2012. Based on these three models—of: anchor plus; re-imagined urban areas, and; urbanized science park, Katz and Wagner urge American mayors to take innovation issues seriously while proposing future development planning.

Similar concern for considering innovation issues in urban development has been echoed by Florida. In the report *Startup City: The Urban Shift in Venture Capital and High Technology*, published in 2014, Florida argues that denser, livelier and less car-dependent urban area is a fertile environment for innovation culture (Florida, 2014). Formulating his argument, Florida maps venture capital and startup activity across the United States. The mapping indicates the greatest volume and concentration of venture capital investment on the East and West Coasts, along the Boston-New York-Washington (BosWash) corridor and from the San Francisco Bay Area through Southern California. Digging deeper, the mapping shows that the venture investment tends to focus in main cities facilitated with efficient public transportation and vibrant lifestyle. New York, Austin, San Diego, Washington DC and Chicago score the high concentrations of venture investment. Besides the focal concentration in main cities, there is also an increasing interest in suburban areas. What appears to be emerging based on Florida’s observation is that smaller startups prefer to settle in cities while established startups which require bigger spaces and larger campuses turn to the sub-urbs, where land is relatively cheaper and more available. From this perspective, Florida claims that startup activity and venture investment in the United States describe a

dual pattern of geographic shift: on the one hand, there is a shift to urban centers; yet on the other hand there is a growing tendency towards what he terms, the “walkable suburbs” (2014: 49).

The discussions on the geography of innovation has also attracted interest outside the United States. In the United Kingdom (UK), according to the latest survey published by the Department for Culture, Media and Sport (DCMS), the creative industries contributed £84.1 billion to the British economy in 2014, grew by almost 9 percent from its previous year (DCMS, 2016). “IT, software and computer services” remains the largest sector of the UK’s creative industries followed by other professions such as advertising, film, publishing, architecture and crafts.

Looking at the prospects of the UK’s creative industries, several policies have been proposed. The British think tank Nesta, for instance, in the report *A Manifesto for the Creative Economy* outlines 10 policy recommendations in order to boost the UK’s creative industries (Bakhshi, Hargreaves & Mateos-Garcia, 2013). The recommendations include: the R&D tax relief for creative businesses, the establishment of investor-friendly data on creative industries, and the enhancement of the school curriculum by integrating into one the subjects of art, design, technology and computer science. Nesta points to the collective efforts from British politicians, policy makers, industrial players and educational figures to nurture innovation culture to ensure the UK’s creative industries remain globally competitive. Supporting the efforts, the government set up the Creative Industries Federation in 2014 to further monitoring and discussing policy issues related to the UK’s creative industries.

Adopting the idea of the geography of innovation, in 2015, Nesta researchers Hasan Bakhshi, John Davies, Alan Freeman and Peter Higgs map the geographical distribution of the creative industries across the UK’s regions. The findings are documented in the report, *The Geography of the UK’s Creative and High-Tech Economies* (Bakhshi et al., 2015). According to the report, despite London indicates a massive employment and financial concentration, there is a tremendous growth in terms of creative industry activities in other UK’s regions as well. Since 2011, the creative economy grew more rapidly in the East of England, West Midlands and North East with more than 5 percent per annum respectively, compared to London by 3 percent. Also, there is an increasing proportion of the creative workforce in counties outside London like Hertfordshire, Cambridgeshire, Surrey, Bristol and Edinburgh. The mapping thus provides not only a visuo-spatial pattern. Moreover, the mapping allows planners and local authorities to reflect

current condition for harnessing the potentiality of creative industries in their development planning.

Following the United States and the United Kingdom, Singapore also has harnessed the advantages of creativity, innovation and urbanisation as a way to accelerate her economic development. In 2002, Singapore launched a national policy called the Creative Industries Development Strategy (Media Development Authority, 2002; Yue, 2006). The policy outlined a comprehensive 10-year plan spearheaded by the then Ministry of Information, Communication and the Arts (MITA) to posit Singapore as a “New Asia Creative Hub” by the year 2012. Among the plans include: an educational initiative to collaborate local universities with world leading creative institutions like the Royal College of Art London and the MIT MediaLab, financial initiatives by introducing tax incentives and funds for creative content development, and the establishment of the Design Singapore Council, a national body for managing design issues. Also, the policy calls for collective efforts between MITA and other government agencies like the Singapore Tourism Board (STB), the National Arts Council (NAC), the Singapore Broadcasting Authority (SBA), the Singapore Sports Council (SSC) and the International Enterprise Singapore (IE) so as to ensure the creative industries strategy may generate economic spin-offs for tourism, local media, sport industry and international export.

