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STRUCTURAL ANALYSIS FOR AUTOMOTIVE A-PILLAR

Nursherida Jalaluddin
Infrastructure University Kuala Lumpur, MALAYSIA

ABSTRACT

Car body design in view of structural strength and light weighting is a challenging task due to all the performance targets that must be satisfied such as vehicle safety and ride quality. An increasing pressure on vehicle manufacturers internationally and also several countries are mandating to reduce vehicle emissions. Thus, light weight strengthening solutions are required to increase roof strengths while minimising structural mass. In this paper, material replacement along with multidisciplinary design optimisation strategy is proposed to develop a lightweight A-Pillar vehicle structure that satisfies the crashworthiness criteria while minimising weight. Through finite element simulations, a Federal Motor Vehicle Safety Standard (FMVSS 216), Roof Crush Resistance test and by the Insurance Institute for Highway Safety (IIHS) was conducted at the A-Pillar model structure. All the tests set up, simulation test constraints and procedure will be based on the standard. Then all the models will be rated, using the specific strength or strength to weight ratio calculations to determine the best model among all the model that had been tested. The wall thicknesses of two parts are which is inner and outer layer of A-Pillar were considered as the design variables. The benefits of the new proposed material (mild steel, aluminium and high strength steel) include reduced mass and hence more efficiency. All the three materials had passed the FMVSS 216 test requirement as the total deformation was not more than 127mm under a force of 1.5 times the weight of vehicle,12.21 kN, was applied so that the test device moves in a downward direction perpendicular to the lower surface of the test device at a rate of not more than 13mm per second. Total deformation for mild steel (MATS 100039MAT2_16800) get the highest value and Aluminium (A6060) gets the lowest value under the FMVSS216 test. This shows that Aluminium (A6060) have higher energy absorption compared with the existing material. The improved A-Pillar with the new proposed material was able to secure a substantial margin of the survival zone as well as to meet the requirement specified by standard.

Keywords:
A-Pillar, FMVSS 216, Total Deformation, Equivalent Stress, Weight Reduction & Structure Strength Rating.

BACKGROUND STUDY

The A-pillar is an important load carrying component of any automobile body. It is a primary support structure for the roof and is typically a thin-walled, spot-welded, closed-section structure made from high strength steels. This is a structural member as the sides of the windshield on which doors will be mounted. This research study will cover the structural analysis of the A-Pillar with different type of materials. The paper deals with the modal analysis of an A-pillar which is Proton Gen 2 that will be the benchmark model. The dimensions of the A-pillar are taken from the drawing or references whichever is available. The 3D model is prepared and then meshing is done in ANSYS and structural analysis is carried out on A-pillar to determine the natural frequencies and mode shapes of a structure. Post-processing is done using ANSYS software. The A-pillar design's acceptance is done from the results obtained in analysis on different type of materials. The analysis results and strength to weight ratio calculation will show the different results from which best material is selected based.

PROBLEM STATEMENT

Current benchmark model material is mild steel which is a conventional material used widely in automotive industry. A study by Cheah (2010), shows that current material of automotive body chassis which is mild steel are material that have low strength to weight ratio (SWR) or strength rating value and had more fuel consumption to be compared to other materials like aluminium, high strength steel and composite materials. (Cheah, 2010). Vehicle weight and size reduction is one known strategy to improve fuel economy in vehicles, and presents an opportunity to reduce fuel use from the transportation sector. By reducing the mass of the vehicle, the inertial forces that the engine has to overcome when accelerating are less, and the work or energy required to move the vehicle is thus lowered. A general rule of thumb is that for every 10% reduction in vehicle weight, the fuel consumption of vehicles is reduced by 5-7%. The strength to weight ratio value can be increased as it has high strength with less weight of material (Cheah, 2010).

OBJECTIVES

i. To improve the structure strength rating value of commercialized automotive A-Pillar and decrease the weight of automotive A-Pillar structure.
ii. To analyse the automotive A-Pillar structure based on its material type and thickness of the structure.

LITERATURE REVIEW

A monocoque chassis is a single piece of framework that gives shape to the car. A one-piece chassis is built by welding several pieces together. Figure 1 shows a monocoque chassis (Wan, 2000). Monocoques chassis consist of front bumper beam, side members, A-pillar, B-pillar, floor platform and roof. The design of A-Pillar from local car manufacturer was chosen as the benchmark model to improved in terms of the structure strength rating with the new proposed material. Material can play an important factor in achieving the expected output. Producing the lightweight material car body design in view of structural performance and light weighting is a challenging task due to all the performance targets that must be satisfied such as vehicle safety and ride quality (Meschtscherjakov 2014). The applications of lightweight materials not only bring the potential for carmakers to reduce the car weight but also simultaneously satisfy the new regulations of fuel economy and emissions. A few lightweight materials have been introduced in automotive industry such as aluminium and composite materials. The growing interest in reducing fuel consumption has encouraged auto industry to come up with various techniques for obtaining a lighter design. One of the common techniques to achieve this demand is material replacement. This technique allows engineers to design a car body structure without compromising the safety and crashworthiness behaviours. The minimum load that the new designed A-Pillar need to withstand is 1.5 times to the total weight of the car and the displacement of plate must be less than 5 inches after the load been applied to it (Meschtscherjakov, 2014).

Figure 1: Monocoque Chassis *(Mark Wan,2000).*

The new designed A-Pillar need to meet the requirement of FMVSS 216 standard (U.S. Department of Transportation National Highway Traffic Safety Administration, 2006) Kashir Naik, run an analysis on the A-Pillar by applying axial load at the top surface of the structure and define the maximum load and deflection it can withstand (Naik & Patil, 2018). A-pillar CAD model using CATIA V5 is shown in Figure 2.

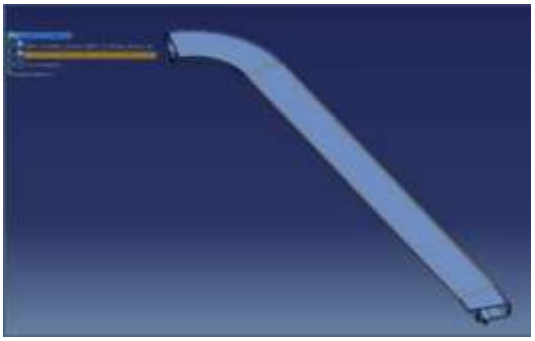

Figure 2: A-pillar CAD model using CATIA V5 *(Naik* & Patil, *2018)*

In mechanical engineering, some machine components and automotive parts can behave differently due to the design of machine elements, manufacturing processes, and selection of materials (Salem & Nursherida, 2019). The material selection is the most important steps in engineering field. The construction sector and automotive sector must adopt environmentally sound planning and design practices to create a safe and sustainable environment design or construction waste materials resulting from development, reconstruction, destruction involving excavation, civil and building construction, road work, automotive safety, clearing of sites and demolition (Mohamed Eliwa & Mohamad Ayob, 2020). Secondly, design stage also plays important roles in designing any mechanical components. According to Wong (2019), lack of design or incorrect design caused due to manufacture error – Improper design may cause connection problems during installation (Wong & Siti Nur Aliaa Roslan, 2019). Boundary conditions and contact interface will be set up based on the FMVSS 216 test requirement. The result will show the value of total deformation, equivalent stress, equivalent strain and weight of all the model.

According to the United States Environmental Protection Agency (EPA), the average new U.S. vehicle weight has been increasing steadily at a rate of 1.2% per annum over the past two decades, levelling off at around 1,730 kg in recent years (EPA 2009, EPA 2010). Based on research findings from Davis (2009), the model assumes that the median vehicle lifetime remains at 16.9 years for cars, and 15.5 years for light trucks, including SUVs (Davis et al., 2009). Figure 3 shows the material

production energy intensity of steel vs. lighter-weight automotive materials (UChicago Argonne LLC, 2007).

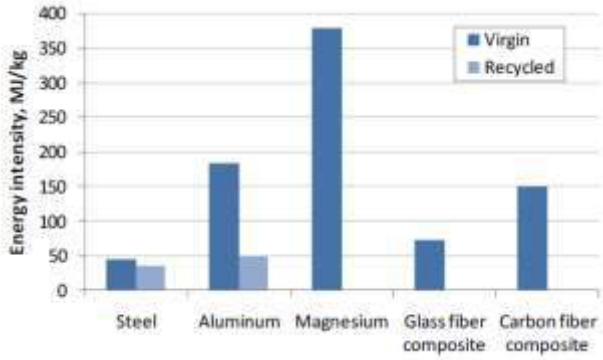

Figure 3: Material production energy intensity of steel vs. lighter-weight automotive materials (UChicago Argonne LLC, 2007, Knittel, 2009).

An older 2002 study from the National Research Council estimates that raising fuel economy targets by 20% by 2013 can lead to fuel savings of 10-15 billion gallons in 2015 (National Research Council (U.S.), 2002). Morrow et al., (2010) examined the greenhouse gas (GHG) emissions reductions arising from a scenario where the fuel economy standard is raised to 43.7 MPG by year 2030 (Morrow, et al., 2010). Based on the research from Smith (2002) and Geyer (2007), the life-cycle energy impact of vehicle weight reduction in the U.S. involved the fuel savings and vehicle light weighting only (Smith et al., 2007).

METHODOLOGY

The flowchart of the project as shown in Figure 4. Figure 5 shows the inner layer and outer layer of the A-pillar structure.

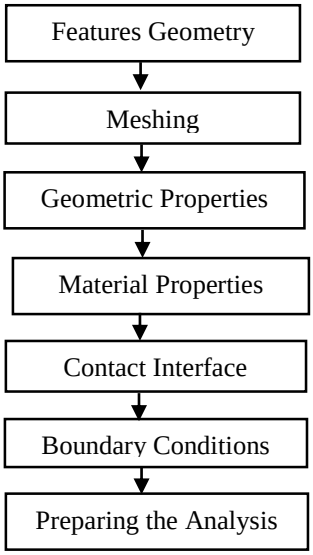

Figure 4: Flow chart of the project.

The area of analysis that will be focus is the structure strength of the A-Pillar, the highest load that the structure can withstand by different type of materials. Secondly, is to calculate the structure strength rating value of every type of materials. Then the results were compared.

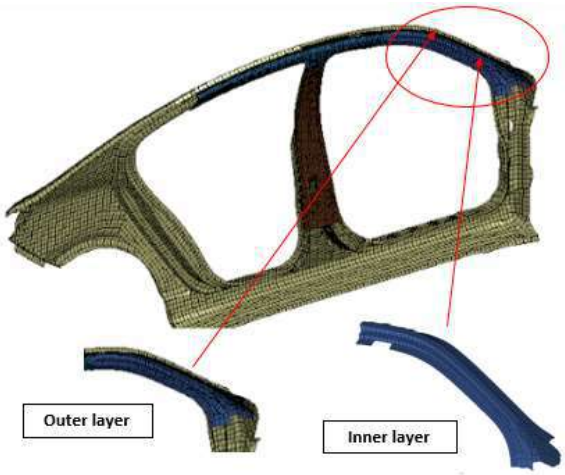

Figure 5: Inner layer and Outer layer for the A-Pillar structure

Table 1 shows the material properties of mild steel, aluminium and high strength steel that have been used in the A-pillar structure model. The material properties and thickness of the model also shown in Table 1 and Table 2. Table 3 shows the meshing details for the A-pillar structure model. The number of nodes are13441 and number of elements are 12704. Figure 6 shows the A-pillar test setup that follow requirement from FMVSS 216 standards.

Table 1: Material Properties

Material	**E (GPa)**	**υ**	**S_y (MPa)**	**ρ (kg/m³)**
Steel	206	0.3	168	7850
AA6060	69.6	0.33	134.84	2650
A606	210	0.3	310	7870

Table 2: Model Specification

Material	**Mild Steel (MATS 100039MAT2_16800 (Model 1)**		**Aluminium (A6060) (Model 2)**		**High Strength Steels (A606) (Model 3)**	
Thickness (mm)	**Outer Layer**	**Inner Layer**	**Outer Layer**	**Inner Layer**	**Outer Layer**	**Inner Layer**
	0.7	**1.8**	**1.0**	**2.0**	**0.7**	**1.8**

Table 3: Meshing Details

Element Types	**Shell**
Number of Nodes	**13441**
Number of Element	**12704**

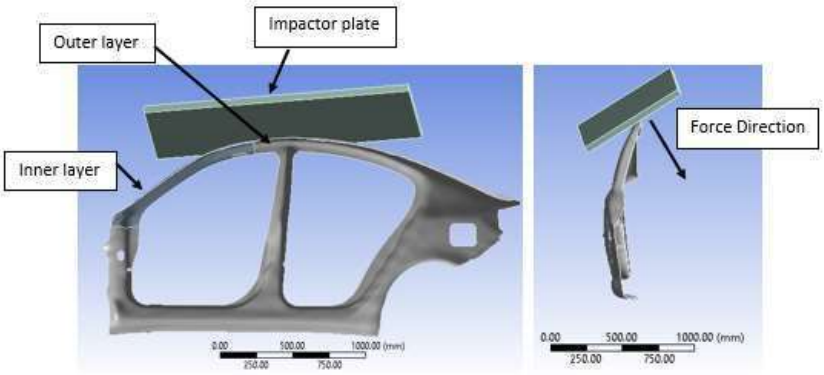

Figure 6: FMVSS 216 test set up.

RESULTS AND DISCUSSIONS

Figure 7 shows the deformation of the A-pillar. The maximum deformation value is 12.23mm. The simulation analysis crash events for the A-pillar are shown in Figure 8.

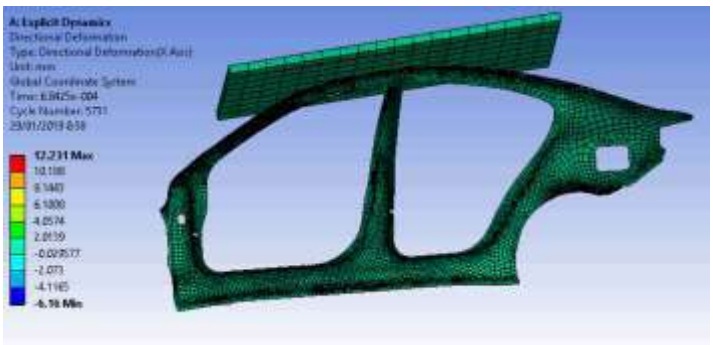

Figure 7: A-Pillar deformation

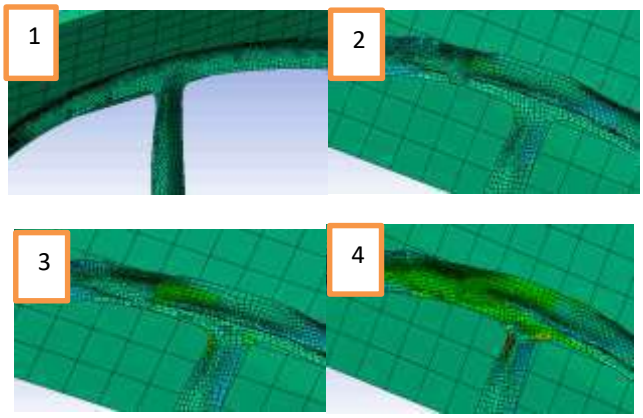

Figure 8: Simulation analysis crash event.

Total Deformation

Graph for total deformation versus time is shown in Figure 9. It shows that the mild steel has the maximum value of the total deformation. Aluminium gives the lowest value of total deformation. Thus, the most suitable material to absorb the energy is aluminium. Table 4 show the total deformation results for mild steel, aluminium and high strength steel.

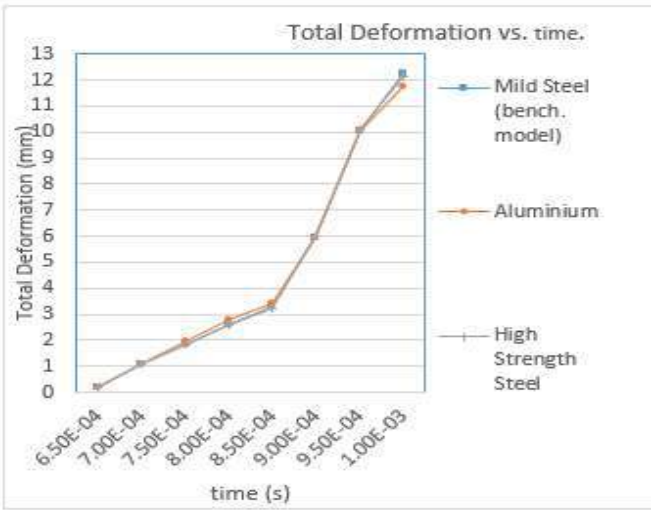

Figure 9: Graph for Total Deformation vs. Time

Material	Mild Steel (conventional material)	Aluminium (A6060)	High Strength Steel (A606)
Total Deformation (mm)	12.231	11.752	12.121

Table 4: Total Deformation result.

From the test, all the three materials are able to reach the targets. The part must not deform more than 127mm. If it deformed more than 127mm then the vehicle fails under this test and the vehicle will not pass successfully. As been shown in the result test, all three materials not deformed more than 127 mm which is 12.231mm for mild steel, 11.752mm for aluminium and 12.121mm for high strength steel. This shows that aluminium has the lowest deformation under the same force indicating that it has the strongest structure compared to the other two.

Equivalent Stress

Figure 10 shows stress versus time chart of A-pillar finite element analysis results.

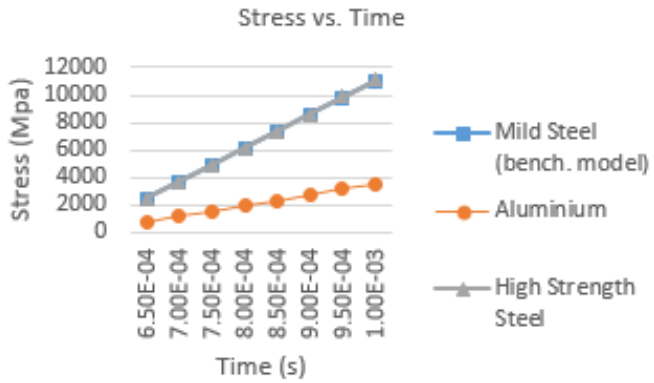

Figure 10: Stress vs. Time chart.

Table 5: Equivalent Stress Result

Material	Mild Steel (conventional material)	Aluminium (A6060)	High Strength Steel (A606)
Equivalent Stress (mm)	11042	3545.5	11087

Determining whether an isotropic and ductile metal will yield when subjected to a complex loading condition. This is accomplished by calculating the von Mises stress and comparing it to the material's yield stress, which constitutes the von Mises Yield Criterion. The objective is to develop a yield criterion for ductile metals that works for any complex 3D loading condition, regardless of the mix of normal and shear stresses. Three types of material will be tested. Result shows that high

strength steel have the highest value of stress. This may be due to higher hardness strength to be compared to others.

Weight Reduction

One of the main objectives is to reduce the weight of the A-Pillar vehicle structure. The conventional material weight was compared with the improved material by using the ANSYS software which it calculated based on the density of the material and volume of the structures. Table 6 shows structure weight with different materials.

Table 6: Structure weight with different materials

Material	Mild Steel (Conventional material)		Aluminium (A6060)		High Strength Steel (A606)	
Part	Main Layer	Inner Layer	Main Layer	Inner Layer	Main Layer	Inner Layer
Weight (kg)	10.374	2.1561	3.5682	0.74158	10.401	2.1616
Total Weight (kg)	12.53		4.3094		14.5626	
Weight Reduction (%)	-		65.6		-24	

Structure Strength Rating

The structure strength is the structure maximum stress (force per unit area at failure) divided by its density. Equation (1) shows the formula for the strength of the structure. The SI unit for specific strength is Pa m^3/kg, or N•m/kg, which is equivalent to m^2/s^2, nevertheless the latter form is infrequently used. This calculation will show which material is the best and rate it based on the calculation results. Table 7 shows the result of the structure strength.

$$\text{Structure Strength} = \frac{Stress\ (force\ per\ unit\ area\ at\ failure)}{Density} \quad (1)$$

Table 7: Structure Strength Result.

Material	Mild Steel (Conventional material)	Aluminium (A6060)	High Strength Steel (A606)
Structure Strength (Mpa $\frac{m^3}{kg}$)	635919887.9	656579677.3	637964186.2

From the result, it shows that Aluminium has the highest value of specific strength which can be concluded that it is the best materials to be compared to the conventional material and another improved material.

CONCLUSIONS

From the result obtained, it can be concluded that:

i. All the three materials had passed the FMVSS 216 test requirement as the total deformation was not more than 127mm under a force of 1.5 times the weight of vehicle,12.21 kN, was applied so that the test device moves in a downward direction perpendicular to the lower surface of the test device at a rate of not more than 13mm per second.
ii. Total deformation for mild steel (MATS 100039MAT2_16800) got the highest value and Aluminium (A6060) gets the lowest value under the FMVSS216 test. This shows that Aluminium (A6060) have higher absorption energy which mean aluminium have better toughness and amount of energy per unit volume that a material can absorb before rupturing.
iii. The result of equivalent elastic strain showed that High Strength Steel obtained the highest value, due to its higher hardness strength to be compared to others
iv. ANSYS software had calculated the weight of the structure as well based on the density and volume of the structure. Aluminium (A6060) was the lightest material and it had reduce weight of the structure until 65.6% of the conventional material.
v. The rate of the material structure were determined by using the structure strength rating. It was a material's strength (force per unit area at failure) divided by its density. Aluminium (A6060) shows the highest value of structure strength rating value which indicate that it is the best material structure as to be compared to others.
vi. Based on the simulation results, the objectives of the study have been achieved where the weight of the structure has been reduced without decreasing the strength of the structure.

RECOMENDATIONS

Further recommendation for this study is to do the FMVSS216 simulation run on the same structure by using the composite materials. Composites are being considered to make lighter, safer and more fuel-efficient vehicles. Based on the author knowledge during the engineering materials subject, the strength and stiffness factors are why composites are currently used in aerospace applications, which also require a material that is extremely light. A composite is composed of a high-performance fiber (such as carbon or glass) in a matrix material (epoxy polymer) that when combined provides enhanced properties compared with the individual materials by themselves. Carbon-fiber composites weight about one-fifth as much as steel but are as good or better in terms of stiffness and strength. Second is the structure itself can be improve as well by adding some rib at the inner layer especially at the contact force area. This will reduce the total deformation and increase the structure strength as well.