Besides the above ‘aspatial’ approaches for promoting creative industries, Singapore also adopts the idea of the geography of innovation. In the text *Beyond Networks and Relations: Towards Rethinking Creative Cluster Theory*, published in 2009, the geographer Lily Kong discusses the creative cluster issues in Singapore. Kong’s overall discussion is more theoretical in questioning the axiological concept of what she terms the “cultural creative cluster” within the non-western context of Singapore (Kong, 2009: 61). According to Kong, the cultural creative cluster in Singapore is best exemplified by the NAC Arts Housing Scheme. The scheme is an effort for promoting adaptive reuse in which old buildings, commonly disused warehouses and old shophouses, are converted into suitable housing for arts use. The buildings are leased to selected artists and non-profit art groups at highly subsidised rates. Tenants pay 10% of the rental charged by Singapore Land Authority (SLA), while the NAC pays the remaining 90%. As a result, the scheme produces numbers of ‘art belts’ across Singapore streets. These include Waterloo Street, Chinatown at Smith Street and Trengganu Street, Little India at Kerbau Road and Telok Kurau. Apart from the NAC Arts Housing Scheme, the cultural creative cluster concept can be traced in “Creative Towns”, an initiative proposed under the national project, *Renaissance City 2.0* (see Media Development Authority, 2002: 17). The

Creative Towns is a collaborative commitment between government and the Singapore’s Community Development Councils (CDCs) to “unleashing the latent creativity and passion of individuals by integrating arts, culture, design, business and technology into community planning and revitalisation efforts” (ibid: vii). The government provides funding to the CDCs so that communities are facilitated with infrastructures and fusion spaces that support creative entrepreneurship and art appreciation. Kong after all emphasizes the government’s seriousness in pushing forward the full advantages of creativity, innovation and urbanisation for the development of Singapore.

The government’s efforts seem to be paid off. According to the Creative Economy Report published by the United Nations Conference on Trade and Development (UNCTAD) and the United Nations Development Programme (UNDP), Singapore has ranked among the world’s top 20 exporters of creative goods after UK and Japan in 2008 (UNCTAD & UNDP, 2010: 132). Also, by the year 2010, Singapore has successfully attracted 53 foreign media companies to set up their regional headquarters including the famous Japanese electronic games developer, Koei (UNCTAD & UNDP, 2010: 84). In 2013, the copyright industries contributed more than 6 percent to Singapore’s total Gross Domestic Product (GDP) (UNDP & UNESCO, 2013: 164). Many studies describe Singapore as one of the most innovative and creative places in the world. A study conducted by the consulting firm Solidiance, for instance, highlights Singapore as the most innovative city in Asia Pacific, ahead of Sydney, Melbourne and Hong Kong (Solidiance, 2013). Nesta considers Singapore as a highly-innovative small country following Finland and Estonia (Rae & Westlake, 2014). In 2015, Singapore has been ranked the world’s top 10 for both creative country and startup-friendly city after Silicon Valley, London and Berlin (Compass, 2015; Florida et al., 2015). And, most recently, in December 2015, Singapore has been designated a Creative City of Design by the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2015).

Overall, the idea of the geography of innovation has allowed developed countries like the United States, the United Kingdom and Singapore to accelerate their economic growth, at least in the sector of creative industries. The strategic initiatives in marrying together industrial policies and creative cluster have paved the way for the formation of “a creative innovation system”, to borrow the Nesta’s term (Bakhshi, Hargreaves & Mateos-Garcia, 2013: 47). It is a system that taps into the efficacy of knowledge creation, dissemination and commercialization in order to produce conducive business environment as well as the pool of highly competitive and talented workforces. These are aspects that the developing countries like Malaysia can learn from, which frame my discussion for the following section.