AUTHOR BIOGRAPHY

Nursherida, Dr. was born on 29th May 1983, in Kuala Pilah, Negeri Sembilan. She obtained a Second Class Upper Honours Degree, Bachelor of Engineering (Mechanical Engineering), 2006, Master of Science (Mechanical Engineering), 2011 and Ph.D in Mechanical Engineering, 2017 from Universiti Putra Malaysia (UPM), Selangor, Malaysia. She has extensive teaching experience in Mechanical Engineering field and Automotive for almost 10 years in IUKL, UNISEL and UniKL MIDI.

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IMPACT OF SOCIOECONOMIC FACTORS ON RESIDENTS' QUALITY OF LIFE IN METROPOLITAN IBADAN, NIGERIA

Solomon Ayodeji Olatunji[1] & Adewale Olufunlola Yoade[2]
[1]*Department of Urban and Regional Planning, Federal University Oye-Ekiti, NIGERIA*
[2]*Department of Urban and Regional Planning, Wesley University Ondo, NIGERIA*

ABSTRACT
The study examined impact of socio-economic factors on residents' quality of life in Ibadan, Nigeria with a view to using information to providing policy guidelines for sustainable development. Using stratified sampling technique, a total of fifteen political wards from the five local government areas in Ibadan metropolis were selected for study. The selection of all the local government areas is based on the fact that all of them cut across the residential zones in the metropolis and they are all main local government of the city. Primary data for the study were collected through the questionnaire administered on 1,035 respondents (2% of household heads in all the residential buildings in the metropolis), using systematic sampling technique. Descriptive and inferential statistics were employed to analyse the data obtained. Thus, the study concluded that infrastructure facilities in Ibadan metropolis were poor.

Keywords:
Infrastructure, facilities, quality of life, management, environment, Ibadan

INTRODUCTION

World Health Organization (WHO) defined Quality of Life (QoL) as an individual's perception of their position in life, in the context of the culture and value systems in which they live and in relation to their goals, expectation, standards and concern (WHO, 2007). QoL can be described as a broad ranging concept that is affected by a person's physical health, psychological state, level of independence and their relationships to salient features of the environment. It focuses on all facets of life, which includes cultural, social, environmental, physical, health and the local value systems, among others.

United Nations (2010) QoL index study report shows that Nigeria is placed 156 out of 187 countries. Despite this poor ranking, QoL studies for the cities of Nigeria are noticeably rare. As such, it will be most beneficial to Nigeria and by extension Africa if QoL studies are carried out in order to make clear the dynamics of QoL and its determinants. QoL as a concept has attracted a lot of researches and policy attention in recent time among social scientists and health professionals (Flora, 2004; Olapegba, 2010).

Researchers contend that the construct of QoL is multi-dimensional and contains both objective and subjective aspects (Veenhoven & Hagerty, 2006; Wills-Herrera et al., 2009). In order for measures of QoL to have meaning, individual's point of view must accurately be represented (Pacione, 2003). Therefore, it has been suggested that one must combine objective and subjective elements to obtain a truly holistic and more complete picture (Post et al., 1999; Schalock, 2000).

To underscore the importance of QoL, WHO set up a group dedicated to the study of the concept with a view to improving quality living. QoL has been a developing concept overtime for addressing issues such as health, environment, liveability, housing, urban psychology and many other social and physical aspects that influence human lives directly and indirectly. The concept has also significantly become more relevant in terms of measuring progress toward achieving improved wellbeing and therefore, helping to fulfil sustainability goals and objectives. More so, it helps in

contextualizing relevant policies and strategies by local and regional governments in seeking a foster sustainable regional development in more holistic and inter-disciplinary ways (Costanza, 2007, 2008). Studies on QoL across different nations of the world have established the variation that exist in space (Olapegba, 2000). For instance, while Karsten (2008) found that there is spatial variation in the quality of life of the people in Germany; Schalock (1996) acknowledged the variation in the quality of life of residents in Bosnia and Herzegovina. More so, Ietto et al. (2008) observed a spatial variation in the quality of life conditioning with reference to the local environmental management in Bivona country (Calabria, Southern Italy).

Although, the above studies examined the variation in Qol of some regions, those that put into consideration the variation in the QoL of a traditional urban centre disaggregated into residential zones are hard to come by. Omole (2010) emphasized in Nigeria housing as a unit of the environment that has profound influence on the health, efficiency, social behaviour, and general life satisfaction of the community. The researchers concluded that cultural, social and economic values of a society are the best physical and historical evidence of the civilization of a country. It is against this background that this study examined socio-economic impact on residents'' quality of life in Ibadan metropolis, Nigeria.

MATERIALS AND METHOD

Study Area

Ibadan city is a traditional urban centre founded in 1820's. It is the largest indigenous urban centre in Africa south of the Sahara (Afon, 2000). It is one of the most urbanized areas in Nigeria. It derived its name from Eba - Odan (i.e. "near the grassland environment'). It is derived from history that its location was not accidental. This is consequent on the fact that the forest provided the much-needed protection for refuges that flock into the town. The presence of grassland provided farmland for cultivation purposes, marketing centre for traders and goods from both the forest and the grassland areas of the Western half of Nigeria.

Ibadan comprises eleven (11) local government councils with 5 in the inner city and 6 in the outer areas. Since its foundation in the 1800s, the city has had rapid growth; in fact, it was regarded as one of the pre-colonial urban centres in Nigeria (Mabogunje, 1968). The built-up areas of Ibadan metropolis in 1984, 2000 and 2016 was analyzed through land use land cover classification of the Landsat images of 1984, 2000 and 2016; and subsequently overlaying the results. The built up area of Ibadan metropolis in 1984 was 28.15km^2, 46.35km^2 in 2000 and 52.48km^2 in 2016. Further analysis of the built-up statistics shows that there was an increase in the built-up area by 18.02km^2 between 1984 and 2000 which was found to be 64.65% increase in extent with an annual rate of expansion of 4.04%. Between 2000 and 2016, there was an increase in the built-up area by 6.13km^2 which represents an increase in extent of 13.23% which an annual rate of 0.83%. The reduction in the rate of expansion from 4.04% between 1984 and 2000 to 0.83% between 2000 and 2016 was because there is virtually no vacant land area in the metropolis available for expansion (refer Figure 1).

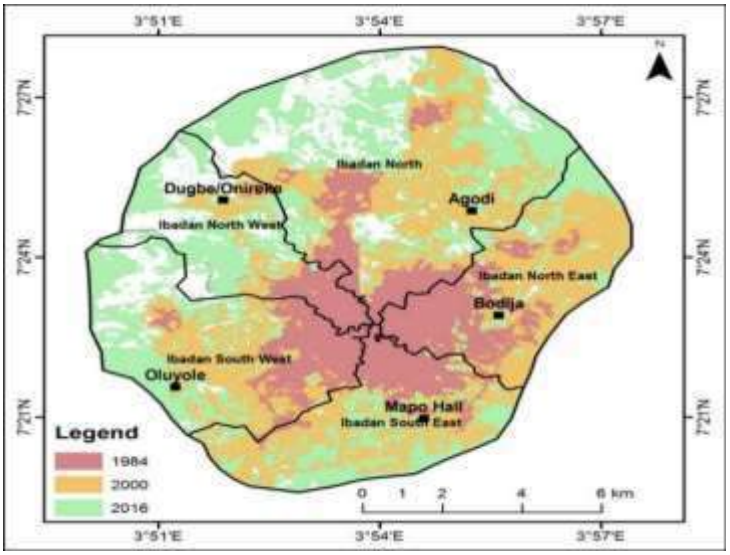

Figure 1: Spatial Growth of Ibadan from 1984 to 2016 (Source: Author's Analysis)

METHODOLOGY

Multi-stage sampling technique was employed for data collection**.** The first stage is the selection of the five Local Government Areas in the metropolis. These are Ibadan North, Ibadan North East, Ibadan North West, Ibadan South East and Ibadan South West. The selection of all the local government areas is based on the fact that all of them cut across all the residential zones in the metropolis and they are all spatially coverage at the centre of the city. The second stage involves the stratification of study areas into residential zones based on Afon's (2000, 2007) scheme: the core, transition and suburban. As a result, the residential areas in the five local government areas of the metropolis were stratified into three: the core, transition and suburban. Furthermore, local government areas in Ibadan metropolis were stratified into the existing political wards, as recognized by Oyo State Independence Electoral Commission (2012) in the conduct of electoral polls. According to the pilot study, the total number of political wards in Ibadan metropolis was 59. In each Ibadan North, Ibadan Northeast, Ibadan Southeast and Ibadan Southwest, there were 12 political wards while Ibadan Northwest was with eleven (11) political wards. The spatial distribution of political wards showed that there were 29, 17 and 23 wards in the core, transition and suburban respectively.

In the third stage, a ward in each residential zone of Ibadan North, Ibadan North East, Ibadan North West, Ibadan South East and Ibadan South West was selected randomly without replacement for questionnaire administration. Through this method, a total of fifteen (15) wards were selected for survey consisting of three (3) wards respectively from the core, transition and suburban of the five local government area council of Ibadan metropolis. This selection represents 33.8% of the sampling frame.

The primary and the secondary data which were obtained through the GPS field operations, the quick bird image and existing maps were integrated together in the ArcGIS software from which local queries were performed to produce a GIS database containing the facilities in Ibadan metropolis.
As presented in Table 1, information from the Google Earth and reconnaissance survey revealed that there were 51,351 buildings in the selected political wards across the three residential zones of the metropolis. These comprised 26,427 buildings in the core residential zone, 14,924 buildings in the

transition zone and 10,417 buildings in the suburban zone. Systematic sampling technique was employed to identify where households heads will be selected for survey. The first building was chosen randomly. Subsequent unit of investigation was every 50th building in each ward, representing 2% of the buildings in the selected wards. Thus, 1,035 buildings were sampled comprising of 528 buildings in the core residential zone, 299 in the transition zone and 208 in the sub-urban zone. A household head was the respondent selected from a sampled building. In the case where the household head was not available, any available adult was sampled. Thus, a total of 1,035 copies of questionnaire were administered for the study.

Table 1: Buildings in the different residential zones where household heads were selected for survey **(**Source: Author's Field Survey, 2018**)**

Residential Areas		**Ibadan North**	**Ibadan NE**	**Ibadan NW**	**Ibadan SE**	**Ibadan SW**	**Total**
Core	Total Buildings	3 556	6 224	4 805	5 433	6 409	26 427
	Sampled Buildings	71	124	96	109	128	528
Transition	Total Buildings	5 673	2 580	1 857	2 238	2 576	14 924
	Sampled Buildings	113	52	37	45	52	299
Sub-urban	Total Buildings	2 315	2 195	2 122	1 792	1 993	10 417
	Sampled Buildings	46	44	42	36	40	208
Total	Total Buildings	11 544	10 999	8 784	9 463	10 561	51 351
	Sampled Buildings	232	220	176	192	212	1035

Also, residents were made to express their opinion on the condition of the facilities in their locality using a five-point Likert scale of 'Very Good' (VG), Good' (G), 'Neither Poor nor Good' (NPNG), 'Poor' (P) and 'Very Poor'(VP). Therefore, respondents also rated their level of satisfaction on each facility using a five-point likert scale of 'Very Dissatisfied, 'Dissatisfied', 'Just Satisfied, 'Satisfied and 'Very Satisfied'. The level of satisfaction was measured by an index called Residents' Satisfaction in Infrastructure Index (RSII). Procedures for arriving at the indices were discussed under chapter three.

RESULT OF FINDINGS

Socioeconomic Characteristics of Residents

Scholars have documented that gender of respondents has influence on people's perception of quality of life (Andrews & McKennel, 1980). The implication of these gender studies is that men and women do not only have different roles and different access to and control of resources, they also have different needs. Hence, gender characteristics are context specific in respect of quality of life. The analysis of quality of life from gender and environment perspective show that perceptions may vary according to gender characteristics, needs and roles; access to resources; and to decision-making processes within the household. It is imperative therefore, to analyse the gender variation of residents' as it affect quality of life perception in Ibadan metropolis. The summary presented in Table 2 reveals that 52.37% of the residents were males, while 47.63% were females. In the identified residential

areas, household heads were mainly males. That the number of male household heads outweighed that of their female counterparts could be attributed to the fact that in African society, particularly in Nigeria, household headship is a role ascribed to the male gender. In addition, the community has able men that can be integrated into the workforce as they are considered to be playing a significant role and perhaps relatively stronger than their female counterparts.

Table 2: Gender Distribution of Residents

Gender	Core	Transition	Sub-urban	Ibadan metropolis
Male	297	140	105	**542**
	(56.25%)	(46.82%)	(50.48%)	**(52.37%)**
Female	231	159	103	**493**
	(43.75%)	(53.18%)	(49.52%)	**(47.63%)**
Total	**528**	**299**	**208**	**1035**
	(100.0%)	**(100.0%)**	**(100.0%)**	**(100.0%)**

The core residential area had the highest male household heads. This area had 56.25% of the household heads as males. In the transition area, 53.18% were female household heads. This figure put transition area to have the highest females as household heads in the study area. Furthermore, core residential area recorded the least of female household heads when compared with other areas of the metropolis.

Age of Respondents

Age is an important socio-economic attribute, which has impacts on the perception of residents' quality of life. Bovaird and Löffler (2003) documented that the older and younger people perceive quality of life differently based on their life experiences. The age of household heads in Ibadan metropolis was grouped into three for ease of analysis. This grouping was on the basis of dependency and active population as adopted by demographers and social statisticians. The groupings were: 18-30 years (the youth or dependency population), 31-60 years (the young adult or the active population), and above 60 years (retired/old adult). As stated in the methodology section, questionnaires were administered on respondents not below the age of 18 years in each of the selected buildings in the study area (see Figure 2).

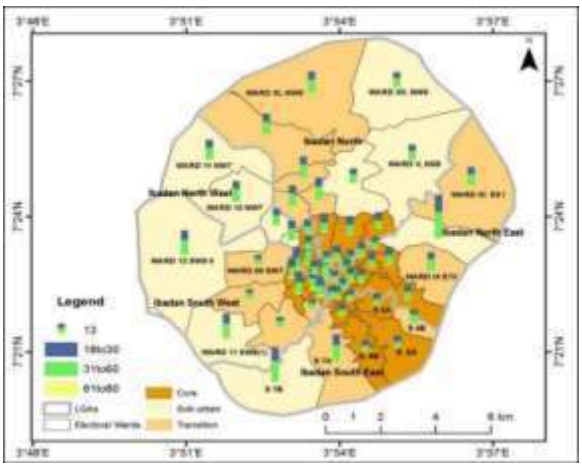

Figure 2: Age distribution of respondents in the study area

Through the summary presented in Table 3 it is apparent that residents' age group of 30-60 years accounted for 51.79% of the residents in Ibadan metropolis. Therefore, the dominant age group in the study area was 31 to 60 years. Next to this was those aged between 18 and 30 years which accounted for 42.22% of the residents in the study area. Furthermore, 5.99% of the residents accounted for ages that were above 60 years

Table 3: Age Distribution of Residents

Age	Core	Transition	Sub-urban	Ibadan metropolis
18-30	248	109	80	**437**
	(46.97%)	(36.45%)	(38.46%)	**(42.22%)**
31-60	241	173	122	**536**
	(45.64%)	(57.86%)	(58.65%)	**(51.79%)**
Above 60 years	39	17	6	**62**
	(7.39%)	(5.69%)	(2.88%)	**(5.99%)**
Total	**528**	**299**	**208**	**1035**
	(100.0%)	**(100.0%)**	**(100.0%)**	**(100.0%)**

It was also established that 58.65% and 57.86% of the residents in the sub-urban and transition residential areas respectively were in the age bracket of 31 to 60 years. Moreover, 46.97% of the residents in the core residential area were in the age group of 18 to 30 years. While residents above the age of 60 years represented 7.39% in the core residential area of the metropolis, those that were above 60 years accounted for 2.88% in the sub-urban residential area. The study observed that the core residential area had the highest number of residents that were above 60 years when compared with other areas in the metropolis. Hence, old adults in the core residential area were large in proportion. This may not be unconnected with the fact that this area is being occupied by the indigenes of Ibadan who happen to be the original settlers.

The mean age of 36 years was thus computed for Ibadan metropolis. This gives an indication that there was more of active population in the study area. The minimum age was 18 years, while the maximum was 75 years. The mean age in the core residential area was 35 years, while that of the transition and the sub-urban residential areas were 37 and 36 years respectively. Variation in the age of residents across the three residential areas was statistically significant. The result of the analysis of variance (ANOVA) ($F=3.644$ and $p=0.026$) confirmed this.

Marital Status of Residents

One other fundamental characteristic of respondents that has been established to be significant to individual's perception of their general quality of life is their marital status. Studies found marriage satisfaction to be an important factor influencing family quality of life. For ease of analysis of this variable, the residents' marital status was classified into four. These are single, married, widowed and separated. The spatial distribution of residents along these classifications in the different residential areas (see Figure 3).

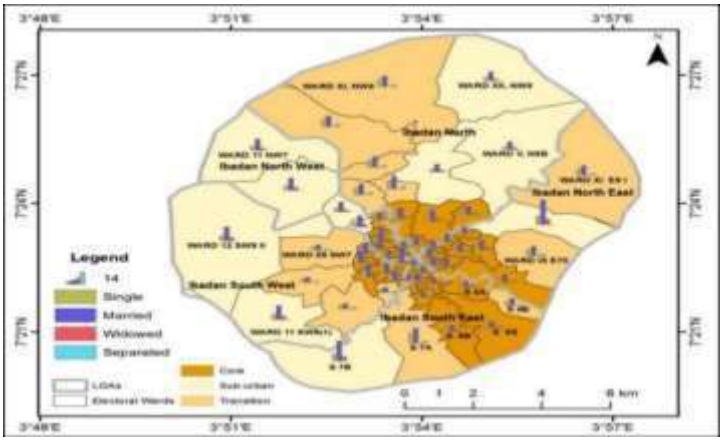

Figure 3: Spatial distribution of marital status of respondents in the study area

The study established that residents were more (59.32%) of married persons than other categories of marital status of the residents in Ibadan metropolis. While 28.50% of the residents were single, a proportion of 8.31% was widowed. Findings on this social attribute in the different residential areas revealed that residents that were separated in marital status were the less predominant. The group represented a proportion of 5.55% and 7.69% in the core and sub-urban, while none was found to be separated in the transition residential area. The implication of these findings is that a great importance was attached to marriage institution in the study area. This is in agreement with Foo (2000), who submitted that people marry at an early age for the benefit of having children to help them on farming activities. The result also implied that since there were many married middle aged and a considerable proportion of unmarried, infrastructure such as the maternity centres and educational facilities, among others, would be highly required. Variation in the marital status of respondents across the three residential areas was statistically significant by chi-square test computed ($\chi^2 = 127.322$ and $p = 0.000$).

Table 4: Marital Status of Residents in Ibadan Metropolis

	Single	**Married**	**Widowed**	**Separated**	**Total**
Core	**150**	310	44	24	528
	(28.41%)	(58.71%)	(8.33%)	(5.55%)	(100.00)
Sub-urban	**76**	116	0	16	208
	(36.54%)	(55.77%)	(0.00%)	(7.69%)	(100.00)
Ibadan	**295**	614	86	40	1035
metropolis	**(28.5%)**	(59.32%)	(8.31%)	(3.86%)	(100.00)

Educational Level of Residents

Educational attainment is another important attribute that influence both quality and perceived quality of life of residents. Studies have shown that a high educational level increases labour market insertion and offers individuals the chance to get higher income. Also, through better training, there is an increased quality and productivity, all directly or indirectly influencing quality of life (Beckie &Hayduk, 1997). Residents in the study area were categorized into different educational levels: primary, secondary, tertiary and those without formal education and their spatial distribution is shown in Figure 4.

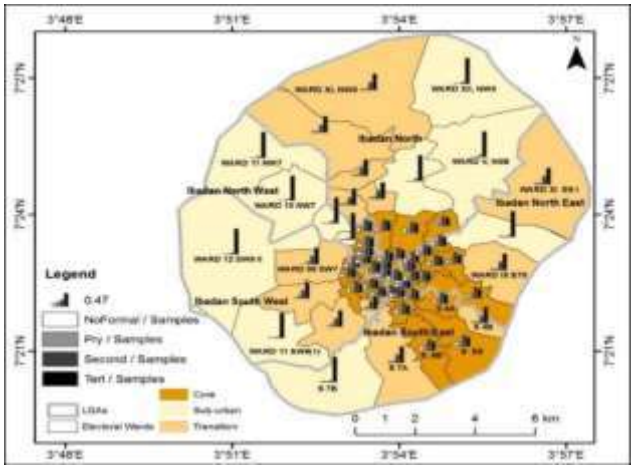

Figure 4: Spatial distribution of Educational Status among residents of Ibadan metropolis

Finding as presented in Table 5, established that 91.88% of the respondents, had one form of formal education or the other. It was, however, ascertained that proportions of 9.1%, 29.66% and 52.66% respectively of residents had primary, secondary and tertiary education qualifications. The proportion of residents in the study area without any form of formal education was only 8.12%. This indicated that there was a high level of literacy in the study area.

Table 5: Education Distribution of Residents in Ibadan Metropolis

	No formal Education	**Primary**	**Secondary**	**Tertiary**	**Total**
Core	68 (12.88%)	78 (14.77%)	209 (39.58%)	173 (32.77%)	528 (100.00%)
Transition	12 (4.01%)	20 (6.69%)	88 (29.43%)	179 (59.87%)	299 (100.00%)
Sub-urban	4 (1.92%)	1 (0.48%)	10 (4.81%)	193 (92.79%)	208 (100.00%)
Ibadan metropolis	84 (8.12%)	99 (9.57%)	307 (29.66%)	545 (52.66%)	1035 (100.00%)

Spatial analysis of residents' level of education revealed that 92.79% and 59.87% were found to have tertiary education in the sub-urban and transition residential areas. Similarly, while a proportion of 12.88% had no formal education in the core residential area, only 1.92% was without formal education in the sub-urban residential area. These findings revealed that residents with no formal education were more concentrated in the core residential area when compared with other two residential areas. Conclusion could, therefore, be drawn that the educational status of residents was on the increase as distance increased from the core towards the sub-urban residential area. This is in tandem with the positions of Afon (2006), who submitted that core residential area of many Nigerian traditional cities is inhabited by people with least form of formal education. This study, however, confirmed that the differences in education status of residents in the different residential areas were significant at 0.05 levels through the chi-square test computed for the study area (x^2=233.379 and p=0.000).

Further investigation into the education status revealed that residents had spent different number of years in the pursuit of formal education. This analysis is necessary so as to authenticate

the formal education qualification claimed by residents in the metropolis. For the purpose of analysis, years spent in pursuit of formal education were categorized into 9 groups as follows: residents who did not attend school at all (0), residents who dropped out of primary school (1-5 years), residents who completed primary school education (6 years), and residents who could not complete secondary school education beyond Junior classes (7-9 years). Others included residents who completed junior secondary school but did not complete senior secondary school (10-11) and 12 year for residents who completed secondary school education. Others included residents that possessed tertiary education qualifications such as National Certificate in Education (NCE) and Ordinary National Diploma (OND) (13-15), residents with Higher National Diploma (HND) and University Graduates (B.Sc) certificates (16-17), while the last group comprised residents who had spent between 18-25 years and thereby possessed higher degrees such as postgraduate diploma, Masters Degree and Ph.D. These classifications were adopted using the Nigeria 6-3-3-4 formal education system and the prevailing postgraduate education employed in most Nigeria Universities.

From the summary presented in Table 6, it was established that the proportion of residents who attained tertiary education (NCE, OND) in Ibadan metropolis was 26.67%. This represented the highest proportion. Residents who completed tertiary education (BSc, HND) were 22.90%, while those with secondary school education qualification were 17.58%. Only a proportion (1.02%) of the residents was unable to round off their primary school education. This group was concentrated most in the core, representing 1.70%. Furthermore, residents who could not complete junior secondary school education beyond junior classes accounted for 2.42%. These were concentrated in the core and transition residential areas, with proportions of 3.22% and 2.68% respectively. Similarly, 11.21% of the residents could have completed junior secondary school education but may not have completed senior secondary school education. This category was concentrated in the core and transition residential areas, representing 13.26% and 15.38% of residents respectively.

Table 6: Years Residents spent in pursuit of formal education

Educational Level	Number of years	Core	Transition	Sub-urban	Ibadan metropolis
No formal Education	0	63 (11.93%)	2 (0.67%)	3 (1.44%)	68 (6.57%)
Primary (drop out)	1-5	9 (1.70%)	1 (0.33%)	1 (0.48%)	11 (1.02%)
Primary school	6	45 (8.52%)	12 (4.01%)	1 (0.48%)	58 (5.60%)
Junior secondary (drop out)	7-9	17 (3.22%)	8 (2.68%)	0 (0.00%)	25 (2.42%)
Senior secondary (drop out)	10-11	70 (13.26%)	46 (15.38%)	0 (0.00%)	116 (11.21%)
Senior Secondary school	12	129 (24.43%)	47 (15.72%)	6 (2.88%)	182 (17.58%)
Tertiary (NCE, OND)	13-15	112 (21.21%)	73 (24.41%)	91 (43.75%)	276 (26.67%)
Tertiary (HND, BSc)	16-17	65 (12.31%)	86 (28.76%)	86 (41.35%)	237 (22.90%)
Tertiary (MSc, PhD)	18-25	18 (3.41%)	24 (8.03%)	20 (9.62%)	62 (5.99%)
Total		**528 (100.0%)**	**299 (100.0%)**	**208 (100.0%)**	**1035 (100.0%)**

The minimum number of years residents spent in pursuit of formal education was 0, while the maximum number was 25. The mean year spent in pursuit of formal education by residents in Ibadan metropolis was 12.58 with a standard deviation of 4.80. Findings further established that the mean year spent in pursuit of formal education by residents was 10.77 in the core, 13.84 and 1536 respectively in the transition and sub-urban residential areas.

Variation in the year spent in pursuit of formal education was statistically significant through the ANOVA computed (F=98.036 and *p*=0.000). This implied that the number of years spent in pursuit of formal education was generally high across the three residential areas.

Monthly Income

The monthly income of residents is an important quality of life indicator that needs to be taken into consideration. This is because, in the words of (Onokerhoraye & Omuta, 1994; Karsten, 2008), income influences a person's or family's ability to achieve and to maintain a certain lifestyle which is essential to provide for their basic needs. Studies have observed that a higher income positively affects one's life evaluation, while on the other hand; lower income and sustained unemployment are associated with lower emotional well-being and to a lower quality of life (Senlier et. al., 2009). To evaluate the income status of residents, income group for federal tax rating is adopted to illustrate the income distribution in Ibadan metropolis. The minimum monthly income was ₦2000.00k while the maximum was ₦450000.00k. The average monthly income for the study area was ₦49880.87k with a standard deviation of N67330.72k. Therefore, the income range was high. This indicated that residents' income was not evenly distributed within and between the areas under consideration. The implication of this is that monthly income will, in one way or the other, affect both the quality of life and the residents' perception of their quality of life.

The monthly minimum income in the core was ₦2000.00k, while that of the transition and sub-urban areas was ₦5000.00k each. Similarly, maximum income respectively in these areas was ₦150000.00k, ₦400000.00k, and ₦450000.00k. The mean income computed for the core area was ₦26774.81k, while that for the transition residential area was ₦54560.54k. Also, the sub-urban residential area had mean monthly income of ₦101807.69k. The mean income of the residents in the transition and sub-urban residential areas was higher than the mean of the study area.

Differences in the income of residents across the three residential areas were found to be statistically significant. The result of the analysis of variance (ANOVA) (F=114.175 and *p*=0.000) confirmed this variation.

Table 7: Monthly Income of Residents

Income (₦)	Core	Transition	Sub-urban	Ibadan metropolis
Below 20000	220	91	66	377
	(41.67%)	(30.43%)	(31.73%)	(36.43%)
20000 – 40000	206	89	10	305
	(39.02%)	(29.77%)	(4.81%)	(29.47%)
41000 – 60000	77	31	30	138
	(14.58%)	(10.37%)	(14.42%)	(13.33%)
61000 – 80000	6	21	13	40
	(1.14%)	(7.02%)	(6.25%)	(3.86%)
81000 - 100000	6	19	25	50
	(1.14%)	(6.35%)	(12.02%)	(4.83%)
101000 and above	13	48	64	125
	(2.46%)	(16.05%)	(30.77%)	(12.08%)
Total	**528**	**299**	**208**	**1035**
	(100.0%)	**(100.0%)**	**(100.0%)**	**(100.0%)**

From the summary presented in Table 7, it is established that, out of the 1035 residents surveyed, 36.43% had their income per month below ₦20000.00k, while a proportion of 12.08% had their income above ₦101000.00k. It was further established that 41.67% and 30.43% of the residents in the core and transition residential areas earned monthly income below ₦20000.00k. Furthermore, while residents who earned income above the average monthly income computed for the study area were concentrated more in the transition and sub-urban residential areas of the metropolis, those with lower income were found in the core residential area (see Table 4.4). Therefore, the study could be concluded that income increased as distance increased from the core residential area to sub-urban residential area of the metropolis.

Household Size

Household size is an important attribute in the explanation of residents' quality of life and their perception of it. Researchers have argued that when household size is high, cares and attention that children in such setting receive may not be adequate (Pacione, 2003; Bramston et al., 2005; Moshen & Afshari, 2009). Families with relatively small size expend lesser on various aspects of life than those with larger families. This has made those with smaller family sizes better-off in terms of their families' economic status and quality of life (Lucas, 2003; Ferris, 2006; Arthur, 2006).

The household size categorization employed in this study was adopted from Afon (2007). Thus the household size was categorized into three: households with 6 members and below, household that contains 7 to 10 members and household with more than 10 members. These were respectively regarded as the small, medium and large sized households. From the summary presented in Table 8, the transition residential area had the largest proportion of residents with small sized household. The group accounted for 88.29% of the residents in this part of the metropolis. Similarly, it was evident that 86.06% of residents in sub-urban residential area had also small sized household, while in the core residential area 67.05% of residents were with small sized household.

Table 8: Household Size of Residents

Household Size	**Core**	**Transition**	**Sub-urban**	**Ibadan metropolis**
6 or Below	354 (67.05%)	264 (88.29%)	179 (86.06%)	797 (77.00%)
7-10	143 (27.08%)	34 (11.37%)	27 (12.98%)	204 (19.71%)
Above 10	31 (5.87%)	1 (0.33%)	0 (0.00%)	32 (3.09%)
Total	**528 (100%)**	**299 (100%)**	**208 (100%)**	**1035 (100%)**

The spatial distribution of residents into large size household, however, showed a reversal of the findings in small household. This is because, while 5.87% of the household in the core were in this household sized group, 0.33% of the households were concentrated in the transition residential area. None of the residents was observed in the sub-urban residential area in this household size.
The average household size for the study area was 5.45, while it was 5.99 in the core residential area, 4.61 in the transition residential area, and 5.30 in the sub-urban residential area. The average household sizes in the core residential area were found to be above that of the study area.

Variation in household size across the three residential areas was found to be statistically significant. The result of the analysis of variance (ANOVA) ($F=36.447$ and $p=0.000$) confirmed the variation on this demographic attribute of residents in the study area.

Residents' Length of Stay

Residents' length of stay is an important attribute, which determines how people perceive the quality of life in their environment. Residents who have lived longer may be more satisfied with the area, facilities and the services available in that area. The work of Costanza (2007) and Karsten (2008) pointed out that experience in an environment is a function of length of residence. A person that has stayed in an environment for longer period of years would have detailed experience of the environment than a new resident. The relevance of length of stay in a residence is, therefore, extremely important in this study.

Presented in Table 9 was the residents' length of stay in the study area. It was established that 64.64% of the residents had stayed for 1-10 years. The proportion of residents that had spent between 11 and 20 years in the study area was 19.32%, while those that lived 21-30 years accounted for 19.32% of the residents. Those that had stayed for more than 30 years were 4.83%. This category was only concentrated in the core residential area.

Table 9: Length of Residence

Length of stay	Core	Transition	Sub-urban	Ibadan metropolis
1-10	240	275	154	669
	(45.45%)	(91.97%)	(74.04%)	(64.64%)
11-20	132	18	50	200
	(25.00%)	(6.02%)	(24.04%)	(19.32%)
21-30	106	6	4	116
	(20.08%)	(2.01%)	(1.92%)	(11.21%)
Above 30	50	0	0	50
	(9.47%)	(0.00%)	(0.00%)	(4.83%)
Total	**528**	**299**	**208**	**1035**
	(100%)	**(100%)**	**(100%)**	**(100%)**

Analysis of descriptive statistics of the residents' length of stay in the study area as well as in their current residence revealed that the minimum length of residence was 1 year, while the maximum was 69 years. The mean and standard deviation of residents' length of stay in the study area were 10.89 and 9.40 years respectively, while the mean and standard deviation of residents' length of stay in their current residence were 9.34 and 8.40 years respectively. The mean length of stay in the study area was 14.80, 5.63 and 8.50 years respectively for the core, the transition and the sub-urban residential areas. The mean length of stay in the residents' current dwelling places was respectively 12.94, 5.04 and 6.37 years in the core, the transition and the sub-urban residential areas. The standard deviation of residents length of stay in the neighbourhood (study area) for the core, the transition and the sub-urban were 10.72, 4.29 and 6.16 years respectively, while it was 9.71, 4.15 and 4.31 years for the length of stay in their current residents.

The length of residence was on reduction as distance increased from the core residential area towards the transition residential area. This is because the core residential area is being occupied by the indigenes and the original inhabitants of Ibadan, while the other areas emerged because of influx of people from other neighbouring towns and cities. This is evident from the fact that 0.06% of residents in the core residential area had resided in the area for more than 30 years. No residents had stayed for this period in the transition and the sub-urban residential areas (see Table 10).

Findings established that 4.83% of the residents had lived in the study area for more than 30 years, while 12.85% of the residents had not changed their residences in the last 21 years and above. This, therefore, implied that residents in the study area were very familiar with their immediate environment. There is every likelihood that residents must have been satisfied with life, otherwise the

length of stay would not have been as high as that. The computed ANOVA (F=124.917; *p*=0.000) established that differences in the residents' length of stay were statistically significant.

Table 10: Residents' Length of Stay in Ibadan Metropolis

	1 to 10	**11 to 20**	**21 to 30**	**Above 30**	**Total**
Core	271	133	92	32	528
	(51.33%)	(25.19%)	(17.42%)	(0.06%)	(100.00%)
Transition	282	11	6	0	299
	(94.31%)	(3.68%)	(2.01%)	(0.00%)	(100.00%)
Sub-urban	188	17	3	0	208
	(90.38%)	(8.17%)	(1.44%)	(0.00%)	(100.00%)
Ibadan metropolis	741	161	101	32	1035
	(71.59%)	(15.56%)	(9.76%)	(3.09%)	(100.00%)

The survey of socio-economic attributes of residents revealed that significant differences existed in some of the characteristics in the residential areas in Ibadan metropolis. These significant differences were noticeable in the residents' marital status, educational level, and occupation and residents length of stay in the study area. These were confirmed by the ANOVA and Chi-square tests through the summary presented in Table 11.

Table 11: Summary of ANOVA and Chi-Square of the socio-economic attribute of residents in the study area

Socio-economic Attributes	**ANOVA**		**Chi-Square**		**Significant**
	F value	***P* value**	**χ^2 value**	***P* value**	
Age	3.644	0.026			Significant
Income	144.175	0.000			Significant
Marital status			127.32	0.000	Significant
Educational status			233.379	0.000	Significant
Year spent in education	98.036	0.000			Significant
Occupation			16.929	0.000	Significant
Household size	36.447	0.00			Significant
Length of stay	124.917	0.000			Significant

From the foregoing, since some socio-economic attributes differ significantly across the three residential areas, it then suggests that variation is likely to subsist in the distribution of available infrastructure in the study area, facilities adequacy and residents' satisfaction derived from the facilities, quality of facilities and residents' quality of life. These are the focus of the next section.

CONCLUSION

The study has examined the spatial analysis of residents' quality of life in Ibadan metropolis. The study revealed that facilities such as water supply, restaurant, dispensary, drainage, electricity supply, waste disposal, fire station, among others, were insufficiently available in the study area. However, this could hamper the residents' well-being. The socio-economic characteristics of residents such as marital status, educational background, occupation and residents' length of stay in the study area varied significantly across the residential areas. Thus, the study concluded that the residents' quality of life in Ibadan metropolis was poor.

This study has provided information on residents' quality of life based on residents' perceptions. This information can be used by decision makers in framing development policies aimed at improving the residents' quality of life.

AUTHORS BIOGRAPHY

Solomon A. Olatunji, Dr. is a Town Planner in both academics and consulting services. He is a corporate member of Nigerian Institute of Town Planners (NITP) and a Registered Town Planner with Town Planners Registration Council of Nigeria (TOPREC). He is the current Head, Urban & Regional Planning Department, Federal University Oye-Ekiti

Adewale O. Yoade, Dr. is lectures in the Department of Urban and Regional Planning, College of Environmental Management, Wesley University Ondo, Nigeria. He is a member of Nigerian Institute of Town Planners (NITP) and a registered practitioner with Town Planners Registration Council of Nigeria (TOPREC). His research focuses on housing development, environmental planning and management.

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CHALLENGES OF IMPLEMENTING ENGLISH MEDIUM INSTRUCTION IN HIGHER EDUCATION OF GLOBAL, ASIAN AND BANGLADESHI PERSPECTIVES: A REVIEW

Md. Shah Alam[1], Karthiyaini Devarajoo[2] & Pavani Malaa Meganathan[2]
[1] *University of Development Alternative, Dhaka, BANGLADESH*
[2] *Infrastructure University Kuala Lumpur, MALAYSIA*

ABSTRACT
A great number of universities from non-English speaking countries have implemented English medium instruction (EMI) in conducting their tertiary teaching and learning activities. Remarkably English medium instruction (EMI) opens the international exposure to the students and the teachers to be in global academic domain but along with this, it also makes some realistic challenges of potential learning outcomes. This study has critically reviewed scholarly papers and peer reviewed journals to identify and evaluate those existing real challenges that are usually experienced and perceived by teachers and students due to English medium instruction in higher education of non-English speaking countries in Global, Asian and Bangladeshi perspectives. This study has primarily reviewed the published articles on the issues of teachers' and students' perceptions of EMI in different universities in non-English speaking countries and in Bangladesh to know the real experiences of the stakeholders and the problems that they face in different courses of different disciplines. This study evaluated some positive and negative effects of EMI and also contradictory natures in implementing EMI at the tertiary academic level. This study will help corroborating macro policy level and implementation level to help taking comprehensive policy for medium of instruction in higher education sector to minimize the challenges of achieving learning outcomes to facilitate higher education of Bangladesh.

Keywords:
English medium instruction (EMI), higher education, realities, challenges, learning outcomes

INTRODUCTION

Globalization, a 21st century phenomenon, has been considered to be a significant worldwide attribute influencing English as medium of instruction in developing countries including Bangladesh (Nur et al., 2021). In Bangladesh from the British colonial period to the present, English enjoys the status of being the most prestigious foreign language (Akter & Mitul, 2020). As a consequence, all private universities in Bangladesh have chosen English language as their de-facto medium of instruction to go along with the international trend of tertiary education (Sharkar, 2019). But the students who come to both public and private universities of Bangladesh from different areas of the country have different educational, linguistic, cultural, and economic backgrounds (Akter & Mitul, 2020) and all courses except English and religious studies in pre-university education level are offered in Bengali medium of instruction in Bengali medium schools, both public and private sectors (Rahman, 2021). Akter and Mitul (2020) in their mixed-method study in a university in Bangladesh have demonstrated that the students, who are mostly coming from Bengali medium backgrounds, get frustrated being unable to properly express their views in English. They also have observed that these students feel alienated in class for their inability to understand English lectures properly and to express themselves thoroughly in English. They have further pointed out that EMI brings difficulties not only to the students but also to the teachers (Akter & Mitul, 2020). While the students face linguistic complexities, the teachers are forced to put additional effort in preparing lectures in an EMI setting which, in turn, demands more energy in their lecture delivery. Consequently, it becomes difficult for both the teachers and the students to cope with EMI (Akter & Mitul, 2020).

Meanwhile, to meet with the increasing demand for tertiary education the Government of Bangladesh (GOB) passed the Private University act 1992. Since then, in spite of the significant

increase of universities in number and the increase of students in both public and private sectors, the standard of teaching, learning, and academic research still is a big question (Sharker & Hossain, 2019). It is high time to have a deeper investigation to have a systematic review on the experiences of teachers and students who are the main stakeholders to accomplish the real complexities of EMI implementation and learning outcomes.

PRESENT TRENDS OF EMI IN HIGHER EDUCATION

English language as medium of instruction globally gained its initial momentum with the Bologna declaration of 1999 (Walkinshaw et al., 2017). After that declaration, the world experienced rapid growth of EMI with substantial conclusive evidence (Dearden & Macaro, 2016). It is now clearly noticed that over the recent twenty-five years, both regional and international EMI has achieved the status of the most important feature of language policy and planning at the macro education level (Zumor & Qasem, 2019). In the last few years, a great number of top universities from non-English speaking countries have implemented EMI in conducting their tertiary teaching and learning activities (Al Hakim, 2021).

Following this current global trend of higher education, the process of transformation of educational programmes into English medium as an alternative to the native language occurs in numerous non-English speaking countries of the world (Shimauchi, 2018). Keeping pace with the growth of globalization of tertiary education, at present all over the world universities are increasingly incorporating the English language as their medium of instruction in teaching many disciplines and in their curriculum (Yuan et al., 2020). Now in the recent modern world of academia in many non-Anglophone countries EMI is observed with prominence and significance (Galloway, 2020). So presently, many non-native Anglophone countries have seen the fast growth of EMI in the tertiary education sector (Rahman et al., 2019).

Starting its momentum in Europe, EMI has been widely incorporated in countries where English is not the native language and in Asian countries such as Bangladesh, China, Malaysia and South Korea English has been adapted to tertiary education (Rahman et al., 2019). Though Asian universities have been adapting EMI in higher education, most of the studies on EMI have been done in the European regions in their own contexts (Rahman et al., 2019). But at the same time, a contrasting scenario has also been observed along with the popular trend of EMI by Dearden & Macaro (2016) in their qualitative study based on Poland, Austria, and Italy, that EMI is on increase and get the opinion in favour of introducing, but there is a distinct lack of awareness of a need to cope with EMI and its immediate negative impacts.

This trend in higher education may pose different kinds of complexities and may make the barriers to ensuring quality education and it may create complications on the abilities of the teachers' performance and abilities of the students' learning and finally may have an impact on the learning outcomes of higher education in non-Anglophone countries like Bangladesh.

In Bangladesh, Bengali has been declared the national language since 1972 and 98% of the people speak Bengali as their native language and receive public education in Bengali. It is also supposed to be used in government administration and in the judiciary (Rahman & Kaur, 2018). But recently English has been adopted largely in private sector higher education since the early 1990s (Rahman & Kaur, 2018). It can be argued that like in other non-English speaking countries private universities have paved the way for establishing EMI in undergraduate and graduate programmes to compete with the public universities (Rahman et al., 2020). In addition, recently EMI has been emphasized in Bangladeshi tertiary education level in National Education Policy-2010 (Nur, 2021) though Bengali is officially functional as the national language and is also declared as the medium of instruction allowing English along with Bengali and Bengali is used as mainstream medium in primary, secondary and higher secondary level of schooling (Rahman et al., 2020). But now no private

universities in Bangladesh use Bengali medium instruction and they declare themselves as English medium universities on their websites (Rahman et al., 2020).

In response to the Bologna process of higher education and globalization, English as the medium of instruction is firmly established around the world as a popular academic language (Macaro, 2015). Following this recent mode in global education, Gimaraes & Kremer (2020) metaphorically stated EMI as 'unstoppable train'. But the contrasting scenario has also been remarked by Dearden & Macaro (2016) in their qualitative study based on Poland, Austria and Italy that there is a distinct lack of awareness of EMI to cope with it and its immediate impacts. But it is not left unnoticed that this trend of installing EMI in higher education might pose some sorts of complexities and challenges to ensuring quality education and there might be the immediate consequences that influence outcomes in higher education especially for non-Anglophone countries.

PROBLEMS OF EMI IMPLEMENTATION IN HIGHER EDUCATION

With the current trend of the global increase of EMI (Dearden & Macaro, 2016) all private universities of Bangladesh since the early 1990s (Rahman & Kaur, 2018), in spite of having Bengali as the medium of instruction in the mainstream of pre-university education (Rahman, 2020), have started adopting English as the de-facto language of instruction for a great number of students currently amounting 398737 (Sarkar et al., 2021) pursuing education in private universities under EMI provision.

Five major challenges in EMI classrooms are identified by Hung & Lan (2017) in their study conducted at a public university in the Mekong Delta in Vietnam. These are teachers' lack of language abilities, student's low English proficiency, issue of engaging in the class discussion, shortage of preparation time for lectures and teaching resources. Meanwhile, Gimaraes & Kremer (2020) in their study in Brazil and Belgium also address these relevant issues in the ways that linguistic challenges may occur in non-English speaking countries and also in English-speaking countries where immigrant students struggle with English medium instruction to comprehend content delivered in English language. Hasan & Ibrahim (2017) find that sometimes learners understand the usages of English from the class lectures given by the teachers and sometimes the new media channels are needed for the support for them. Similarly, Bradford (2016) gave emphasis on the lack of skilled support staff to maintain the coherence with EMI in doing academic work with diverse participants.