3. THE DEVELOPMENT OF INDUSTRIAL POLICIES AND CREATIVE CLUSTER IN MALAYSIA

In the context of Malaysia, the effort in fostering the ‘creative innovation system’ is clearly evidenced from the launch of the Knowledge-based Economy (K-based economy) Master Plan in 2002 (ISIS, 2002). It is a detailed master plan aiming to turn Malaysia from a nation that is heavily dependent on agriculture and manufacturing-based economies to “an economy in which knowledge, creativity and innovation play an ever-increasing and important role in generating and sustaining growth” (ibid: iii). In doing so, as with the United States, the United Kingdom and Singapore, Malaysia needs to leverage, among other things, the potentialities between industrial policies and the geography of innovation. To begin with, it is noteworthy to briefly discuss the historical development of industrial policies in Malaysia.

The first attempt to promote industrial policy in Malaysia has been started as early as in 1958, a year after Malaysia gained her independence (Lim, 2011: 9). Prior to the independence, during the British colonial period, Malaysia’s economy primarily revolved around natural resources, as a producer and exporter of rubber and tin. The government then introduced the 1958 Pioneer Industries Ordinance which granted tax holidays to firms granted ‘pioneer status’ with a certain duration for tax exemption depending on the level of investment. The attempt in general proved successful particularly for attracting industries. Since then, a number of industries were established producing items such as metal products, bricks, cement, building materials, cooking oil, detergents and consumer durables. Apart from the fiscal incentives to encourage industrial development, the government also made a specific allocation for physical incentives since the first national economic plan. In the 1st Malaya Plan 1956, about 2.5 percent or \$115.8 million of the total public development expenditure had been allocated for industrial and mining development. This allocation has steadily increased over the subsequent economic plans. By the 5th Malaysia Plan (1986 – 1990), the period when Malaysia was intensively concentrated on heavy industries, the allocation raised to \$3,149.65 million or 4.56 percent of the total public development expenditure (Said, 1988). The national car project PROTON and controversial steel plant PERWAJA are some examples of the then government’s commitment in heavy industries.

Another initiative to boost industrial activities in Malaysia is the establishment of industrial estates and free trade zones (FTZ). It might be said that this is an important step and an impetus for the spatial clustering of innovation in Malaysia. In the 1950s, the first industrial estate was promoted in the satellite town of Petaling Jaya, Selangor. The international consumer companies like Colgate Palmolive and Fraser and Neave (F&N) are among the early

industries in the estates later followed by multinational manufacturers such as Motorola, Panasonic and Matsushita (Sundaram, 1993). In the early 1970s, the government gazetted the Free Trade Zone Act 1971. The gazettment saw the opening of Malaysia’s first FTZ in Bayan Lepas, Penang. The urban planner Ghani Salleh (2000: 61) argues that the establishment of the industrial estates and FTZ is a national strategy for “industrial decentralization”, a strategy to accelerate development in the poorer states beyond the metropolitan Klang Valley. To date, there are over 500 industrial estates and FTZ across Malaysia which include the Kulim Hi-Tech Industrial Park in northern Kedah, Malaysia-China Kuantan Industrial Park in eastern Pahang and Iskandar Malaysia in southern Johor (MIDA, 2016). It is undeniable that the government’s commitment in promoting industrialization has changed tremendously both social and physical landscape of Malaysia. From one perspective, industrialization fosters a paradigm shift among Malaysian citizens to be more innovative and adaptable to new technologies for embracing modernity and globalization.

With the inevitable coming of globalization or the “Third Wave”, to borrow Alvin Toffler’s term (1980), Malaysia needs to realign her policy initiatives. The Third Wave claims, among other things, the importance of information and knowledge as a key driver for economic growth. As such, by the mid-1990s, the government began to encourage the K-based economy and identified ICT industries as a new source for wealth creation. One main initiative taken by the government then is the establishment of incubators. Concerning the need for highly skilled ‘K-workers’, the government aims to generate more homegrown producers instead of the end-users of technology. The incubators acts as an exploratory place for R&D activities at the institutional level. Several incubators are set up in major higher educational institutions (HEIs) and government research institutes (GRIs) which include: the USains Incubator in Bayan Lepas, Penang; the Technology Park Malaysia (TPM) Incubator in Bukit Jalil, Kuala Lumpur; the Standards and Industrial Research Institute of Malaysia (SIRIM) Incubator in Shah Alam, Selangor, and; the Malaysian Technology Development Corporation (MTDC) Incubator in three HEIs, namely, Universiti Putra Malaysia (UPM) in Serdang, Selangor; Universiti Kebangsaan Malaysia (UKM) in Bangi, Selangor, and; Universiti Teknologi Malaysia (UTM) in Skudai, Johor (Danaraj, 2011: 405). Each incubator by design form a specific ‘creative cluster’ that pooling together researchers, inventors, scientists, entrepreneurs and venture capitalists. I argue that these incubators reflect the idea of the geography of innovation as discussed in the previous section.