It is now obvious in the field of higher education that conducting teaching individual courses in tertiary education programmes in English medium instruction is considered by governments and institutions in many non-English speaking countries as useful for both national and international students (Bradford, 2016). That is why policymakers, administrators of higher education institutions, teachers, staff, and students with mother-tongue-based academic backgrounds engaged in the processes of EMI implementation have to count multiple issues including the scope of using English, instructional quality for teaching and learning and the integration of essential courses and programmes into existing institutional frameworks (Bradford, 2016).

Nevertheless, it is a matter of concern that the educational outcome is questionable due to adoption of EMI policy which threatens the development of knowledge in higher education in Asian non-Anglophone countries (Rahman et al., (2018). Moreover, Sarkar et al., (2021) in their qualitative study interviewing students and lecturers in private universities in Bangladesh have reported that EMI causes multiple challenges for such a big portion of the recipients of higher education and the content lecturers also experience difficulties in conducting the classes by thoroughly adopting EMI. Besides, Sultana (2018) in her ethnographic study on students in a private university in Bangladesh explores the context of EMI practice and the identity of learners remarking that students find themselves incompatible with internalizing and speaking in classroom discussions and activities and noticeable demoralization takes place. Sarkar et al., (2021) have reported in concluding remarks in their study

that the quality of higher education through EMI in the private universities in Bangladesh has been compromised and most importantly the nation exhibits limited success in instilling EMI in higher education. Along with this it is also informed by Sarker et al., (2021) that the perception of the stakeholders of language management level and implementation have been found absent and thus language practice has been suffering in the pedagogy. Rahman et al., (2019) also have observed the situation of higher education in their qualitative research that descriptions of everyday's experiences of the stakeholders at the micro-level have been given little or no importance.

However, Sharkar (2019) reported that there is a lack of empirical study on the experiences of the teachers and the students about English medium of instruction in higher education in Bangladesh. Akter & Mitul (2020) in their study at Bangladesh University of Professionals have identified some current specific complexities and barriers confronted by the students and the teachers in the implementation of EMI. They also identified complexities related to the cognitive ability of teachers to perform teaching. They further found complexities related to the cognitive ability of students in making notes, writing reports, responding to questions, participating in discussions or in understanding subject matters which affect negatively on academic outcomes in the tertiary education and all these issues imply that academic performance may be compromised.

NEGATIVE EFFECTS OF EMI IMPLEMENTATION IN HIGHER EDUCATION

Zumor (2019) in Saudi Arabia, Aizawa and Rose (2019) in Japan, Hengadeekul et al., (2014) in Thailand, Rahman and Kaur (2018) and Sultana (2014) in Bangladesh, in their studies focused on micro-level education systems have found mentionable negative consequences of EMI implementation in the issues of content comprehension and assessment, classroom language use, code-switching, instructional motivation, speaking anxiety, socialization on campus and self-image. Along with those researchers cited above, Macaro et al., (2018), Macaro (2018), Macaro, Akingcioglu & Hu (2019), Lina & Murata (2016), Walkinshaw et al., (2017), Toh (2019), Pulcini & Camoagna, (2015), Splender (2016), Dimova (2020), Cao & Yuan (2020), Macaro & Han (2020), Costales (2017), Zenkova & Khamitova (2017), Dafouz & Camacho-Miñano (2016), Bradford (2016), have reported different complexities and negative consequences of implementation of EMI in higher education in their research carried out separately in different non-Anglophone countries.

Macaro & Han (2020) in their study conducted in China have reported that the EMI comes with some tensions and challenges and they assert that the teachers not having English as their first language teach the majority of academic programmes to the students who do not have English as their first language and therefore the teachers and students face the difficulties in teaching and learning through English language. Hung (2020) in his study conducted in Taiwan has got a similar result that some students and teachers may not feel initially comfortable in EMI condition which does not conform to long-standing conventions in Taiwanese classrooms. This discomfort minimizes academic optimism but the academic optimism has significant impacts on university students (Zhihao & Mustaha, 2021). So the question of the competence of teachers to teach in English medium instruction is not merely a question of their own level of English proficiency but of their pedagogical knowledge, their awareness of the linguistic challenges that also is faced by the students to communicate and ensure learning (Macaro et al., 2019).

Along with this, the low English proficiency of the students is an argument against EMI implementation (Dafouz et al., 2016). In addition to this, important evidence is noticed that in the EMI classrooms simplification, scaffolding and translanguaging exist (Dimova, 2020). Cao & Yuan (2020) have shared their personal experiences in their study on "Effective ways to meet students' cognitive and affective needs in EMI classrooms" in international business and have asserted that English medium instruction always generates challenges in teaching the pupils who have less English proficiency and a large number of students to show the frustration in participating and doing course

assignment. Insufficient English proficiency, low motivation of teachers and students, faculty members' unpreparedness for English language use, shortage of teaching materials, conservative attitudes, etc. are also considered as barriers to methodological innovation and for implementation of EMI (Zenkova & Khamitova, 2017). Similarly, all respondents identify that the instructors' low language proficiency level, the students' low language skill level, and the extra amount of workload for preparing for the class to provide quality services are responsible for the negative impact on education in EMI provision (Zenkova et al., 2017). It is also noted that simplified content is required due to students' problems learning with their low level of English language skills and it causes a decline in the quality of education (Zenkova et al., 2017). The proficiency of English of both teachers and students is identified as the main barrier that can hamper the implementation of EMI at the tertiary level (Zenkova et al., 2017).

Macaro et al., (2017) in their study on EMI in higher education have raised some questions about the consequence of EMI on content learning to identify the challenges faced by the students coming from secondary education to university academic programmes. Field level stakeholders of EMI express the existing struggles to understand the content of the subject taught to them following the western style of instruction (Galloway, 2020). Rahman & Kaur (2018) in their study of an Asian perspective have reported that the use of English in operation in tertiary educational institutions is often limited and so it causes code-switching. Besides, Zumor and Qasem (2019) have reported on the serious negative impact on specific disciplines in their survey conducted in the Middle East.

Apart from this, other challenges related to linguistics are most visible crucial experiences of teachers and students working in non-English language speaking settings including students' inability to take notes from "context reduced" (Cummins, 1983) academic texts, teachers' lack of proficiency to use proper language in their classroom and these challenges result in declining of programme quality and faculty members' loss of confidence in instructional capacities (Bradford, 2016). This review highlights studies that have mainly emphasize the implementation of EMI in micro-level education, which has negative consequences of switching instructional language from mother tongue to English in non-Anglophone countries worldwide.

MIXED EFFECTS OF EMI IMPLEMENTATION IN HIGHER EDUCATION

Hung (2020) asserts that EMI should be encouraged at the university level to foster students' language competence, content learning and intercultural sensitivity so that teachers can have more confidence in implementing EMI. Similarly, Costales (2017) has observed in the survey conducted in University of Oviedo in Spain that in EMI provision students' overall satisfaction level is high due to the global demand of English and students are interested to be engaged in English medium instruction for international mobility. He also claims that EMI promotes the global dimensions of university students and is viewed as a positive outcome. Another study conducted in Kazakhastan by Zenkova & Khamitova (2017) in a like manner reports that teaching the subjects in English medium instruction has positive impact and it is beneficial for the career of teachers and for external academic mobility and migration to developed countries. The articles discussed above mainly have given the emphasis on macro-level education policy and on the necessity of English language and got popular positive effects of using EMI in higher education worldwide.

Apart from the articles cited in the above chapters, Hung (2020), Costales (2017),Zenkova & Khamitova (2017), Dafouz & Miñano (2016), Koksal & Tercan (2019) have obtained some mixed results in their studies on switching from mother tongue (L1) to EMI (L2) in university education in non-Anglophone countries. Some studies (Hu & Duan, 2019; Anka & Yahoo, 2017; Manan, 2019) have found contrasting result that EMI setting had no significant effects on students' learning in the classroom and have explored the effects of EMI on content learning with mixed results. However, interestingly the study conducted by Hung (2020) in Taiwan has compared academic results of EMI

and non-EMI students and it has reported no significant consequences. Tawir & Mustapha (2017) show in their study that there is no a remarkable relationship between English Language performance and overall learning. But Zenkova & Khamitova (2017) have identified the possibility of content reduction through teaching in English medium instruction due to more workloads for students. In contrast, other researchers (Hu & Duan, 2019; Anka & Yahoo, 2017; Manan, 2019) have claimed that there is no difference in final outcomes in performance between EMI learners and non-EMI learners. Similarly, no mentionable difference among them is identified in the study with the business students of final grades in three subjects offered in the first year (Dafouz & Miñano 2016). On the other hand, Koksal & Tercan (2019) with the help of different references of Rahmadani (2016) in his study in Turkey have argued that most of the learners have positive perception to English medium instruction because they can improve their English proficiency, gain confidence in conversation and comprehend more text books, journal articles in English and can receive international culture. However, Koksal & Tercan (2019) again have given reference of the research of Tsui and Ngo (2017) to argue that learners are tensed about class discussion, motivation to learn and their academic result due to EMI courses. At the end, we can conclude with Galloway's (2020) opinion where he has recommended for more effective implementation of EMI and more research including longitudinal studies on the effectiveness of teaching subjects through English medium instruction.

CHALLENGES OF EMI IMPLEMENTATION IN HIGHER EDUCATION OF BANGLADESH

EMI implementation in higher education sector is rising all over the world because of the market demand for English and the case of Bangladesh is not different and so consequently private institutes of higher education in Bangladesh offer academic programmes in English (Sarkar, 2019). Rahman et al., (2019) have stated that Asian universities have been optimistically adopting EMI but most research in this field has been done in European contexts. So, this trend in higher education poses different kinds of challenges and makes the barriers to ensuring quality higher education and there might be the possibility of a loss of learning outcomes which is reported in the field of science, technology, engineering, and medicine in Bangladesh (Rahman et al., 2019). Rahman et al., (2019) also have observed the situation of higher education in their qualitative research and have mentioned that there is little or no actuation and interpretation from the micro-level stakeholders such as faculty members and students.

Rahman & Kaur (2018) have provided a chart presenting EMI situation in Asian countries based on different secondary sources which indicate that in Bangladesh privately run universities have adopted English as the de-facto medium of instruction. In such a way in Bangladesh like other non-inner circle English speaking countries private universities have paved the way to counter the mother-tongue-based medium of instruction through English in undergraduate and graduate programme (Rahman, 2020). In contrast, Bengali which is the national language of Bangladesh is functional legally for official uses and in higher education and at the macro level in primary secondary, secondary and higher secondary levels of schooling (Rahman, 2020). So, all courses that accept English and religious studies are offered in Bengali at the pre-university education level in Bangladesh (Rahman, 2021). But unfortunately, no private universities offer any of the courses in Bengali medium as they desire to ensure their identification as English medium universities on their websites (Rahman, 2020). As a result of this, from 1990s onwards an enhanced and robust attitude towards English Language Education Policy (ELEP) rhetoric has been observed prominently in Bangladesh, indicating a necessity of symbiotically keeping pace with the impetus of globalization and local development motives (Nur, 2021). For instance, The National Education Policy (NEP)-2010 has promulgated the necessity of English language education by defining its aims and objectives for developing a

knowledge-oriented, skilled human resource so that students can compete in the job market, especially in the economic sector of the country and also in the global sector (Nur, 2021).

It is now obvious that private universities in Bangladesh have adopted English as a de facto medium of instruction (Sharkar, 2019). It should also be mentioned that in Bangladesh there are about 103 private higher education institutions that are operating their academic activities in English and all of them are called English-medium universities (Sharkar, 2019). However, in the past few years academic programmes have been developed in EMI without considering of how the EMI courses fit with each other and the perceptions of learners and teachers remain absent from most of the studies (Sharkar, 2019). But the practical issues are exposed in the study in the Gulf countries done by Belhiah & Eelhami (2015) where it is stated that the current EMI policy is not without disadvantages.

Akter and Mitul (2020) in their study have exposed the fact that both the teachers and the students have accepted EMI at tertiary education as a positive endeavor in this age of internationalization but they have been facing several barriers during its implementation due to students' varying levels of language competency, differences in learning style, some critical issues related to pedagogy and the scarcity of required resources. Akter and Mitul (2020) also have found that the students face linguistic barriers and the teachers are required to put extra effort in the preparation of EMI lectures and their delivery. Additionally, there is a scarcity of textbooks and other resources available in English. Akter & Mitul (2020) have further added that the greatest challenge in implementing EMI comes from the proficiency level of the students. The most drastic consequence in this regard is the degradation of the overall quality of education by means of result in engineering of high-stake national examinations. Though Bangladesh is enjoying a high pass rate in public examinations at the pre-university education level (Nur, 2021), most of the students being Bengali native speakers and having their schooling in Bengali medium, are trying to use and think only in English and that hinders the flow of their thought as Choi & Lantolf (2008), as stated in Kanakri, (2017), in their study based on the notion of inner speech hypothesis of Vygotsky (1987) examines that learners fail to express motion in L2 frequently which shows that the students cannot think about the activity in L2 frequently but in L1. They may have excellent command over their subject area, but have a lack in English speaking skills because of getting less exposure to it. Based on the above critical discussions, it is a demand of time for policymakers to address a more context-driven, rational, synchronized and holistic approach to English language education policy (Nur, 2021).

So there is a clear gap between policy and implementation of EMI in Bangladesh which needs more in-depth study and research to find out the complexities and problems to address for better implementation of EMI and for quality higher education. That is why it is now a necessity of time to investigate the compatibility and the competency of the universities that are conducting their study in English medium instruction (Rahman, et. al., 2019). In these circumstances in the higher education sector, it is now a big challenge to ensure quality higher education through EMI. While the students face linguistic difficulties, the teachers are forced to put additional effort into preparing lectures in EMI, which, in turn, demands more energy in their lecture delivery. Moreover, they are forced to compromise the EMI policy by mixing English and Bengali as students need the English lectures to be supplemented by Bengali (Akter & Mitul, 2020). The students who get admitted to private universities due to several reasons are largely coming from Bengali medium schooling backgrounds. So, the problem regarding the medium of instruction in their tertiary level of education is a burning issue. As a result, due to the lacking of organizing and expressing ideas in English properly, some students may not get their desired grades in academic results (Akter & Mitul, 2020).

CONCLUSION

The crucial point is that some studies that have been reviewed in above sections have reported positive effects of EMI. The other groups of scholars have remarked negative effects. The third groups of scholars have pointed out mixed effects of EMI implementation. As the result of the different studies conducted in different countries in different perspectives following different methodologies and many-sided complexities of implementation of EMI, further studies focusing on experiences of stakeholders' proficiency of English language, challenges of implementation of EMI and variation of academic outcomes in tertiary education level seem to be necessary to feel up the gap of the knowledge in this field.

The above literature has illustrated that there are many contradictory natures found in implementing EMI at the tertiary academic level. It is likely due to insufficient attention paid to the EMI learning scenarios in which the research should take place (Hung, 2020). The reason behind this is that till now there has been a minimum number of research on the consequences of EMI teaching and learning in classroom and class practice has been largely ignored (Chen, et al., 2020). It is now obvious that in EMI setting the difficulties faced by teachers and students with speaking, writing, and reading skills can affect their teaching and learning, their research, their effectiveness in group works, and the successful completion of their dissertations. Whatever might be the standpoint about EMI in higher education, it is clear from the above study that there is a positive or negative correlation between EMI and the academic performance of teachers and students in EMI-based higher education. But the use of English as the language of academia remains uncontested (Dafouz & Miñano, 2016).

As stated in the above literature, the researches in this field are neither abundant nor conclusive. Dafouz & Miñano (2016) generally claim that second language (English in this study) learners face more difficulties in comprehending content and thus they will achieve lower scores. That is why more studies are needed to explore the experiences of the teachers who are facing problems in communication, explaining contents, maintaining work load, preparing lecture and the experiences of the students in getting clear information from books and lectures, taking notes, writing reports, responding questions, participating in groups, taking time in private study from the participants perspective due to English medium instruction.

According to Rahman et al. (2019) English medium instruction might hinder educational outcomes as the principal aim of higher education is to develop special knowledge of the subjects, not giving the emphasis on language development. But until now, Sarker et al., (2021) in their qualitative study in Bangladesh have found that the research on teachers' interpretation of performance and students' interpretation of compatibility in micro level in EMI classrooms in higher education level is limited. That is why challenges of implementing EMI in higher education in Bangladesh need further investigation (Rahman et al., 2019). To fill up this gap of studies concerning the EMI phenomenon, a further large-scale in-depth research is needed regarding the complexities of implementation of EMI in Higher education with a view to critically analyzing and synthesizing the interpretations and perceptions of challenges experienced by university faculty members and students about the implementation of EMI.

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AUTHORS' BIOGRAPHY

Md. Shah Alamis an Assistant Professor and researcher at University of Development Alternative, Dhaka, Bangladesh. His main areas of academic interests are sociolinguistics, psycholinguistics, second language acquisition, translation study, and continental literature. Currently he is doing PhD in Education at Infrastructure University Kuala Lumpur, Malaysia. *Email:* smshahi0777@gmail.com

Karthiyaini Devarajoo, PhD is an Associate Professor and researcher at Infrastructure University Kuala Lumpur, Malaysia. Her main areas of interests are teacher training, teaching and learning, assessment in education, and comparative international development education. Currently she supervises Master's and PhD students as well. *Email:* karthi@iukl.edu.my

Pavani Malaa Meganathan, PhD is currently working asa language lecturer and researcher at Infrastructure University Kuala Lumpur, Malaysia serving as the head of the postgraduate Programme in Education. Her areas of expertise are English language teaching and learning, second language acquisition, technologiesin education and discourse analysis. *Email:* meganpavani@gmail.com

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DEVELOPMENT OF SURVEILLANCE SYSTEM WITH AUTOMATED EMAIL AND TELEGRAM NOTIFICATION USING OPEN-SOURCE APPLICATION PROGRAMMING INTERPHASE (API)

Fatin Faqihah Majid, Sazwan Syafiq Mazlan & Norazlina Mohamed
Infrastructure University Kuala Lumpur, MALAYSIA

ABSTRACT

Theft results in harm, property loss, and emotional suffering. Everyone needs a security system to protect their possessions because of the alarming amount of theft that occurs daily. This project aims to develop a low-cost surveillance system that makes use of a Raspberry Pi 4 Model B, a camera module, and a motion sensor to record video and detect motion in protected areas such as user property and belonging. Application Programming Interphase (API) and Dynamic Programming Algorithm (DPA) are the algorithms employed in this project. According to the study's findings, an IoT system can automatically send email and Telegram alerts with a ten-second video attachment when a motion detector detects an intruder within a range of 0 to 2 metres. The speed of sending the alert is influenced by the state of the Internet Network Connection. Due to immediate notice, which enables immediate action, remote monitoring, and the presence of proof in the form of video recordings, it is anticipated that the relevance of this surveillance system can lower the theft rate in Malaysia

Keywords:
Email notification - Telegram notification - Internet of Things - Raspberry Pi - Video Forensic

INTRODUCTION

Internet of Things (IoT) for technological activities open a new medium for information sharing, productivity, and modern lifestyle. IoT has improved human's lifestyle for ease and modernization. Human reliance towards IoT has been increasing over the past few years to complete various activities such as work, study, research, and daily errands. Hence this improvement has the potential to expand the basic purposes of a surveillance system.

Surveillance system is vital in any organization. The major aim is to safeguard people and their belongings from numerous threats such as theft and burglary. The surge in crime cases in Malaysia has increased the need for a sophisticated surveillance system that integrates with the Internet to allow continuous monitoring of activities from anywhere, at any time. There are 52344 cases of theft in 2020, accounting for about 80% of all cases based on crime index (Mahidin, n.d.). Even though closed-circuit television (CCTV) has widely employed, it is still considered passive monitoring system that necessitates continual and ongoing human supervision, takes more time, highly expensive, and the captured files are frequently corrupted (Rezvy & Prasannan, 2018).

Because of the limitations of passive surveillance systems outlined above, researchers and academics were drawn to develop a non-passive surveillance system (Rani & Indora, 2019). Most of the researchers then leveraged the advantages and benefits of Wireless Sensor Networks (WSN) for monitoring (Pathak, 2017) (Narkhede & Khadke, 2016). Sensor nodes can be put in any part of a building because of their wireless connectivity, providing them the advantage of portability in deployment (Sasongko & Sucipto, 2021). The first objective is to build a system that can monitor belonging and property for security purposes. Second objective of this research is to design a surveillance system that integrate with open-source application programming interphase (API). The open-source API can provide a cost-effective surveillance system. Third and fourth objectives are to give an instant problem solving and crime prevention as the surveillance system uses two medium of communication which are Telegram and Email. These implementations are to provide a complete and

relevant evidence for forensic investigation in case any crime happens. This is because the surveillance system provides a ten second video recording to identify the intruder.

LITERATURE REVIEW

The IoT-based security system (Sharma & Sharma, 2019) presented in the study proposal by the researcher(s) comprises monitoring for intruders, LPG leakage, and electrical short circuits. In this study, the system's hardware consists of a Raspberry Pi 3, a USB webcam, a PIR sensor, a current sensor, and an ESP8266 Wi-Fi module. This article employs Python programming, the Arduino IDE, and the Raspbian operating system for its software. This study describes a security system that, in the event of an intrusion, send the user a telegram message with an image attachment. The system presented in this work is more general than a surveillance system since the MQTT protocol are used to read multiple sensor's state and not only for monitoring.

The surveillance system described in the research proposal by researcher(s) (Noorjannah Ibrahim et al., 2019) allows users to monitor their home live via mobile application as long as the user is in the same network as the surveillance system. Plus, after motion sensor detects an intruder nearby and sends two notifications which are an email and SMS, both SMS text message and email notification has an image attachment. The Raspberry Pi, Pi camera, PIR motion sensor, Ultrasonic sensor, buzzer, and LED are all used in this project. MQTT broker, Node-Rack, and Thing Speak are the software used in this study. Another study that is using Node technology is the research by (Luu et al., 2019).

Widiyasono et al. (2020) provide a study that describes a clever motion detection system that enables the Raspberry Pi to send email notifications with image attachments when motion is detected. The researcher also discussed how to send emails using SMTP on port 587 and Transmission Control Protocol on port 55. The Raspberry Pi 3 model B, PIR sensor, Pi camera, and female to female wires are used in this study. The Raspbian and Windows operating systems are used in this paper's software to set up the email. To guarantee that only intended recipients may read the email, this research has their own mail server.

Researchers (Patil et al., 2017) have proposed a surveillance system with a motion detector that notifies the user via email when motion is present. The Raspberry Pi, a camera module, and a motion sensor are used in the article. The alert is delivered as an email attachment. The research provided by (Patil et al., 2017) is somewhat similar to (Widiyasono et al., 2020) but differs in terms of email notification methods. The email notification is sent using a Python script, as suggested by the researcher(s) (Patil et al., 2017), however the research by (Widiyasono et al., 2020) utilizes its own server.

A video surveillance system service that provides email and telegram notifications with a video attachment has been proposed in the study by (Gualotuñ et al., 2018). The approach taken, however, is distinct; the paper makes use of a Raspberry Pi B+ as a video streaming server and storage, and an Atmega 328 Arduino as a microcontroller and CPU. The speed of the Raspberry Pi utilized in this article is 1.5 GHz, which is substantially quicker than the 20 MHz speed of the Arduino used in the research reported by the researcher(s) (Gualotuñ et al., 2018). The system's performance in terms of speed is impacted by the use of Arduino. Table 1 contains a detailed summary of all relevant research.

Table 1: Detailed Summary of Relevant Research

Researcher			***N. Patil, S. Ambatkar, S. Kakde)***	***T. Gualotuña, E. Macías, Á. Suárez, E. C., A. Rivadeneira***	***H. Sharm , M. Sharma***	***S. Noorjannah Ibrahim, A. H. Hasan Basri, A. Liza Asnawi***	***N. Widiyasono, A. Rahmatulloh, H. Firmansah***	***This paper***
Year			***2017***	***2018***	***2019***	***2019***	***2020***	***2022***
The scope of research	**Notificati**	**SMS**				/		
		Email	/	/		/	/	/
		Telegram		/	/			/
	Attachmen	**Text**						
		Image	/		/	/	/	
		Video		/				/
	Platform	**Arduino**		/				
		Raspberry Pi 2	/	/				
		Raspberry Pi 3			/	/	/	
		Raspberry Pi 4						/
	Live Streaming			/		/		/

METHODOLOGY

The system has been designed to monitor personal/property/belonging, give instant email notification with video attachment of detected motion nearby surveillance system, send instant Telegram notification with video attachment when the system senses motion and allow live monitoring where users can view live video after the Python code executed. Plus, it is a cost savvy and easy-to-implement surveillance system.

This system's hardware consists of a Raspberry Pi 4 Model B computer with 8GB of RAM, a camera module, and a motion sensor (McManus & Cook, 2021). Through a designated camera port, the camera is incorporated within the Raspberry Pi. The Raspberry Pi is connected to the motion sensor by a GPIO pin. The Raspberry Pi's GPIO4 pin, 5V, and GND have been utilised. Figure 1 depicts the surveillance system's whole hardware installation.

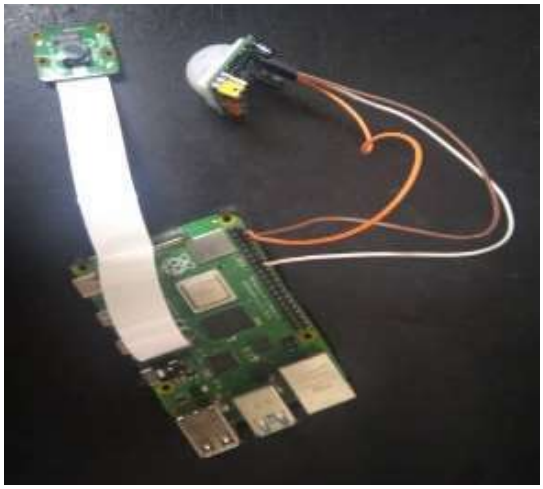

Figure 1: Complete Hardware Installation

The Raspberry Pi is connected to a motion sensor and camera as shown in Figure 2 (Ahmad et al,2019). Launching the Python script on the Raspberry Pi will start the camera's live video of the home, possessions, and people. The property's motion sensor will detect any intruders as they approach. The camera module will then begin recording the events after ten seconds. A Python script will send the user's email and telegram the ten second video recording. The same script permits the camera module to continue live streaming even after motion is no longer detected.

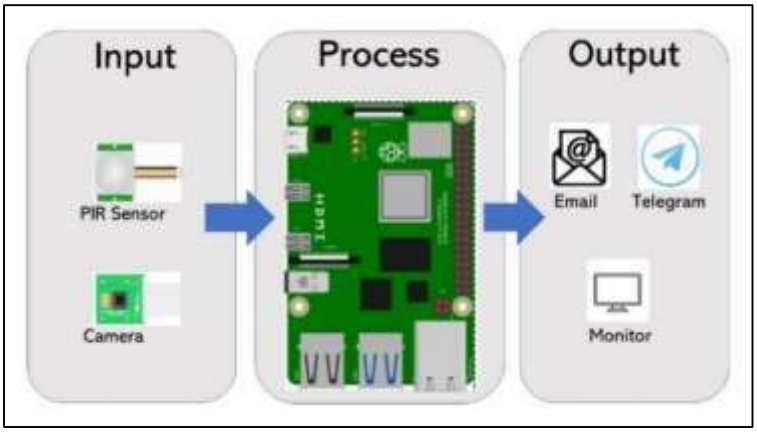

Figure 2: System Flow

A 32 GB storage memory is used in this study. The SD card serves as the installation medium for Raspbian OS, the operating system for the Raspberry Pi (Dow, 2018). The configuration of the camera module and motion sensor, as well as their integration with Telegram and email, depend on the operating system. Additionally, the micro-SD card will store all live recordings and ten seconds of video recordings for forensic purposes.

Application Programming Interphase (API) is utilized in this research. The MQTT messaging protocol is a standard for IoT (MQTT - the Standard for IoT Messaging, n.d.). It is intended to connect remote devices with a tiny code footprint and low network bandwidth by acting as an incredibly lightweight publish/subscribe messaging transport (Ramlee et al, 2019). A wide range of industries,

including the automotive, manufacturing, telecommunications, oil and gas, etc., use MQTT. There are few characteristics of MQTT API that make it best fit in this research. It is lightweight and efficient, can be scale to multiple of IoT devices, support for unreliable network no matter speed, it allows bi-directional communication and lastly, it is security enabled.

Regarding the security and optimization of MQTT API protocol, there are three different types of client authentication methods available for any MQTT broker to confirm the identity of MQTT clients. The methods are client id, username with password and client certificate. The methods that are used in this research is client id and username with password. To send the Telegram notification, the clients' id is hard coded in the script, while to send email notification, the username and password are hard coded in the script by the researcher. Before accepting the MQTT session, the MQTT broker verifies the authentication's credential that a client gives to it along with the CONNECT packet. The credentials are sent in the CONNECT packet to the broker in cleat text format unless encrypted at the transport layer i.e., using port 8883 for connection. Figure 3 shows the API structural diagram of the surveillance system. First, user activate the connection by allowing the client's id from Telegram and credentials from email to be hard coded in the Python that is programmed in the IoT devices. Next, the API will activate the MQTT Service, run the script code hence, complete the IoT system.

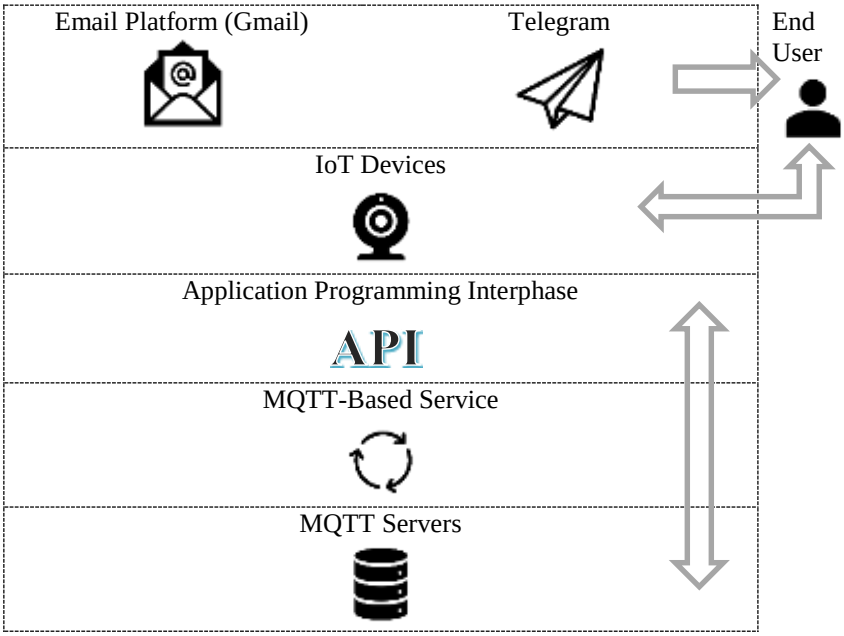

Figure 3: API Structural Diagram

Dynamic Programming Algorithm (DPA) are the algorithms that are utilized. Python, PHP, and JavaScript make up the Dynamic Programming Algorithm. The script for combining Telegram and Email notifications with the necessary hardware, such as motion sensor and camera module, is created primarily in Python. The Python code can be reliable for integration of hardware and software regardless of any communication technology (Fatima, 2019).

Thonny IDE and Raspbian OS are additional software requirements that are utilized in the construction of the suggested system. Thonny and Visual Studio Code are used to create the code. Thonny is a free Integrated Development Environment (IDE) for Python that was created specifically for the Python programming language. It contains a built-in debugger that can be used to run in order to fix errors and it provides the ability to perform step-by-step analysis.

Both the Telegram API and the Email API are used to send the notification alert. Telegram is a cloud-based, cross-platform instant messaging program that is free and open source. Additionally, it offers VoIP, file sharing, and a number of other features. In this project, when a motion sensor detects any intruder movement, a ten-second video attachment will be sent over Telegram as an instant warning. Email is a means of message exchange, a channel of contact between people, or a system notice. For this project, Google Mail, or Gmail, is utilized.

The procedure will be split down into five crucial steps: setting up the Raspberry Pi, the camera module V2 and motion sensor, Telegram and email. The camera module V2 was linked to the Raspberry Pi 4's camera port for live streaming and video recording. Python code was used to configure video recording for ten seconds. The video by default will be saved in H.264 format since H.264 format video recording is the industry standard. The majority of devices did not support this video format, thus it will to be converted to MP4 by the Python code.

The system begins with the ability to stream live footage of the building or property and the motion is turned on right away. The live streaming feature will halt and record the invader for ten seconds if the motion sensor detects motion. The video recording features will keep working even if the sensor doesn't pick up any motion. The video notification flowchart is based on Figure 4.

Figure 4: Flowchart of the Video Notification

Python code allows users to access to surveillance system using any devices such as phones, tabs, laptops, and computers. To add some security and assurance, not all users can sign into the web application. Only allowed user which is the owner of the surveillance system may sign into the dashboard. The flow chart of live streaming video is based on Figure 5.

Figure 5: Flowchart of the Video Notification

RESULT AND ANALYSIS

First, the camera module can record video for ten seconds and automatically save the file. Figure 6 shows the saved videos from the Camera Module. The videos are vital to be the backup for forensic investigation when crime happen. Not only the authorities will have the videos from the email and Telegram but also from local file. These files were taken by inserting command in the Python code. The commands used is 'raspistill o nameOfFile.jpg' and 'raspivid -o nameOfFile.h24' (Amos et al., 2021). These files will be automatically saved in the memory.

Figure 6: Saved Video

Next, when Motion Sensor detects movement, it will send instant email notification. Figure 7 shows the Telegram notification when motion sensor that is attached to Raspberry Pi detect movement. The sender and receiver of the notification with video recording has already been set at the Python code.

Figure 7: Saved Image and Video

Next, when Motion Sensor detects movement, it will send instant Telegram notification. Figure 8 shows the Telegram notification when motion sensor that is attached to Raspberry Pi detect movement. The receiver of the notification has already been set with the identification of user token from Telegram bot. The token being set in the Python Code.

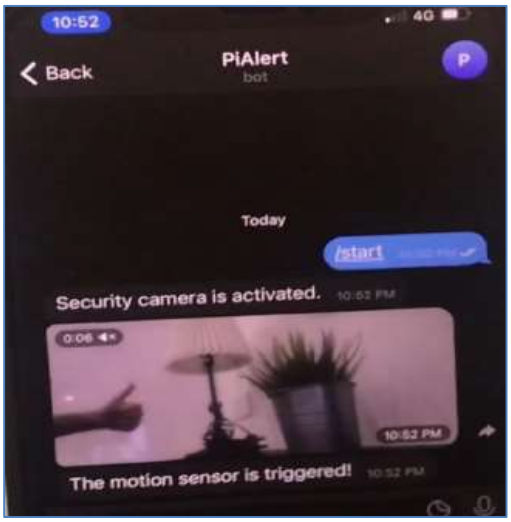

Figure 8: Saved Image and Video

Next, the sensor capability and reliability were tested. Table 2 shows the behaviours of motion sensor towards movement and light condition. Testing performs at a distance of 1-5 meter of several testing subject movement while testing at a distance of more than 3 meters, the sensor was unable to detect the subject movement. In the light condition, movement of the testing subject is able to detect both in light and dark conditions. In conclusion, the range and light condition of the motion sensor

detection limit on movement of subject is 1-3 meters apart. However, the fire can only be detected within 1-2 meters.

Table 2: Behaviours of Motion Sensor

Testing subject	Distance (Meter)					Light Condition	
	1.0	2.0	3.0	4.0	5.0	Light	Dark
Human	✓	✓	✓	✗	✗	✓	✓
Cat	✓	✓	✓	✗	✗	✓	✓
Ball	✓	✓	✓	✗	✗	✓	✓
Fire	✓	✓	✗	✗	✗	✓	✓

Based on test data in Table 3, a conclusion can be drawn. Namely, the duration between sending and receiving notification on telegram and email alerts on repetition 1-3 is 2 seconds, while on repetition to 4 and 5 are 3 seconds. This difference can be influenced by different video size files and internet network connection conditions. When the internet access on the Raspberry Pi is off, sensor and the camera still work, but the video captured is saved first and not directly sent to telegram and email as alert. It will be sent when the internet connection is restored.

Table 3: Duration of Sending and Receiving in Telegram and Emails

Testing	Time (hour:minute:second)			File Size	Dimension
	Sending	Received	Delay		
1	10:18:20	10:18:22	2 second	200 kb	480x320
2	10:18:30	10:18:32	2 second	200 kb	480x320
3	10:19:12	10:19:14	2 second	200 kb	480x320
4	10:19:40	10:19:42	3 second	220 kb	480x320
5	10:20:02	10:20:04	3 second	220 kb	480x320

DISCUSSION AND CONCLUSION

When it comes to today's technology, the Raspberry Pi opens a whole new chapter. Not just because of its size, but also because of what it can do. Because of its portability, it can be utilized for almost anything (Halfacree, 2020). This is demonstrated through the surveillance system project. This research has achieved four objectives that has been explained in detail in introduction with the improvement from the previous research. The achieved objectives are monitored through personal/property/belonging, give instant email notification with video attachment of detected motion nearby surveillance system, send instant Telegram notification when the system senses motion, and built cost effective of microprocessor-based surveillance system. The improvement of this research that has been achieved sends instant Telegram and email notification with ten seconds video attachment when the system senses motion. This improvement has maximized the efficiency, flexibility, security, and instant response whenever threat is triggered by the surveillance system. However, the downside of the system is that it can be hard for non-technical person to setup without proper written guide and it also relies heavily on the internet connectivity to send the alert where it might be hard to those whoe live in rural area where the internet access is limited.

This surveillance system can be improved for future research by utilizing more GPIO Pins to maximize its function and uses. More function and uses can ease user's daily routines and activities. To conclude, this project can be extended to fully utilize the proposed system with latest technology such as AI recognition feature or other detection where it can be one complete security system.

AUTHOR BIOGRAPHY

Fatin Faqihah Majid is student of the postgraduate programme Master (Electronic Engineering) at Infrastructure University Kuala Lumpur (IUKL) Faculty of Engineering, Science and Technology. She graduated in Diploma in Science Computer and Degree in Computer System Security. Based on the certifications, the thesis in her master is the combination of Information Technology, Security and Internet of Things which lead to a complete Electronic Engineering. Email: ffaqihah97@gmail.com

Sawan Syafiq Mazlan, **Ts. Dr. PhD** in Electrical and Engineering, is a Head of Postgraduate Program at Faculty of Engineering and Science Technology in IUKL. His research interests are in Robotic, Artificial Intelligence, Electrical and Electronics, Internet of Things. Email: sazwan@iukl.edu.my

Norazlina Mohamed, Master of Engineering (Electrical-Electronics Telecommunication) is a member at the Faculty of Engineering and Science Technology in IUKL. Her research interests are in Analog and Digital Electronics, Photonic Technology, Internet of Things. Email: norazlina@iukl.edu.my

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BIO-ADSORPTION PROCESS USING CARICA SEED TO REDUCE WATER TURBIDITY FROM LINGGI RIVER

Khairunisah Kamaruzaman, Low Pui Yee, Nik Nuraini Azhari & Nadzifah Che Mat
Infrastructure University Kuala Lumpur, MALAYSIA

ABSTRACT
This study examined natural adsorbent (papaya seed) in reducing turbidity from Linggi River. The natural adsorbent, papaya (carica) seed was grinded in powder form. Adsorption test was conducted to test the turbidity of the water sample through a jar test. The optimum dosage of papaya seed powder was identified in order to obtain the optimum turbidity removal. The effectiveness of papaya seed on the adsorption process was compared with chemical alum which was an aluminium sulfate solution. 6L of water samples from Linggi River were collected in December 2019 per batch. There were three batches in total. Interval dosage of papaya seed powder was 40 mg/L which started from 40 mg/L, 80 mg/L, 120 mg/L, 160 mg/L and 200 mg/L. Aluminium sulfate was added 10 mg/L in the first beaker jar test to be compared with papaya seed in reducing the turbidity level. The average turbidity of water samples from Linggi River was 81.7 NTU before the test. The lowest turbidity value was 3.95 NTU with the optimum dosage of 80 mg/L of papaya seed powder. Based on the results obtained, papaya seeds have the ability to control the turbidity from river intake.

Keywords:
Adsorption test, jar test, Linggi River, papaya seed, turbidity

INTRODUCTION

Rivers are usually considered as freshwater which flows towards the ocean, sea or lake. Moving water dilutes and decomposes pollutants more rapidly compared to still water. Municipal and industrial sewage couples with anthropic activities (Sekharan et al., 2022) causes more diluted solids and results to turbid water on river water.

Water turbidity is measured using the nephelometry which is the relative measurement of light scattering through a restricted range of angles to the incident light beam. Turbidity measured by different turbidimeters would be producing different numerical NTU values. Turbidity can be determined as the cloudiness or haziness of fluid which is caused by the huge number of particles that could not be seen by human eyes. If there are very tiny particles (suspended solid) in the water, it would sink very slowly or not at all if the particles are colloidal. These particles would cause the water to appear turbid.

According to the Department of Environment (2019), Linggi River was classified under Class II for river water classification and sub classes for suspended solids it shows under Class III. Based on Class II, it requires conventional treatment as a water supply (Razak et al., 2021). The turbidity of water sample from Linggi River is tested which is 111 NTU, considered as high turbidity water. The water does not fulfill the water parameter from WHO which is 5 NTU for drinking water (Rahmanian et al., 2015). Thus, it needs to be treated to reduce its turbidity by coagulation. Solids that cause the turbidity condition of water can be reduced using the suitable treatment process. The Absorption process became the chosen process in removing the turbidity.

This adsorption process has been identified as a physicochemical method in reducing the turbidity. It effectively removes the colloidal and suspended solids by the usage of the coagulants. Coagulants can be based inorganic and organic. Several inorganic coagulants or chemical based substances such as alum, polyaluminium chloride and ferrous sulfate can cause several harmful effects towards human health. Aluminium can be overused for efficient coagulation but the overuse of

aluminium salt increases the alum concentration and cause turbidity. Excess consumtion of aluminium causes Alzheimer's disease (Chandran et al., 2015). Other than that, these inorganic coagulants are quite costly in order to treat the chemical sludge, which is the end product of agglomeration formation. Thus, several studies have been conducted to use natural coagulants which are cost effective and nontoxic to water supply (Kusuma et al., 2022).

Papaya seed or known as Carica Seed can be one of the natural coagulants in bio-adsorption process. Papaya seeds are a rich source of protein. The presence of the positively charged proteins in papaya seeds work as a coagulant because it can bind with the negatively charged particle which is silt, clay, bacteria and toxins. It allows the solid to settle down at the bottom of the water after treatment. It can be used in order to get a clear water result. It is proven that the usage of papaya seeds powder is an efficient natural coagulant and reduces the dosage of alum that brings side effects to human health (Chandran et al., 2015).

In this study, bioadsorbents using the Carica seed in reducing the turbidity from Linggi River were tested. To achieve this research, several objectives were conducted. The objectives were (1) to identify the physical characteristic which is the turbidity of water sample from Linggi River, (2) to obtain the optimum dosage of papaya seeds powder on adsorption process, (3) to determine the effectiveness of papaya seeds as natural coagulants compared to inorganic coagulants, chemical alum.

METHODOLOGY

Sampling Location

6 liters of water samples were collected from the Linggi River in December 2019 per batch. Three batch of water collection in total. Water sampling were collected by gap of one week per batch. Batch 1 was collected on 6 December 2019, batch 2 collected by 13th December 2019 and batch 3 collected by 20th December 2019. A grab sampling was chosen as collecting the water sample. Sampling location as shown in Figure 1. The river flows from Pantai to Ampangan, Seremban, Rasah, Mambau, Rantau, Linggi and ends at Kuala Linggi, Melaka. The water sample was collected from the river that pass through Rasah, Seremban.

Figure 1: Map of sampling location (Linggi River); sampling location as sub-picture taken in December 2019

Preparation of Carica (Papaya) Seed

A papaya fruit was sliced open using a clean knife. Distilled water was used to wash the papaya seeds. The seeds were dried under the sun for at least 7 days before crushing them into powder. Home grinder was used to crush the seeds into fine powder. The fine powder was collected into an air-tight container for experiment later. Papaya seeds were grinded as powdery condition as shown in Figure 2.

Figure 2: Papaya seed powder

Preparation of Alum Stock Solution

10 grams of aluminium sulfate was added into 1000 ml of distilled water per batch. Each 1 ml of this stock was equal to 10 mg/L when added to 1000 ml to be tested.