Promoting further the K-based economy initiative, in 2017, the government launched an international collaborative project with the China’s conglomerate,

Alibaba Group known as the Digital Free Trade Zone (DFTZ). Located at the Kuala Lumpur International Airport (KLIA) Sepang, the project aims “to facilitate SMEs to capitalise on the convergence of exponential growth of the internet economy and cross-border e-commerce activities” (MDEC, 2017).

The above discussions describe the Malaysian government’s commitment in pushing forward the potentiality of creativity, innovation and urbanisation for economic development. To manifest the commitment, an urban scale project was developed aiming to turn a whole city into an economic hub of creative cluster. The project is called Cyberjaya.

Cyberjaya is the first ‘intelligent cybercity’ in Malaysia located midway between the KLIA international airport, the national administrative city of Putrajaya and the capital city of Kuala Lumpur (see Figure 1). It is the hub of the special economic zone Multimedia Super Corridor (MSC), an area identified by the government as the new growth for the national ICT industries. Inspired from the economic success of innovation culture, the master plan of Cyberjaya is designed to replicate Silicon Valley, a benchmark for the geography of innovation as discussed earlier.

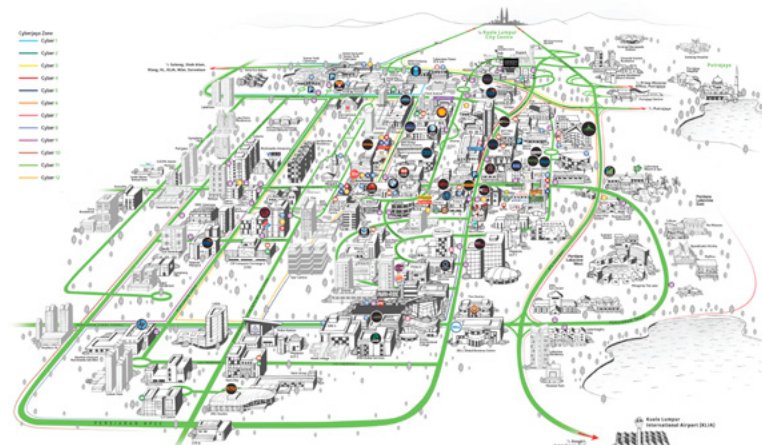


Figure 1: The ‘fun map’ of Cyberjaya which indicates the location of the city between KLIA, Putrajaya and Kuala Lumpur. (Source: Cyberview, 2015)

Cyberjaya was launched on 17 May 1997 by the Malaysian Prime Minister Datuk Seri Dr. Mahathir Mohamad. It was launched with a vision to transform an area of approximately 7,000 acres from palm oil plantation estate into “a mecca for IT companies providing operational quarters for multinationals to

direct their worldwide manufacturing and marketing activities in multimedia, as well as their production and marketing of multimedia products and services” (Mohamad, 2002: 135). To ensure the vision becomes a reality, four key institutional stakeholders were appointed to oversee Cyberjaya project, namely, Multimedia Development Corporation (MDeC), the custodian for MSC project; Cyberview Sdn. Bhd., the real estate management of the area; Setia Haruman Sdn. Bhd., the master developer of Cyberjaya, and; Majlis Perbandaran Sepang (MPSP), the local government of the city. The ‘mecca for IT companies’ in Cyberjaya would consist not only offices and residential units but also training centers, R&D institutes, incubators, universities, recreational parks and retail areas for lawyers, bankers, accountants and venture capitalists. In short, it is a concentration of infrastructures and creative agents that hope would foster creativity and innovation at an urban scale. To date, Cyberjaya is home to more than 38 multinational corporations (MNCs) including HSBC, DHL, Shell, Motorola, OCBC, IBM, Ericsson, BMW and Fujitsu, as well as 800 both foreign and homegrown technology-oriented companies (see Figure 2). KRU Academy, Animonsta Studios and Giggle Garage are some local multimedia companies based in the city. Cyberjaya is also home to government agencies that play pivotal role in promoting innovation culture like MSC Malaysia Knowledge Workers Development Centre (KDC), Malaysian Foundation for Innovation (YIM), National Innovation Agency of Malaysia (AIM) and Malaysian Global Innovation and Creativity Centre (MaGIC). Several international-standard universities located in Cyberjaya as well such as Multimedia University (MMU), Limkokwing University of Creative Technology (LUCT), University Malaysia of Computer Science and Engineering, Cyberjaya University College of Medical Science, Cyberjaya Putra College and Kirkby International College (Cyberview, 2016).