Experimental Setup

This experiment was applied by jar test as shown in Figure 3 to conduct the adsorption process treatment. First, six of 1 Litre beakers were prepared with water samples from Linggi River respectively. The first beaker was added 10 mg/L of stock solution whereas another five beakers were added different dosage of papaya seed powder which were 40 mg/L, 80 mg/L, 120 mg/L, 160 mg/L and 200 mg/L. Then, six beakers were placed in jar test machine and started the mixing process simultaneously. The stirrers were turned on after the dosing process. The mixing process was at 50 rpm for 30 seconds in the beginning of the experiment. The mixing speed was adjusted to 110 rpm for 1 minute for the rapid mix purpose. The mixing speed was adjusted into 50 rpm again continuous for 30 minutes. The settling process was allowed for 1.5 hours. The experiment was repeated for another two times from step 1 to 6 by using the water sample. The final turbidity was analyzed and recorded. Sample collection and testing procedures were performed according to the Standard Method for Water and Wastewater Analysis (APHA, 2017).

Figure 3: Jar test

RESULTS AND DISCUSSION

Physical Characteristics of Linggi River

Physical characteristics of Linggi River water as shown in Table 1. Average turbidity, pH and temperature were 81.7 NTU, pH 7.23 and 25.57 ºC respectively. Turbidity readings show high value due to the rainy season in Seremban, Negeri Sembilan during December 2019 as shown in Figure 4. Average monthly rainfall in Seremban (Negeri Sembilan) in Millimeter from the World-Wide Travel Organization, Amsterdam in December shows more than 150mm. This rainfall distribution shows the reason of quite high turbidity concentration of the river, pH value in neutral condition and it does not create a harmful effect on Linggi River. Since it is quite rainy in December, the temperature was 25.57 ºC which is quite cold.

Table 1: Characteristics of Linggi River

Parameters	Turbidity (NTU)	pH	Temperature (ºC)
Value	81.7	7.23	25.57

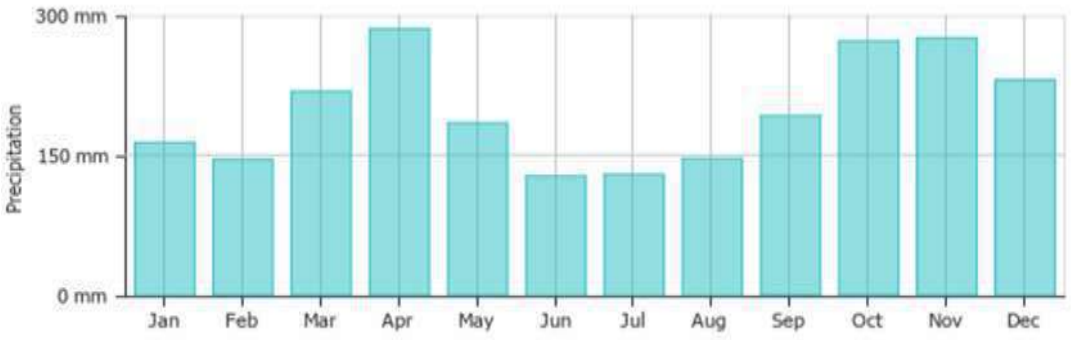

Figure 4: Average monthly rainfall in Seremban (Negeri Sembilan) in Millimeter from the World-Wide Travel Organization, Amsterdam in 2019

Optimum Dosage of Papaya Seeds Powder on Adsorption Process

The optimum dosages of Papaya Seeds were checked based on three batch of experiments shown in Figure 5. Batch 1 which is on 6th December 2019, batch 2 on 13th December 2019 and batch 3 on 20th December 2019. The optimum dosage based on batch 1 shown in Figure 5 was at 80 mg/l and turbidity reading shows 10.4 NTU. Followed by batch 2, the optimum dosage was 80 mg/l as well and turbidity reading shows 6.28 NTU and the optimum dosage for batch 3 was 80 mg/l by reading of 3.95 NTU. These results could be concluded that the overdose of papaya seed powder contributed to the turbidity in water. Thus, the optimum dosage of papaya seed powder was 80 mg/L from the experiment. According to Chandran et al., (2015), the presence of the positively charged proteins in papaya seeds work as a coagulant because it can bind with the negatively charged particle which is silt, clay, bacteria and toxins. It allows the settling down of solid at the bottom of the water after treatment.

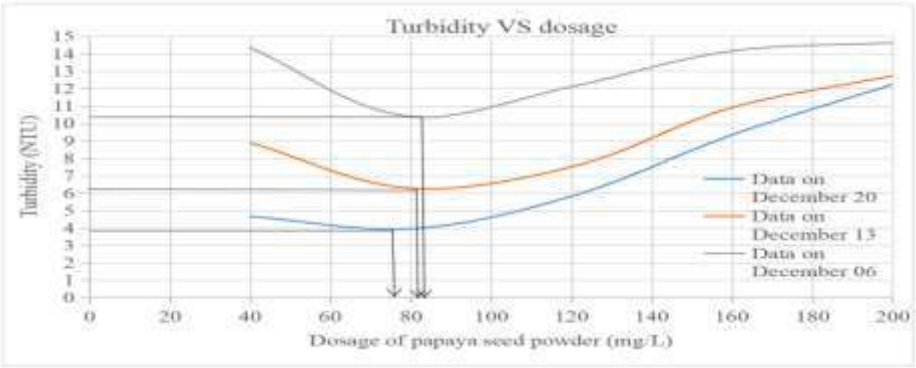

Figure 5: Graph of turbidity against dosage of papaya seed powder

Comparison on Application of Chemical Alum and Papaya Seed Powder

Chemical alum which was an aluminium sulfate solution applied in the first beaker in adsorption test. The concentration of alum was 10 mg/L. The turbidity of the water was measured after the adsorption test. The result showed turbidity was 1.47 NTU. The lowest turbidity reduction using papaya seed as natural coagulant was 3.95 NTU. The safe limits of turbidity from the World Health Organization (WHO) is within 5 NTU (Rahmanian et al., 2015). The application of chemical alum and papaya seed powder were lower than the required limits which was 5 NTU. However, application of aluminium sulfate would be affecting the human body. The dosage of aluminium sulfate was consumed by humans little by little during drinking of water. It may cause Alzheimer's disease in the human body (Chandran et al., 2015) Thus, although the turbidity reduced by using aluminium sulfate was more effective, it may be replaced by the application of papaya seed powder in order to reduce the potential of experiencing Alzheimer disease.

CONCLUSION

Parameters such as pH, temperature and dissolved oxygen were measured as physical properties of Linggi River. Turbidity, pH and temperature were 81.7 NTU, pH 7.23 and 25.57 ºC respectively. The interval dosage of papaya seed powder was 40 mg/L. The optimum dosage of papaya seed powder was 80 mg/L. Three sets of data were plotted in a graph of turbidity against dosage. The lowest point of the three curves were around 80 mg/L. The lowest turbidity value was 4.66 NTU after the treatment. Chemical alum which was an aluminium sulfate solution was used in the first beaker to compare with others using papaya seed powder at different dosage. 10 mg/L of chemical alum was added to the water sample. The lowest turbidity was 1.47 NTU with the applied of 10 mg/L chemical alum solution whereas the optimum turbidity was 4.66 NTU with 80 mg/L of papaya seed powder. The chemical alum and papaya seed powder were effective in reducing the turbidity of water samples. Although the chemical alum had a higher efficiency than papaya seed powder, it would cause Alzheimer disease.

AUTHORS BIOGRAPHY

Khairunisah Kamaruzaman is a lecturer in the Civil Engineering & Construction Department of Infrastructure University Kuala Lumpur. She received her Master of Science in Environmental Engineering from Universiti Teknologi Mara in 2014. Her area of expertise is Environmental Engineering with a focus on Water & Wastewater Treatment. Her research project for bachelor degree focusing on Phytotoxicity of Seed Germination and accomplished research project for master degree in Geopolymer study.

Low Pui Yee is a degree holder of Bachelor of Civil Engineering from Infrastructure University Kuala Lumpur (IUKL). She obtained her degree in 2020. The courses such as Water and Wastewater Management were giving many opportunities to concern more on environmental topics. Fortunately, she had the opportunity to do an environmental related topic as her thesis during final year of degree.

Nik Nuraini Azhari is a lecturer in the Civil Engineering & Construction Department of Infrastructure University Kuala Lumpur. She obtained her Master of Science in Civil Engineering (Environmental) from Universiti Teknologi Mara in 2012 and her interest focused on Environmental Engineering, Water and Wastewater Treatment Technology.

Nadzifah Che Mat is a lecturer in the Civil Engineering & Construction Department of Infrastructure University Kuala Lumpur. She obtained her Master in Building Technology from Universiti Sains Malaysia in 2002. She is an expert in construction materials and technologies

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THE EFFECT OF CONCRETE'S PROPERTIES ON PARTIAL REPLACEMENT OF FINE AGGREGATE WITH DIFFERENT SIZE RANGES OF POLYETHYLENE TEREPHTHALATE (PET) IN CONCRETE MIXTURE

Mohamed Emierul Qazzarul Khir Johari, Oscar Yap Khai Ming & Mohd Nasir Hussin
Infrastructure University Kuala Lumpur, MALAYSIA

ABSTRACT
Human beings use up to 50 billion tonnes of aggregate every year and the extraction of aggregate give severe impacts to the environment. Therefore, finding an alternative material to replace aggregates in the concrete mixture is necessary. Plastic pollution is the scourge of humanity. Plastic waste that causes significant challenges in recycling and leads to massive plastic pollution. This study aims to investigate tthe effects of utilizing polyethylene terephthalate (PET) as a partial replacement for sand in concrete by using two different range of PET which are 2mm-1.18mm and 1.18mm-600µm. The effects on the properties of concrete such as compression were examined. A group of five concrete mixtures containing PET was prepared as a partial substitute for sand with the replacement of 0%, 5%, 10%, 25% and 50%. Concrete was cast to determine the behavior of fresh and hardened concrete in terms of workability, unit weight and compressive strength. The experimental results showed an increment in workability, reduction in unit weight, the replacement harmed the compressive strength of concrete at varying percentage of replacement and sizes of PET. However, this study had proved that the plastic waste can be replaced by specific percentages and sizes

Keywords:
Compressive Strength, Concrete, Polyethylene Terephthalate, PET, Workability

INTRODUCTION

Aggregates like gravel, crushed rock, and sand are the second most traded and extracted Earth's resource after water, and human beings use up to 50 billion tonnes of aggregate year (UNEP, 2019). In the BBC Future article by Beiser (2019), Pascal Peduzzi, an environmental scientist, points out that it is impossible to extract 50 billion tonnes of any resource every yearwithout severe impacts to the environment. Therefore, finding an alternative material to replace aggregates in the concrete mixture is necessary. Numerous types of plastic waste are produced worldwide, only 9% of them have been and 12% incinerated, with the remaining 79% just being disposed to the nature environment. These plastics include Polyethylene Terephthalate (PET), Polypropylene (PP), high-density polyethylene (HDPE).

In Malaysia, the problem is worsening with the increase of single-use plastics for food, beverage, and goods packaging for delivery and takeaway since thelockdown of the Covid-19 pandemic. In 2020, Malaysians utilized 148000 tonnes of plastic only for food packaging due to the pandemic (Yeo, 2021). The Worldwide Fund for Nature- Malaysia (2020) also did a study and presented that Malaysia's per capita plastic usage is 16.78kg per capita in 2019 and ranks second in Asia. Plastic usage is still increasing yearly despite many programs being held to move people away from single-use plastics. Cestari (2020) points out in the study that plastics could assist on creating a sustainable future and help on reducing plastic pollution because they are strong, durable, waterproof, light, easyto shape, and recyclable which are essential aspects for construction materials. UNEP (2018) findings show that 1 million plastic beverage bottles are bought every minute and 5 trillion single-use plastic bags are used globallyper annum. Half of all plastics were produced to be single-use and then just dumped. Plastics harm millions of living things yearly, from birds to fish to other marine organisms.

According to Parker (2019), plastic has harmed roughly 700 species, including the endangeredspecies. Dumped fishing gear or discarded plastic products strangled the majority of the creatures, including seals, whales, turtles, and others. The usage of waste materials in the construction industry is widely explored. Various waste substances and industrial by-products, including glass, fly ash, ceramic, slag, and recycled concrete aggregate are used with and without the natural aggregates. The presence of several research on the use of various forms of waste material to solve some of the existing global issues, including waste pollution and the dwindling of non-renewable natural resources. This includes the attempts to utilize Polyethylene Terephthalate (PET) waste to partially substitute aggregate in concrete production. PET, abbreviated as PETE, is the shortened form for Polyethylene Terephthalate, the chemical name for polymer and comes with the recycling code of number 1 usually can be found at the bottom of the PET products. PET is one of the most widely used thermoplastics in the world (Hardin, 2021). It is a semi-crystalline and naturally transparent plastic. In the textile industry,PET can be known as polyester, while when used as packaging for food or beverage, it is generally known as PET or PET resin. PET plastic is the most commonly used thermoplastics mainly in the packaging and textile industry (Habib, 2021). These polymers are given preference over others due to their differentiation properties like outstanding stiffness and strength due to the presence of a large aromatic ring in the PET especially when the polymer chains are aligned with one another in an orderly arrangement by stretching.

In previous research, 66.67% or 14 research had been done based on the replacement of coarse aggregate and only 33.33% or seven studies are based on fine aggregate replacement. The gap was identified in the method of using plastic waste to replace fine aggregate. Therefore, PET as the plastic waste was proposed to replace the fine aggregate in the concrete mixture in this research. Besides that, another research gap can also be obtained from the reviewing of published research article journals. 76.19% or 16 research had been done based on the replacement of plastic waste in concrete mixture using one specific size range of plastic wasteor the sizes of the plastic waste was not considered. While only 23.81% or five studies have beendone based on various sizes of plastic waste replacement in the concrete mixture. The gap was identified in the testing variable based on various sizes of plastic waste replacement in the concrete mix. Therefore, various sizes of PET as plastic waste were proposed to replace the aggregate of concrete mixture in this research.

METHODOLOGY

The study was conducted in five phases. Phase one of this study was preliminary studies which include literature studies, collection of data and the studies on materials properties. The second phase was PET treatment. In this phase, PET bottles collected from the plastic waste were transformed into fine PET fragments by shredding and cutting of PET waste bottles. Before the fine PET fragments can be used to be partially replaced into concrete mixture, it had been sieved and those passing through 4.75 mm sieve size was only used in the concrete production. Next the study was carried on with the concrete sample preparation which is in phase 3. The concrete samples were prepared with water-cement ratio of 0.55 and with 0%, 5%, 10%, 25% and 50% of PET replacement in concrete mixture. After that, the study then entered phase 4 - testing stage. Two types of testing that had been conducted were fresh concrete testing by slump test and hardened concrete testing which include density and compressive strength test. Finally, the data obtained from all of the tests were analysed.

In this research, the PET is replaced by volume instead of weight. In order to gain the volume to be used for replacing the fine aggregate in concrete mixture by various percentages and size ranges of PET, a mould or container firstly prepared to be filled fully with fine aggregate of the river sand. Once the container is fully filled with sand weight, a record the reading is taken. After that, the same container is used again but this time filled full with PET and then it was weighed. Next, to find the ratio

of PET over fine aggregate by using the obtained weight from the container with PET dividing the obtained weight from the container with fine aggregate (sand).

The volume of PET used to replace the fine aggregate can be obtained by multiple the ratio of PET over fine aggregate with the PET weight that calculated. A total amount of 54 (100mm x 100mm) samples were prepared for density test followed by compressive strength test that tested at the curing age of 7 and 28 days.All of the samples had been tested for slump test before they were being casted. Three cubes were tested on density and compressive strength test for both curing age of 7 and 28 days to obtained the accuracy of results by using the average. Table 1 showed the standard and guidelines used for the lab tests and Table 2 showed the mix proportions.

The data were tabulated and analyzed by using bar chart for slump and density test to show the differences between the concrete with and without partial replacement of PET. While for compressive strength test, the data was tabulated and analyzed through a best fit line in the graph where the optimum compressive strength of concrete with PET can be observed.

Table 1: Summary of standard used

Test	**Standard**
Slump Test	BS EN 12350-2
Density Test	BS 1881: Part 114
Compressive Strength Test	BS 1881: Part 116

Table 2: Mix Proportions of Concrete Mixture

NO.	**Mix**	**0.018 m^3 (kg)**				
		OPC	**Coarse Aggregates**	**Fine Aggregates**		**Water**
				Sand	**PET**	
1	PFA 0% (Control)	5.106	16.576	10.138	0.00	2.812
2	PFA 5%	10.212	33.152	19.262	1.014	5.624
3	PFA 10%	10.212	33.152	18.248	2.028	5.624
4	PFA 25%	10.212	33.152	15.207	5.069	5.624
5	PFA 50%	10.212	33.152	10.138	10.138	5.624

RESULTS AND DISCUSSION

The results obtained from the laboratory testing include slump test, density test and compressive strength test. In this research, there are for types of concrete which is the control mix with 0% of PET, concrete with 5%, 10%, 25% and 50% of PET partially replaced the sand in the concrete mixture. Two size ranges of PET were used in the replacement which include 2mm to 1.18mm and 1.18mm to 600µm. The compressive strength of various concrete mixes including varying percentages and sizes of PET will be studied in this chapter. Additionally, the workability of concrete mixtures and concrete density were explored.

Slump Test

Slump tests were conducted to determine the workability of the concrete mixtures. Throughoutthis procedure, the relationship between the control mix and the concrete mixtures that partially replaced by different percentages and size ranges of PET can be determined

Figure 1: Comparison of Slump (mm) between Control Mix and Partially Replacement of 2mm-1.18mm PET.

Figure 1 which showed the bar chart of slump readings for the slump test for control mix and the concrete mixes that replace with various percentages of 2mm to 1.18mm of PET which prepared to be cured for 7 days and 28 days. This comparison is necessary to detect the pattern on how the workability of the concrete behave. The design slump range was specified to be 30-60 mm. The slump test was carried out for each mix after the concrete mixing process and all of the slump values obtained were true slumps. By referring to the slump test results, it can be said that the 5% PET mix had the same workability as the control sample but the workability increased when the percentage of PET increased starting at 10% until 50% of PET replacement in the mixture. Based on Suryakanta (2019), smooth surface of aggregate gives a poor bond while a rough texture aggregate shows a good mechanical bond with cement. Thus, the increment of workability of concrete mixture with the increasing of PET replacement percentage was due to the smooth surface of the PET aggregate since smooth surface cannot generate stronger bond between the cement past and aggregate as how a rough surface fine aggregate did.

Figure 2 showed the slump readings and bar chart for the slump test for control mix and the concrete mixes that replace with various percentages of 1.18mm to 600µm of PET which prepared to be cured for 7 days and 28 days. The design slump range was also specified to be 30-60 mm and any values outside of this range will consider failed. The concrete 5% PET mix had the lowest workability compared to the control sample and other percentage of PET replacements of smaller size range of PET had a greater surface area ,so more cement was used to cover the entire surface of aggregates resulting in lower workability.The workability only started to become higher when the PET replacement reached 25% and 50 % PET mixes result in highest workability.

Figure 2: Comparison of Slump (mm) between Control Mix and Partially Replacement of 1.18mm-600um PET.

By comparing the results in Figure 1 and 2, the workability of concrete mix was affected by the sizes and the surface texture of PET aggregate. The larger sizes of PET aggregate as well as PET aggregate with a softer surface texture compared to sand resulted in improving the workability of concrete mixes.

Density Test

According to Figure 3, it can be concluded that the control mix samples were denser than other mixes that contained PET in either samples that prepared for testing at 7 or 28 days of curing age.By referring to Alexander & Mindess (2019), the concrete that had the density between 2100 to 2500 kg/m^3 can be classified as ordinary or normal weight concrete and 1450 to 1900 kg/m^3 can be known as structural lightweight concrete. Therefore, the control, 5% PET, 10% PET and 25% PET mixes can be known as normal weight concrete while 50% PET mix is structural lightweight concrete

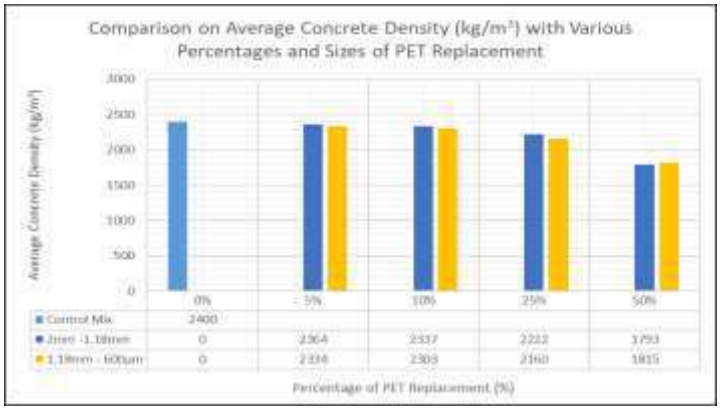

Figure 3: Comparison on Average Concrete Density (kg/m^3) with Various Percentages and Sizes of PET Replacement.

According to Material Properties ORG (2021), the density of PET is 1350 kg/m^{3}while sand have a density of 1500 kg/m^{3}showed PET was less dense than sand. Hence, the concrete with higher percentage of PET will give low density as plastic is lighter compared to the typical sand that used in concrete production. In addition, smaller size range of PET also resulted in lower density since the smaller size PET is lighter than the larger one. The 50% PETmix had the lowest as-received dry unit weight of 1793 kg/m^{3}for PET size 2mm to 1.18mm and 1815 kg/m^{3}for PET in the size of 1.18mm to 600µm.

Compressive Strength Test

The main objective of this research was to study the compressive strength of concrete containing various percentages and size ranges of PET then compare them with the compressive strengthof the control sample. The concrete samples were cured for a period of 7 and 28 days before being removed from the curing tank for testing on compressive strength. The designation compressive strength of control mix concrete is 25MPa at 28 days and there were a total numberof 54 100mm x 100mm concrete cubes to be tested in this research (27 cubes for both 7 and 28days).