Figure 2: An example of MNC in Cyberjaya: Wisma Shell which locates the Shell Business Service Centre for global operation. (Source: Author)

The development model of Cyberjaya enriches the examples of innovation districts across Asian countries that are akin to Silicon Valley like Zhong Guan Cun in Beijing, China, Daedeok Innopolis in Daejeon, South Korea, Fusionopolis in Singapore as well as the one in Hyderabad and Bangalore, India. This trend of replicating the economic success of Silicon Valley then becomes a popular discourse among planners and sociologists, in which they term the trend as the “Siliconisation of Asia” (see Indergaard, 2003; Bunnell, 2004; Yusof & van Loon, 2012).

4. TWO DECADES AFTER THE ‘SILICONISATION OF ASIA’ IN MALAYSIA: WHERE ARE WE NOW?

Critics have shared varied perspectives in responding to the development of Cyberjaya. Some are skeptical with its sustainability. The geographer Tim Bunnell, for instance, is pessimistic with Cyberjaya’s capability to reverse brain drain. In some Asian advanced emerging economies like South Korea and Taiwan, the succesful innovation districts have managed to attract highly skilled workers that based overseas to come back to their home country. For Bunnell, it seems difficult for Cyberjaya to follow the similar pattern. Providing a city with world-class working environment, Bunnell argues, is insufficient enough to woo overseas Malaysians back unless there is a “fundamental shift” in the whole country for favouring population from ethnicity to skills (2004: 98). Bunnell goes on with acculturation. While Cyberjaya strives to emulate Silicon Valley’s technological lead, authorities in Malaysia nonetheless “seeking not to replicate urban America’s high divorce rates and incidence of family breakdown—what, in the case of Southern California, has been termed the ‘dark side of the chip’” (2004: 100). Bunnell after all calls for the improvement of socio-economic policy in Malaysia in tandem with her vision to become the global technology hub.

In a similar vein, but with a different concern, Norhafezah Yusof and Joost van Loon highlight “a discrepancy” between the government’s idealizations and real social life in Cyberjaya (2012: 298). According to them, the modernist belief of urban design in Cyberjaya with far distance between residential, commercial and recreational facilities, exclusive commercial spaces and fortified communities leads the city to become “a lifeless non-place” (2012: 311). The city loses its genius loci; there is almost no social life. While Yusof and Loon focus on the anthropological polemic of the city, Tan Siew Mung (2014) otherwise emphasizes the lack of Cyberjaya in attracting FDI. She refers to the 2012 ICT census survey that revealed only 7 percent of the gross output and 9 percent of value added in national ICT industries are contributed by foreigners. With stiff competition from the neighbouring Singapore, Vietnam, Philippines and Indonesia, Cyberjaya, Tan asserts, needs

to play bigger role for attracting foreign investment and technology transfer. In addition, the Malaysia Productivity Corporation (MPC), a government agency for overseeing national productivity performance, brings to light the challenge of ICT industries due to the country’s weak links to the global R&D and innovation network (MPC, 2014: 54). This resonates with the concern raised by the economist Ali Salman who calls for smart role played by the government to boost demands both locally and internationally using the technical expertise developed in Cyberjaya (Salman, 2018).

Cyberjaya is seen as a state-led model for cultivating innovation culture. As the sociologist Michael Indergaard discusses, unlike Silicon Valley that evolves from strong ‘bottom-up’ R&D activities and tech businesses ecosystem, the Malaysian government has made ample use of its sovereign powers in developing Cyberjaya. In this context, the city, Indergaard suggests, sets a “desirable” reference for other developing nations that look to ICT industries as a national agenda (2003: 381). Apart from that, the assigned government agencies have played an important role in manouvering the development of Cyberjaya. Over the past few years, MDeC has launched several initiatives such as Digital Malaysia and Creative Lifelong Learning Programme (CILL) to stimulate Malaysian SMEs, particularly, in creative content industry. The initiatives bear fruit when numbers of homegrown multimedia companies started to produce world-class products. Some examples include the international distribution of the animation, SeeFood produced by the local MSC status company Silver Ant in 2011 and the participation of the Cyberjaya-based visual effects company Rhythm and Hues (R&H) in producing the Oscar-winning animation, Life of Pi in 2012. Also, the MSC status company Les’ Copaque’s popular animation, Upin & Ipin has been broadcasted overseas, in 17 countries (MATRADE, 2016). Based on these results, it is unsurprising to note that the creative content industry is considered a promising prospect for national economic growth. The Oxford Economics report entitled The Economic Contribution of the Film and Television Industries in Malaysia shows that the industry contributed a total of USD1.7 billion or RM5.6 billion to Malaysia’s GDP in 2013 (Oxford Economics, 2014). The report then emphasizes the vast potential of the creative content industry in Malaysia. The potentiality is supported by the 2014 Annual Report of the Economic Transformation Programme (ETP) produced by the Performance Management and Delivering Unit (PEMANDU), a government think tank under the Prime Minister’s Department. According to PEMANDU, Malaysia’s creative content industry shows a tremendous growth since 2010 with an export amounted to RM 609 million (PEMANDU, 2015: 15).

While MDeC is assigned to oversee the MSC project, MaGIC is set up as a specific government agency to promote the entrepreneurial ecosystem of

startup particularly among Malaysian youth. MaGIC was launched by the United States President Barack Obama and the Malaysian Prime Minister Dato’ Sri Mohd Najib Tun Abdul Razak on 27 April 2014. It is based in Cyberjaya (see Figure 3). Since its launch in 2014, MaGIC has been playing aggressive role by providing resources, education and networks for local startups to expand their businesses overseas. MaGIC’s achievement is impressive and commendable. Within a year of its establishment, few local startups started to secure luxurious investments and seed funding. Among them is FashionValet, the first Malaysian online fashion store. The startup has secured a multimillion dollar investment led by Elixir Capital, a global private equity firm based in Silicon Valley. The investment allows the startup to scale up its operations to other Asian cities (MaGIC, 2015). Another successful story is MyTeksi (now Grab). This startup started its operation by providing taxi services through smartphone application in Malaysia. Upon securing a multi-million dollar investment, the startup now is the largest ride-hail service in Southeast Asia, covering private car services, motorcycle taxis, social carpooling and last mile delivery. It is dubbed as ‘The Uber of Southeast Asia’ (ibid; Yap, 2016). From this perspective, it can be argued that Cyberjaya has successfully injected considerable impact to the advancement of K-based economy in Malaysia.



Figure 3: Malaysian Global Innovation and Creativity Centre (MaGIC) in Cyberjaya.
(Source: Author)

The recent improvement in some international rankings may also reflect the advancement of K-based economy in Malaysia. Among upper-middle income economies, Malaysia ranks second after China as a country with effective innovation policies (Cornell University, INSEAD & WIPO, 2014: 23). Malaysia is also considered a leader among middle-income countries in the development of research-oriented graduate education. The 2014 report *Higher Education in Asia: Expanding Out, Expanding Up*, produced by the

UNESCO Institute for Statistics (UIS), describes a “dramatic growth” in the expansion of higher education and research in Malaysia over the last decade (UIS, 2014: 12).

To further accelerate the advancement of the K-based economy, in 2014, Cyberview was tasked to transform Cyberjaya into a ‘Global Technology Hub’. It is an ambitious plan to make Cyberjaya a vibrant, liveable city to “attract talent, businesses and investments to Malaysia” (Cyberview, 2014: 2). Defining the idea of the ‘technology hub’, Cyberview outlines five technology focus areas for Cyberjaya, namely, ICT; green technology; biotechnology; wearable technology, and; smart grid technology. Cyberview is quick to understand the ‘nested’ configurations between Cyberjaya, MSC area and Greater Kuala Lumpur. Instead of concentrating on available talent pools within only Cyberjaya, Cyberview expands collaborative R&D works with GRIs, prominent universities and companies around the neighbouring areas of Klang Valley. These include the GRI Malaysian Institute of Microelectronic Systems (MIMOS), local Research Universities (RUs) such as Universiti Malaya (UM), UKM and UPM, and homegrown technology companies like MyCERT, exabytes, Predictry, Bioalpha, DominoDiversified and Masers Energy. From a physical planning perspective, Cyberview is very careful with future development due to the depletion of land bank in Cyberjaya. The upgrade of both existing ‘soft’ and ‘hard’ infrastructures are taken into account. Soft infrastructures include the enhancement of digital connectivity with fast speed of fixed broadband network and adequate wireless connection. Whereas hard infrastructures involve providing more inclusive spaces such as pedestrian-friendly streets, hospital and affordable housing. Thus, to be a global technology hub, Cyberjaya needs not just ‘bricks and mortar’ but also ‘the memory and the soul’ of the place.