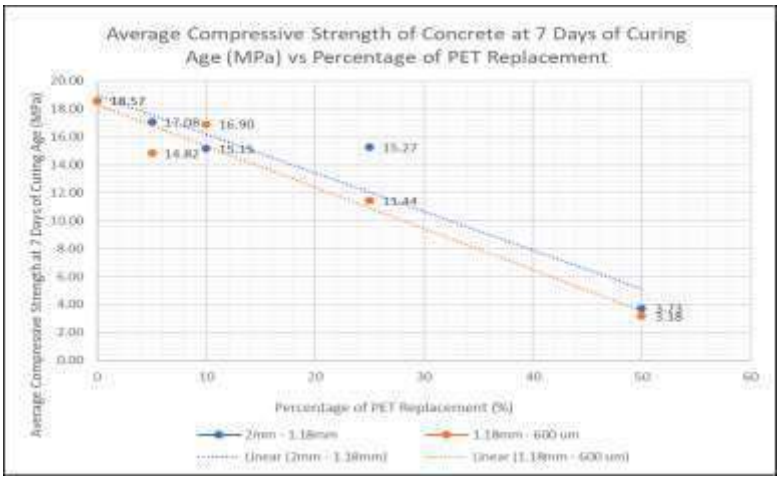

Figure 4: Average Compressive Strength of Concrete at 7 Days of Curing Age (MPa) vs Percentage of PET Replacement

At 7 days of curing age, 27 concrete cubes were tested and the results obtained can be referred to Figure 4. The highest compressive strength of concrete that achieved at 7 days of curing ageis the control sample giving 18.57 MPa. The mixes that contained larger size range of PET, 2mm to 1.18mm have a better performance under compressive strength compared to the smallest size range of PET in 1.18mm to 600µm. According to Jamal (2017), sharp and rough aggregates have a higher surface-to-volume ratio and smaller aggregates can fill up most of the void in the concrete mixes, resulting in better bond characteristics. By right, the smallest size of particle will give better interaction of bonding between the cement and aggregate contain inthe mixtures, but due to the smooth surface, flaky and elongated shape of 1.18mm to 600µm PET it resulted to lower strength compared to the 2mm to 1.18mm PET that had sharp edges andrough texture which created strong bonding in the mixture.

As the percentage of PET replacement in the concrete mixture increased, the compressive strength of the concrete became weaker. For 5% PET mixes the compressive strength acquiredis 17.08 MPa for the replacement using 2mm to 1.18mm PET and 14.82 MPa for 1.18mm to 600µm.

10% PET mixes have the strength of 16.90 MPa and 15.15 MPa, 25% PET mixes give 15.27 MPa and 11.44 MPa while 50% PET mixes show 3.73 MPa and 3.18 MPa in respectiveof 2mm to 1.18mm and 1.18mm to 600µm of PET sizes. The average optimum compressive strength of the concrete with the replacement of PET in mixture at 7 days of curing age is 17.08 MPa obtained from the 5% of 2mm to 1.18mm PET mix.

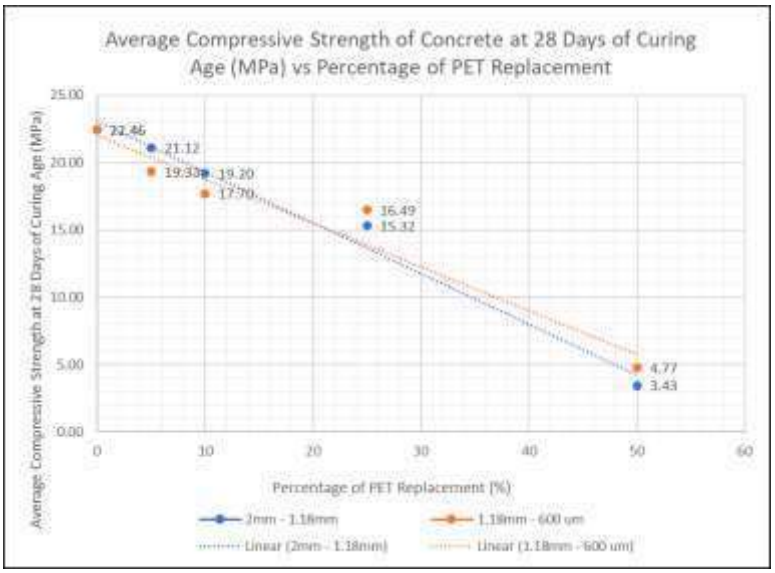

Figure 5: Average Compressive Strength of Concrete at 28 Days of Curing Age (MPa) vs Percentage of PET Replacement.

Besides testing on 7-day of curing age, concrete specimens also had been tested on 28th day as the concrete achieve 99% of its strength. At 28 days of curing age, 27concrete cubes were tested and the results obtained can be referred to Figure 5. The control sample reached the highest compressive strength among the concretes at 28 days of curing age give 22.46 MPa but it achieved the designation compressive strength of control mix concrete of 20 MPa at 28 days. The control mixes obtained an average of 22.46MPa. Based on (Krasna et al., 2019), coarse aggregate plays an important role in concrete production as its properties determine the strength of concrete. This indicating the significant of the mix proportion are suitable and are set to test for replacement. When compared to the smallest size range of PET in 1.18mm to 600mm, the mixes that comprised a larger size range of PET, 2mm to 1.18mm, performed better under compressive strength. Because of the smooth surface, flaky, and elongated shape of 1.18mm to 600mm PET, it has lower strength than 2mm to 1.18mm PET, which has sharp edges and rough texture and hence creates strong bonding in the combination.

Most of the results obtained showed the increasing in compressive strengthfrom 7 days to 28 days of curing age except for the results on 50% of 2mm – 1.18mm PET replacement showed a decrement from 7 days 3.73 MPa to 28 days 3.43 MPa. This is expected due to the bonding between PET and aggregates showed the surface of the materials were weaker compared to the controlled sample. The 50% replacement have shown the declining results which leads to a conclusion in which by replacing the fine aggregates with waste materials are not suitable.

CONCLUSION

In conclusion, the smooth surface of PET plastic increased the workability of concrete containing it, resulting in a weaker bonding between the cement paste and the coarse aggregate.The workability of the mixtures improved as a result of this situation. The concrete with higher percentage of PET will give low density as plastic is lighter compared to the typical sand that is used in concrete production. In addition, smaller size range of PET also results in lower density since the smaller size PET is lighter than the larger one. For 5%, 10%, 25% and 50% of 2mm to 1.18mm PET concrete mixes, the compressive strength decreased by 6%, 14.5%, 31.8% and 84.7% respectively, compared with the control mix at 28 days of curing. While for 5%, 10%, 25% and 50% of 1.18mm to 600µm PET 75 concrete mixes, the compressive strength decreased by 13.9%, 21.2%, 26.6% and 78.8% respectively, compared with the control mix at 28 days of curing. Apart from that,the compressive strength decreased as the proportion of PET in concrete increased compared to the control mix. The optimum compressive strength for the concrete with the partialreplacement of PET is archived by 5% of PET replacement in the PET size range of 2mm to 1.18mm giving 17.08 MPa and 21.12 MPa respectively for 7 and 28 days of curing age. A feasibility study should be completed on the use of plastics as partial replacement for sand in concrete production should be undertaken, particularly in terms of economics where the costs of sand and shredded plastic are compared, as well as the provision of significant areas of land for plastic waste disposal.

AUTHORS BIOGRAPHY

Mohamed Emierul Qazzarul Khir Johari, Ts. is a lecturer in the Civil Engineering & Construction Department of Infrastructure University Kuala Lumpur. His expertise is in reinforced design and infrastructure.

Oscar Yap Khai Ming is a graduate student in Infrastructure University Kuala Lumpur. His expertise is in reinforced design and infrastructure

Mohd. Nasir Hussin, Assoc. Prof, Ir. is Associate Professor in Infrastructure University Kuala Lumpur. His expertise is in reinforced design and infrastructure.

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TRENDS IN PENINSULAR MALAYSIA RAINFALL DURING THE SOUTHWEST MONSOON USING DEGREE OF RAINFALL AMOUNT (DORA)

Tan Vincent & Naimah Yusoff
Infrastructure University Kuala Lumpur, MALAYSIA

ABSTRACT

Rainfall distribution patterns and the total amount of rainfall days are important in relation to the effects such as haze, drought, and forest fire during the Southwest Monsoon, which is a dry season in Peninsular Malaysia that starts from late May to September. This research identifies the rainfall distribution pattern and categorizes the rainfall distribution in Peninsular Malaysia during the Southwest Monsoon. By using DORA software, the total amount of rainfall days during the Southwest Monsoon was found to be the lowest in June and highest in August. The Northwest region of Peninsular Malaysia had the lowest total amount of rainfall days compared to other regions. The month of August was found to be prone to occurrence of haze, drought, and forest fire especially in the Southwest region of Peninsular Malaysia. This research provides information on the rainfall distribution pattern and its effects during Southwest Monsoon in Peninsular Malaysia so that mitigation measures can be taken before any disaster happens.

Keywords:
DORA, Peninsular Malaysia, Rainfall Distribution Pattern, Southwest Monsoon, Total Rainfall

INTRODUCTION

In tropical and subtropical climates, monsoons are a common feature across the region in the world, which are characterized with wet and dry seasons accompanied by seasonal reversal of prevailing winds (Geen et al., 2020). In Southeast Asia, the Southwest Monsoon in late May to September, the Northeast Monsoon in November to March, First Inter-Monsoon season in March to April and Second Inter-Monsoon season in October to November affect the SEA countries. In Peninsular Malaysia, the Southwest Monsoon season is generally a dry season with lesser rainfall. It is the most drought vulnerable season with the southern region showing an increasing drought trend (Fung et al., 2020). This drought trend will increase further with the effect of temperature increase due to climate change in the future. Hot and dry weather during the Southwest Monsoon causes small and big scale forest fires. In 2014, forest fires in Peninsular Malaysia were the worst with 56 cases, 2682.6 ha of permanent reserve forest and 70% of peat swamp forest were affected due to prolonged hot and dry periods (Musri et al., 2020). This destroys the natural environment, so prevention and rehabilitation work need to be carried out.

During the Southwest Monsoon, the Southeast Asian region experiences dry season that leads to an increased number of fires where the existing southerly and southwesterly winds bring air pollutants from the burning areas in Kalimantan and Sumatera, Indonesia, causing cross-boundary haze in Peninsular Malaysia nearly every year (Latif et al., 2018). This haze causes health problems to the people due to low air quality in Peninsular Malaysia. Hence, it indicates that Peninsular Malaysia experiences numerous disasters during the Southwest Monsoon period in the past years due to less rainfall that contributes to hot and dry weather. Rainfall is one of the data frequently used to determine climatological data. The rainfall data is important for policy decisions in regards to water resources planning and to study the impact of climate change. The rainfall trends are used to make future predictions or analysis to study rainfall patterns and its effect especially during the monsoon season in Peninsular Malaysia. Particularly in this research, the focus will be on Southwest Monsoon.

During the Southwest Monsoon season from late May to September, Peninsular Malaysia experiences a rather hot and dry climate often with less rainfall and less cloud (Chenoli et al., 2018). Therefore, disasters occur frequently, almost every year during the Southwest Monsoon season.

Chenoli et al., (2018) in the research on onset date for Southwest Monsoon and the associated climatological characteristics over Malaysia, characterized the Southwest Monsoon as high outgoing long-wave radiation, low precipitation, and less cloud using the data from 1981 to 2015 reveals that during the Southwest Monsoon, it is often accompanied by dry spells of less than 10mm of rainfall daily. The Southwest Monsoon season in Peninsular Malaysia experiences a rather hot and dry climate often with less rainfall and less clouds.

Increasing drought trend is an issue that can occur during the Southwest Monsoon season since during this season, Peninsular Malaysia receives less rainfall. Drought is a condition of dry and warm weather that occurs over a period of time that causes water available on land surface to be less than average volume (Hasan et al., 2021). Dry and less rainfall condition together with the trans-boundary haze event during the Southwest Monsoon in Peninsular Malaysia will cause harmful effects towards human health.

To overcome the issues during the Southwest Monsoon in Peninsular Malaysia, two objectives were conducted which (1) To identify the rainfall distribution pattern in Peninsular Malaysia during the Southwest Monsoon and (2) To categorize the rainfall distribution in Peninsular Malaysia during the Southwest Monsoon. The selected locations of the study area are in Peninsular Malaysia, where the rainfall stations are selected based on the four classified regions. The four classified regions are namely the southwest region, which consist of Johor state, the east region, which consists of Kelantan, Terengganu and Pahang state, the west region, which consists of Perak, Selangor, Negeri Sembilan and Melaka, finally, the northwest region, which consists of Perlis, Kedah and Penang. There are a total of 12 rainfall stations selected in this research to consider a daily rainfall amount as an analysed parameter by using the Degree of Rainfall Amount (DORA) method.

The understanding of rainfall patterns during the Southwest Monsoon season is significant in ensuring dry season related disaster mitigation measures can be carried out since less rainfall will be experienced during this season. The study of rainfall during the Southwest Monsoon in Peninsular Malaysia is also important to analyse the effect of less rainfall during the monsoon related to drought, forest fire and haze condition to the people and the environment. This study will benefit the future researchers with the pattern distribution of rainfall during the Southwest Monsoon in Peninsular Malaysia, which can be compared to rainfall trend in Peninsular Malaysia during Northeast Monsoon and mitigation measures can be taken earlier by the authority.

METHODOLOGY

A flow chart was used to show the sequence on how this research was carried out from the beginning until the end as in Figure 1. This research analysis used the data ranging from year 2011 to 2020, covering daily rainfall data for a total of ten years duration. The daily rainfall data for the rainfall station were obtained from the Department of Irrigation and Drainage (DID), Malaysia.

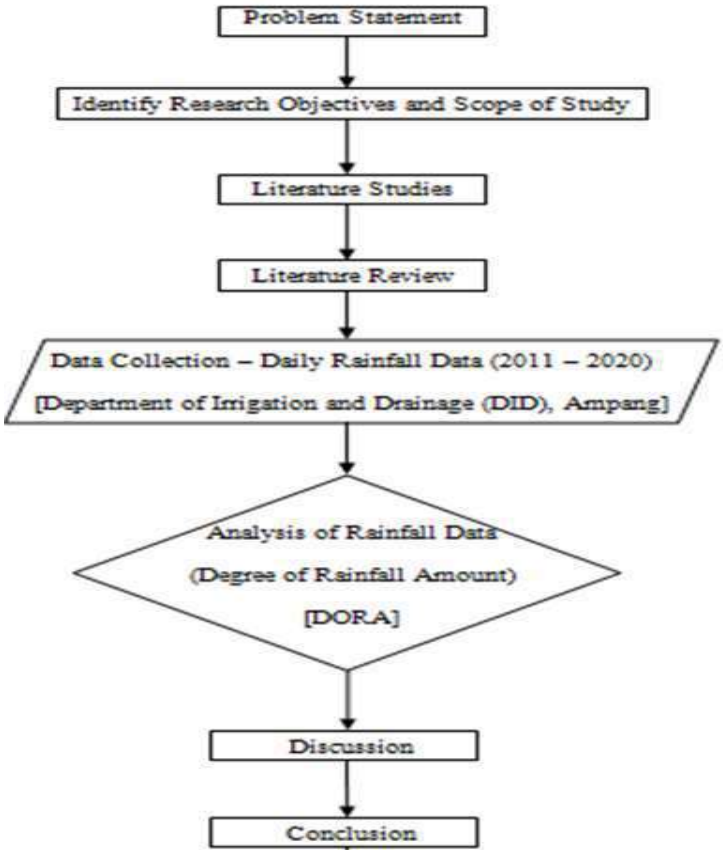

Figure 1: Flow Chart to Conduct Research

There was a total of 12 rainfall stations selected in Peninsular Malaysia, which were classified according to the regions namely, the southwest region, the east region, the west region and the northwest region. The selected rainfall stations according to these regions are shown in Table 1. Based on the daily rainfall data, the categorization of rainfall from 7 days cumulative rainfall was determined by using DORA which is one of the components in the ROSE INDEX. The categorise of degree of rainfall includes Low (L), Moderate (M), High (H), Very High (VH) and Critical (C) degree of rainfall amount in mm as shown in Table 2.

Table 1: Rainfall Station Selected in Peninsular Malaysia

Station ID	Station Name	Latitude	Longitude
Southwest Region			
1832001	Empangan Sg. Machap	01° 53' 10"	103° 16' 20"
1437116	Stor JPS Johor Bahru	01° 28' 15"	103° 45' 10"
1931003	Empangan Sg. Sembrong	01° 58' 25"	103° 10' 45"
East Region			
3631001	Kg. Pulau Manis	03° 39' 10"	103° 07' 10"
4234109	JPS Kemaman	04° 13' 55"	103° 25' 20"
6024074	Bachok	06° 03' 20"	102° 24' 05"
West Region			
2324033	Hospital Jasin	02° 18' 30"	102° 25' 55"
3022001	MARDI Jelebu	03° 02' 59"	102° 13' 40"
3115082	Taman Mayang	03° 06' 44.2"	101° 35' 47.2"
4011144	Rumah JPS Chui Chak	04° 02' 50"	101° 10' 20"
Northwest Region			
5505033	Rumah Pam Pinang Tunggal	05° 33' 26"	100° 30' 25"
5403001	Lorong Batu Lanchang	05° 24' 09"	100° 17' 58"

Table 2: Categories of rainfall using DORA (Roslan et.al,2001)

DORA (mm)	Category
< 90 mm	LOW
90 - 120 mm	MODERATE
120 - 150 mm	HIGH
150 – 190 mm	VERY HIGH
> 190 mm	CRITICAL

ANALYSIS AND DISCUSSION

DAILY RAINFALL ANALYSIS

The intensity of daily rainfall distributions during the Southwest Monsoon season serves as an early indicator on how this season can affect Peninsular Malaysia in terms of environment and the people. The total number of rainfall days are determined as lesser rainfall days contribute to the dry season during the Southwest Monsoon in Peninsular Malaysia. The lower number of rainfall days indicate that there is a possible risk of dryness due to less rainfall that could lead to haze, drought and forest fires. Readings from June to September year 2011 to 2020 on the total number of rainfall days is shown based on the four regions namely the Southwest region, East region, West region and Northwest region in Peninsular Malaysia.

Table 3: Comparison of Total Number of Rainfall Days in the Four Regions

Regions	Total No. of Rainfall Days-Month		Average Total No. of Rainfall Days
	Lowest	Highest	
Southwest	June	August	564
East	June	August	608
West	June	August, September	544
Northwest	June	September	477

Based on Table 3, it was found that the month having the lowest total number of rainfall days in most of the rainfall stations is in June in Southwest region of Peninsular Malaysia. Meanwhile, in the East region, the month having the lowest total number of rainfall days is in June as well. While in the West region, all the rainfall stations recorded the lowest total number of rainfall days in the month of June. In the Northwest region, the total number of rainfall days was lowest in the month of June. From this comparison, it can be seen that in the month of June the total number of rainfall days during Southwest Monsoon season in Peninsular Malaysia is the lowest compared to other months. In terms of rainfall days in the region, Northwest region were found to have lesser total number of rainfall days compared to other regions, which indicate this region is drier during the Southwest Monsoon.

In contrast, the total number of rainfall days during the Southwest Monsoon season in Peninsular Malaysia was the highest in August in most of the rainfall stations in the Southwest region. While in the East region, the total number of rainfall days was the highest in the month of August. Meanwhile, in the West region, the rainfall stations show the highest total number of rainfall days in August and September. In the Northwest region, the total number of rainfall days was the highest in September. Generally, from this comparison, it can be seen that most of the regions in Peninsular Malaysia during the Southwest Monsoon have the highest total number of rainfall days in August. In terms of rainfall days in the region, the East region had a higher total number of rainfall days compared to other regions.

Table 4: Summary of Percentage of Rainfall in the Southwest Region

Rainfall Station	Percentage (%)		Risk Month
	L	M	
Empangan Sg. Machap	97.42	2.58	August
Stor JPS. Johor Bahru	95.45	4.55	August
Empangan Sg. Sembrong	96.48	3.52	July August

Table 5: Summary of Percentage of Rainfall in the East Region

Rainfall Station	Percentage (%)		Risk Month
	L	M	
Kg. Pulau Manis	94.83	5.17	August
JPS. Kemaman	94.04	5.96	July
Bachok	94.73	5.27	July

Table 6: Summary of Percentage of Rainfall in the West Region

Rainfall Station	Percentage (%)		Risk Month
	L	M	
Hospital Jasin	97.09	2.91	July
MARDI Jelebu	97.64	2.36	August
Taman Mayang	93.58	6.42	June August
Rumah JPS. Chui Chak	93.61	6.39	July

Table 7: Summary of Percentage of Rainfall in the Northwest Region

Rainfall Station	Percentage (%)		Risk Month
	L	M	
Rumah Pam Pinang Tunggal	92.51	7.49	July
Lorong Batu Lanchang	92.12	7.88	August

Tables 4, 5, 6 and 7 show the Summary of Percentage of Rainfall in the four regions in Peninsular Malaysia during the Southwest Monsoon. It was based on two major categorizations, which is Low and Moderate. The percentage of the Low category was the highest in the Southwest region, the West region, the East region and followed by the Northwest region. Consequently, the Southwest region had a higher potential occurrence of haze, increased drought trends and forest fires in Peninsular Malaysia during the Southwest Monsoon since the amount of rainfall was less. Overall, the potential critical risk month had less rainfall, which led to the occurrence of haze, increased drought trends and forest fires in Peninsular Malaysia during Southwest Monsoon in August. This finding concurs with Asha'ari and Badrunsham (2014) that from August to September, the fire counts and hotspot events increased due to less rainfall. Besides, based on the results obtained, all the regions were more than 90% in the Low category, meaning less rainfall. This indicates a very high potential occurrence of haze, increasing drought trends and forest fires in Peninsular Malaysia during Southwest Monsoon. However, in this research, the data only highlighted the Low (L) and Moderate (M) categories that were likely to show the potential occurrence of haze, increasing drought trends and forest fires in Peninsular Malaysia during Southwest Monsoon.

Figure 2 Potential Risk Months 2011 – 2020

Overall, based on Figure 2, the potential critical risk month with less rainfall, which might lead to occurrence of haze, increased drought trends and forest fires in Peninsular Malaysia during Southwest Monsoon was in August, since most of the rainfall stations peak at that month. This finding supports Asha'ari and Badrunsham (2014) findings that from August to September, the fire counts and hotspot events increased due to less rainfall. Besides, based on the results obtained, all the regions were more than 90% in the Low category, meaning less rainfall. This indicates a very high potential occurrence of haze, increasing drought trends and forest fires in Peninsular Malaysia during Southwest Monsoon.

CONCLUSION AND RECOMMENDATION

In this research, twelve rainfall stations were selected and divided into four regions, namely the Southwest region, East region, West region and Northwest region, to identify the rainfall distribution pattern and to categorize the rainfall distribution during Southwest Monsoon in Peninsular Malaysia. By using DORA analysis software, the data collected from the Department of Irrigation and Drainage (DID), Ampang was analyzed and results were obtained. There are a few conclusions that can be made based on the analysis and results obtained. It can be concluded that the total amount of rainfall days in June was the lowest during Southwest Monsoon season in Peninsular Malaysia while in August, it was the highest. It was also found that the Northwest region had the lowest total amount of rainfall days compared to other regions.