To date, there are eight major developers in Cyberjaya include Emkay Group, SP Setia, United Engineers Malaysia (UEM) Land, OSK Property, MCT, Paramount Properties, Mah Sing and most recently, the Malaysian Resources Corporation Berhad (MRCB). In 2015, MRCB announced a new development called Cyberjaya City Centre (CCC) that will feature assets worth RM11 billion (Kaur, 2015). The 20 years’ development will cover, at this moment, the construction of convention centre, business hotel, office buildings and retail podium. Also, MRCB plans to upgrade the pedestrian walkways and transport connectivity of the city with the metropolitan Greater Kuala Lumpur area. This is in parallel with the rail project Klang Valley Integrated Transit System (KVITS), a massive government project that connects, among other places, Cyberjaya with Kuala Lumpur’s major spots such as the bustling business district of Golden Triangle area, the administrative city of Putrajaya and the world-class tourist attractions such as Kuala Lumpur City Centre

(KLCC) and Bukit Bintang (SPAD, 2011: 12). The project is expected to be completed by the year 2022, and with that, the developers are bullish with the prospect of Cyberjaya. And, early of this year, MDeC announced a significant increase in the FDI of the MSC project. The FDI has increased 11 percent in revenue to RM 38.52 billion in 2015, the highest since Cyberjaya’s inception in 1996 (Ibrahim, 2016).

It is still too early to claim that the Global Technology Hub of Cyberjaya is a fruitful programme. But one thing is for sure, the works for the programme have got off the ground. The works have paved the way for more possibilities in exploring the creative cluster issues in Malaysia. In this respect, Cyberjaya becomes an interesting testbed to assess whether or not an “innovation is in itself a geographic process”, to reiterate Feldman’s proposition (1994: 93).

5. CONCLUDING THOUGHT

This article contextualizes broad issues in the relationships between industrial policies and creative cluster by first highlighting the policy implementation in the United States, the United Kingdom and Singapore; before narrowing down to the context of Malaysia. The review revealed some strategic initiatives among developed countries in marrying together industrial policies and creative cluster that resulted the efficacy of knowledge commercialisation and conducive business environment for highly competitive talents.

In Malaysia, following the K-based economy initiative in the early 2000s, the country is now in the process of harnessing her economic diversification beyond the traditional agricultural and manufacturing-based revenues. While some Asian emerging economies like South Korea and Taiwan have managed to overcome the curse of ‘middle-income trap’, Malaysia has been struggling to accelerate her progress to become a high-income nation. Creativity and innovation is seen as a key driver, but more studies and reseaches are needed to accommodate an effective policymaking process.

This article thus calls for more specific and contextualized studies for understanding creative cluster issues in Malaysia. With the establishment of industrial estates, FTZs, the special economic zone of MSC and most recently, the Global Technology Hub programme in Cyberjaya, it is more than timely to explore the spatial aspects of creativity and innovation in Malaysia. By ‘spatial’, I mean the geographic dimension of urban economics. How far can the economy’s behavior change with the locational concentration of R&D, business activities and transportation networks in Malaysia? How does urbanisation process may encourage (or discourage) innovative and creative environments in the country? are some questions that need specific spatial

geographical investigations. Similar questions become increasingly relevant at the regional level of Southeast Asia with the current interest among ASEAN leaders to adopt the economic success of Silicon Valley as announced during the US-ASEAN Summit in California (Basu, 2016) as well as the recent launch of the ASEAN-China Year of Innovation (ASEAN, 2018).

As the geographer David Harvey points out, back in the early 2000s, the “distinctive geographical processes of the production and reconfiguration of space have created the specific conditions of contemporary globalization” (2001: 24). Perhaps, in this case, we are now dealing with the ‘geographical processes’ of creativity and urban space that have created a specific condition for the globalization of ideas and innovation.

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