Besides, it can be concluded that August was the risk month that is prone to occurrence of haze, increasing drought trends and forest fires especially in Southwest region in Peninsular Malaysia during Southwest Monsoon since more than 95% are in the Low category. Overall, it can be concluded that the objectives of this research have been achieved. This research outcome will provide useful information on the distribution pattern of rainfall and the relationship between the rainfall amount during Southwest Monsoon season and the possible effects such as haze, drought and forest fires. By understanding this relationship, people can be more prepared and precautionary steps can be taken before any disaster happens.

Through this research, there are several recommendations for future research projects. The first suggestion is to construct rainfall stations that have complete rainfall data collection equipment that are more accurate for in this research there was about 10% of rainfall data lost. Next recommendation is to increase the number of rainfall stations, so that more areas in Peninsular Malaysia can be covered for a more accurate outcome for in this research mostly covered only the edges of Peninsular Malaysia, hence, the inland was not much covered.

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AUTHORS BIOGRAPHY

Tan Vincent is a graduate in Bachelor of Civil Engineering, Faculty of Engineering, Science and Technology, Infrastructure University Kuala Lumpur (IUKL). He is one of the recipients for IUKL best student award in 2022. He comes from Kajang and was supervised by Naimah Yusoff. Email: vincenttan8360@gmail.com

Naimah Yusoff is a Senior Lecturer in the Civil Engineering & Construction Department of Infrastructure University Kuala Lumpur She gained her master by research in Civil Engineering from IUKL under the topic of 'Rainfall Erosivity and Soil Erodibility profile along Langat River" in 2014. She also presented and won few innovation competitions in Malaysia. She is an expert in soil erosion study and river management. Email: naimah@iukl.edu.my

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The Cost Comparison of High-Rise Foundation for Mixed Bored Piles and Micro Piles Proposal with Solely Bored Piles Proposal at Project Rumawip Residensi Gembira 737, Kuala Lumpur

Seow Kok Thong[1], Wani Kasmiah Mohd Sapuan[1] & Lim Khay Hun[2]
[1]*Infrastructure University Kuala Lumpur, MALAYSIA*
[2]*KH Perunding, MALAYSIA*

ABSTRACT
The paper aims to construct a framework on how value engineering of bored pile foundation design can improve the value for the high-rise building projects and studies the optimum design for bored pile foundation. One of the Rumah Mampu Milik Wilayah Persekutuan (RUMAWIP) residential high-rise projects known as Happy Residency 737 was used as a case study to compare the original and alternative foundation designs. As a result of this study, original piles foundation design of bored piles and micro piles were over designed which increased the construction cost significantly. Therefore, an alternative design of bored piles foundation was proposed to replace original bored piles and micro piles foundations. The strength capacity of bored piles was designed to the optimum while maintaining satisfactory performance. Next, the pile length was analyzed and designed to optimum level based on the soil investigation report. The alternative design of bored pile required 227 number of piles and original foundation design required 353 number of piles. Therefore, total 126 number of piles were reduced, consequently led to cost saving. Based on the Bill Quantities comparison between alternative and original foundation design, the total cost saving is RM 2,822,104.40. Pile Dynamic Load (PDA) Test and Static Load Test (SLT) are used to determine the performance of bored piles with Factor of Safety (FOS) of 2.0. In fact, 87.5% of PDA test results and 100% of SLT test results shown passed. In conclusion, value engineering of new bored pile design is technically sound, save cost and time.

Keywords:
Bored pile foundation design, High-rise building, Pile load testing, Value Engineering, Factor of safety

INTRODUCTION

According to Department of Statistic Malaysia (DOSM), urban population is expected to increase to 76.6% in 2020 and 88% in 2050 which led to widespread urbanization of cities, especially in Kuala Lumpur, the capital city of Malaysia. The increasing urbanization in recent decades has led to an increase in the construction of high-rise buildings worldwide, particularly in emerging economies. Husin et al. (2021) highlighted that cities can no longer afford horizontal development strategies due to limited land availability and high cost. The increasing urban population could drive developers to opt for building high-rise building projects.

High-rise buildings are designed to safely support the great load applied to it. Therefore, to ensure the buildings are safe and stable, the foundation system must satisfy both the loads bearing capacity and settlement criteria. High-rise buildings are usually built on piled foundation subject to a combination of vertical, horizontal, and overturning forces. According to Shoib et al. (2017), bored piles are commonly used as deep foundations to support very heavily loading structures due to its great advantage of low vibration, low noise, and flexibility of diameter sizes. Bored pile foundation widely used in high-rise buildings often arrange identical piles in pile cap with constant spacing between them. Several value engineering works and design strategies for pile foundations are presented to achieve an economic, efficient, and safe design.

The process of value engineering (VE) pile foundation design and verification is described, then the application of these principles, data & results are illustrated via the 46 stories RUMAWIP high-rise building project. The objectives of this research are: (1) To determine an alternative design

concept of bored piles; (2) To determine cost efficient alternative for bored piles foundation design; (3) To determine the safety factor for alternative bored piles foundation design.

LITERATURE REVIEW

According to Rane (2016), value engineering is a successful technique tested in many countries which could reduce the construction cost and add value to the project. Countless elite academicians with high standard of research interests and engineers with pragmatic design approaches have applied the principle of value engineering (VE) in high rise project especially in the foundation design. These include optimization design of long pile in deep soft soil foundation, pile group design optimization, piled raft foundation, soil stabilization consideration, etc. According to Surenth et al. (2019), the most critical cost affecting factors for bored piles are pile sizes, pile drilling time, depth of pile, rock socket length, drilling type, concrete pouring time, and weather conditions. Soil investigation is a very important step before design works begin. The case study of RUMAHWIP Happy Residency 737 was conducted for a total of four times (BH1, BH2, BH3 & BH4) of exploratory boreholes as per shown in Figure 1. Therefore, there are four sets of soil sampling used in each borehole. Subsequently, the bored pile length was divided into four zones based on each exploratory boreholes data. In fact, the bore log data was used to determine the bored pile length required for into soil or rock socketing. The bored pile length was divided into four zones which was a more optimal design compared to the single zone instead, because single zone was based on the weakest soil profile among the four boreholes data. In this case, the bored pile length design was conservative, which led to increasing the bored pile length.

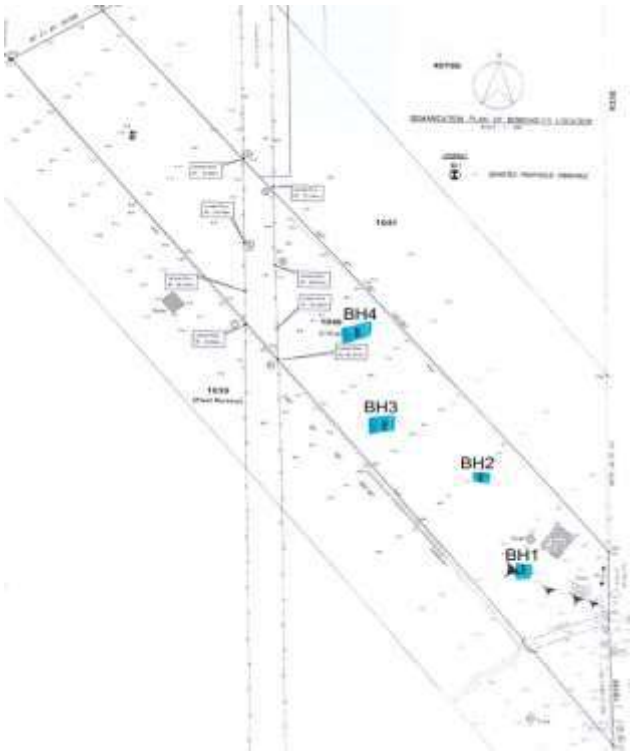

Figure 1: Soil Investigation Layout Plan (August 2016)

METHODOLOGY

Conceptual Framework

Through the systematic and thoughtful approach at the initial stage of planning and design, the final design of high-rise building foundation could be a successful showcase of VE in foundation design. The foremost priority is to study the soil investigation report to determine the soil parameters. Next, to study the original foundation design and check any of possibilities for VE works. The alternative design for bored pile foundation was tailored based on the given column loading. The structural capacity and geotechnical capacity of bored piles were designed to optimum level. Finally, a few PDA tests and SLT tests were carried out to justify the pile load capacity and pile settlement.

Case Study of the Original Foundation Design

The original design of the high-rise project RUMAWIP Happy Residency 737 is the case studied in this research. The original conceptual design of piled foundation at the initial stage is a combination of bored piles and micro piles. There are 5 types of bored piles and 2 types of micro piles in the original conceptual design. The original proposed bored pile diameter sizes are 750mm, 1050mm, 1350mm, 1500mm, and 1800mm respectively, and for micro piles are 200mm and 300mm respectively. The original type of bored piles and micro piles details are shown in Table 1 and Table 2 respectively. The highest pile group in the original design pile is 5 pile group. Based on this design, the original proposal for bored pile type and micro pile type were rephrased. A foundation design with too many different types and sizes of piles will increase the construction cost significantly. In fact, the size of rotary rig for drilling machines are required to be changed frequently during construction works due to many types of bored pile sizes. These actions may prolong the rotary rig drilling operations. Besides that, the original geotechnical pile length design into soil and rock socketing were too conservative as it could lead to wastage, unsustainable, and expensive design.

Table 1: Original Design of Bored Piles

Bored Pile Type	Bored Pile Diameter (mm)	Bored Pile Working Load (ton)	Main Steels	Helical Links	Concrete Grade
A	750	320	14T16	T10-175	G35
B	1050	1000	15T25	T10-300	G35
C	1350	1350	18T25	T10-300	G35
D	1500	1850	22T25	T10-300	G35
E	1800	2150	32T25	T10-300	G35

Table 2: Original Design of Micro Piles

Micro Pile Type	Micro Pile Diameter (mm)	Micro Pile Working Load (ton)	Main Steels	Helical Links	Concrete Grade
F	200	55	5T16	T10-175	G30
G	300	80	6T16	T10-300	G30

Alternative Design of Bored Piles Foundation Design (V.E.)

To optimize the pile foundation design, the alternative design only proposed one type of pile which is bored pile. In the value engineering of bored pile design, the new bored pile type was proposed through the given loadings. Based on the single column loadings, the highest column loading was 40,335kN and the lowest column loading was 485kN. Therefore, the bored pile diameter sizes or capacity strength are designed based on the given highest and lowest values of column loading. In general, the bored pile foundations is designed to optimum capacity strength through a larger pile diameter size and lesser quantity of piles. The new bored pile sizes proposed are 600mm, 1350mm, and 1500mm diameter sizes. There are four types of new bored piles proposed as per shown in Table 3 based on the given column loadings. The pile groups are limited to 1, 2 and 3 pile groups only. The alternative design of bored pile numbers become lesser, consequently would reduce the quantity of concretes and steel reinforcements which could lead to cost saving.

Table 3: Alternative Design of Bored Pile

Bored Pile Type	Bored Pile Diameter (mm)	Bored Pile Working Load (ton)	Main Steel	Helical Links	Concrete Grade
C	1350	1520	12T25	T10-300	G40
D	1500	1850	15T25	T10-300	G40
E	600	130	6T16	T10-300	G35
F	600	240	6T16	T10-300	G35

Structural Capacity Design of Bored Piles

The design of pile foundations and pile caps are in accordance with the following design codes and reference books: (1) BS8004:1986 Foundations; (2) BS8110:1985 Structural Use of Concrete; (3) "Pile Foundation Analysis and Design" Poulos and Davis for the design parameters of the new proposed bored piles. The concrete grade for the bored pile are 35N/mm^2 and 40N/mm^2 (Tremie II Mix). The main steel reinforcement of bored pile uses high yield type 2 steel bar, f_y is 500N/mm^2 and for helical links mild steel, f_y is 250N/mm^2. The minimum concrete cover for bored pile is 75mm. Steel reinforcement cage with minimum 0.4% of the pile cross section area is provided for every design pile. Nevertheless, for ease practices in construction, the minimum steel reinforcement length of 12m is provided right to the bottom through the bored pile to support the upper steel cage during concrete casting. The bored pile structural capacity is derived from the concrete strength itself and

nominal steel reinforcement is advisable to provide to prevent damage during pile head cut-off. The maximum permissible stress under working load condition shall not exceed 0.25 times of the characteristic cube test strength of the concrete as given in Clause 7.4.4.3.1 of the BS8004:1986 Foundations. According to Wong et al. (2016), the structural capacity of bored pile is less issues if there is a proper control on concreting works and assurance of concrete supply time. In fact, the main challenge bored pile construction is the estimation and verification of the geotechnical capacity of bored pile from the pile shaft and base. The structural capacity of bored piles design is defined as:

$$Q_w = \{[\ \pi \times D^2/4\ ] - A_s\ \} \times [\ 0.25 \times f_{cu}\ ] + f_{sc} \times A_s \qquad (1)$$

Where, D is Diameter of pile, Q_w is Allowable working load for pile, f_{cu} is Characteristic cube strength of concrete, f_{sc} is Permissible compressive stress of high yield reinforcement (175MPa), A_s is Area of Steel Reinforcement.

Based on the equation (1), four type of bored pile (Types C, D, E and F) are derived and the diameter sizes are 1350mm, 1500mm and 600mm as per shown in Table 3. Each of the categories of pile strength capacity is tailored through the column loading given. The proposal for alternative design of bored piles diameter sizes is lesser compared to original foundation design. Thus, the type of rotary rig for drilling machines are reduced which could increase the speed of piling construction works. The number of piles required are also reduced when compared to original foundation design which will discuss in Results and Discussion part.

Sub Soil Information for Geotechnical Design

According to Yusoff et al. (2016), Kuala Lumpur soil strata is underlain by three main rock types which are Kuala Lumpur limestone, Kenny Hill Formation and Granite. Kuala Lumpur limestone is the sedimentary rock formed through the intrusion of igneous rocks. Kenny Hill Formation is a metamorphic rock formation which compromise schist, phyllites, shale, sandstones and other similar sedimentary rocks. In fact, Kuala Lumpur limestone underlain the most at the Kuala Lumpur area. The 737 Happy Residency project is located at Kuala Lumpur area as shown in Figure 2. The project site is located within the Kuala Lumpur Limestone area and Kenny Hill Formation. The limestone area has always posed great problems to construction of piles due to karstic features of limestone such as steeply inclined bed rock, cavities, floater as per shown in Figure 3. Therefore, additional cost for pile remedial works has to be taken into considerations.

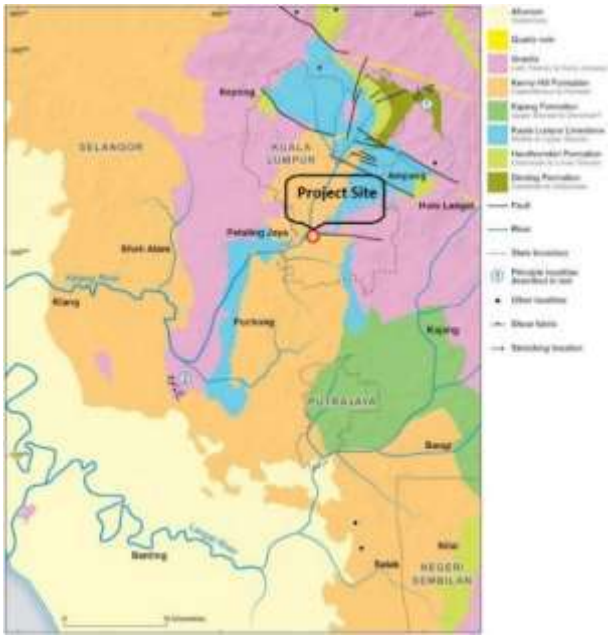

Figure 2: Geological Map of Kuala Lumpur (Department Mineral & Geosciences Malaysia, 2011)

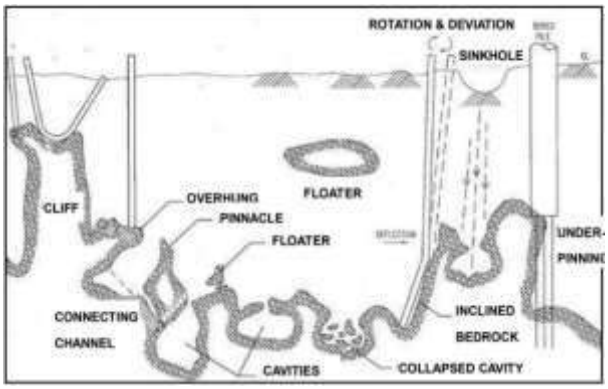

Figure 3: Typical Pile Problems Encountered At Limestone Area (Neoh, 1998)

In the assessment of a sub-soil model and the soil parameters for foundation design, a detailed site investigation (S.I.) is utterly important to provide soil strata information for design and construction. Because of the natural vagaries of soils, failure such as building settlement or crack tend to occur, regardless of how well these structures were designed. Some failures have been catastrophic and have caused severe damage to lives. In fact, it is first necessary to review the geology of the site and identify any geological features that may influence the design and performance of the foundation.

During the boring of soil investigation works, SPT N value of soils were obtained. The number of blows required to effect 300mm penetration below an initial penetration of 150mm was recorded as penetration resistance or SPT N value. The SPT N value provide information regarding the soil strength. In Malaysia, the geotechnical design of bored piles is usually based on Standard Penetration Test SPT N value. The semi empirical equation which correlating the ultimate base resistance (f_{bu}) and ultimate shaft resistance (f_{su}) to SPT N value are very commonly practiced in Malaysia. In fact, a

total 4 borehole logs were summarized and presented as shown in Table 4. The borehole logs data was used to determine the geotechnical capacity for bored piles. The project site ground level is flat in general, and the boring depth is start from reduced level of 0.0m.

Table 4: SPT N-Value Data based on Soil Investigation

	Boreholes Data							
Boring Depth (m)	BH1 Strata	BH1 (N)	BH2 Strata	BH2 (N)	BH3 Strata	BH3 (N)	BH4 Strata	BH4 (N)
0-1.5	Sandy Silt	6	Sandy Silt	10	Sandy Silt	10	Sandy Silt	9
1.5-3.0	Sandy Silt	10	Sandy Silt	5	Sandy Silt	4	Sandy Silt	14
3.0-4.5	Sandy Silt	16	Sandy Silt	25	Sandy Silt	12	Sandy Silt	19
4.5-6.0	Sandy Silt	23	Sandy Silt	64	Sandy Silt	16	Sandy Silt	44
6.0-7.5	Sandy Silt	31	Sandy Silt	61	Sandy Silt	64	Sandy Silt	83
7.5-9.0	Sandy Silt	64	Sandy Silt	94	Sandy Silt	88	Sandy Silt	94
9.0-10.5	Sandy Silt	94	Sandy Silt	83	Sandy Silt	86	Sandy Silt	83
10.5-12.0	Sandy Silt	120	Sandy Silt	150	Sandy Silt	88	Sandy Silt	94
12.0-13.5	Sandy Silt	100	Sandy Silt	100	Sandy Silt	91	Sandy Silt	86
13.5-15.0	limestone	100	Sandstone	100	Sandy Silt	83	Sandy Silt	83
15.0-16.5	limestone	100	Sandstone	100	Sandy Silt	91	Sandy Silt	150
16.5-18.0	limestone	75	Sandy Silt	112	Sandy Silt	100	Sandy Silt	150
18.0-19.5	Sandy Silt	79	Sandy Silt	100	Sandstone	143	Sandy Silt	86
19.5-21.0	Sandy Silt	120	Sandy Silt	120	Sandy Silt	94	Sandy Silt	64
21.0-22.5	Sandy Silt	120	Sandy Silt	120	Sandy Silt	83	Sandy Silt	91
22.5-24.0	limestone	300	Sandstone	300	Sandy Silt	94	Sandy Silt	88
24.0-25.5	limestone	300	Sandstone	300	Sandy Silt	94	Sandy Silt	88
25.5-27.0	limestone	300	Sandstone	300	Sandstone	300	Sandstone	300
27.0-28.5	limestone	300	Sandstone	300	Sandstone	300	Sandstone	300
28.5-30.0	limestone	300	Sandstone	300	Sandstone	300	Sandstone	300
30.0-31.5	limestone	300	Sandstone	300	Sandstone	300	Sandstone	300
31.5-33.0	limestone	300	Sandstone	300	Sandstone	300	Sandstone	300
33.0-34.5	NIL	NIL	NIL	NIL	Sandstone	300	Sandstone	300
34.5-35.0	NIL	NIL	NIL	NIL	Sandstone	300	Sandstone	300

Geotechnical Design for Bored Piles in Soil

The design of bored pile geotechnical capacity has adopted Semi Empirical Method. The geotechnical design of bored piles is based on the shaft friction and end bearing force. The contribution of the friction from the overburden soil is neglected in computing the geotechnical capacity of the pile. The geotechnical design of the bored pile is based on the following expression:

$$Q_w = Q_s / FOS_1 + Q_b / FOS_2 \qquad (2)$$

Where, Q_w is Allowable working load of pile, Q_s is Ultimate shaft capacity of pile, Q_b is Ultimate end bearing capacity of pile, FOS_1 is Factor of safety shaft capacity of pile, FOS_2 is Factor of safety end bearing capacity of pile

The factor of safety (FOS) normally is used to evaluate the bored pile geotechnical capacity are partial from Factor of safety on pile shaft and end bearing of pile. The proposed factor of safety for both FOS_1 and FOS_2 for geotechnical design bored pile is 2.0.

In Malaysia, commonly engineers have been practicing geotechnical design for bored pile based on Standard Penetration Tests (SPT) data. The semi empirical equations which correlate to the value of the ultimate pile shaft resistance (f_s) and ultimate end bearing pile resistance (f_b) to SPT N values are suggested. The ultimate shaft resistance factor (K_{su}) and base resistance factor (K_{bu}) values were developed many years ago and have been in practice extensively over the years. The commonly used correlations for ultimate shaft and base resistance equations as per following:

$$f_{su} = K_{su} \text{ x SPT“N”} \qquad (3)$$

$$f_{bu} = K_{bu} \text{ x SPT“N”} \qquad (4)$$

For pile shaft resistance (f_s), Tan et al. (1998) have derived the value of K_{su} as 2.6 but limit the f_{su} values to 200kPa based on the results of 13 fully instrumented bored piles in residual soils. For base resistance (f_b), the values of K_{bu} varies greatly due to difficulties in base cleaning during the construction of bored piles. The contribution of base resistance can only be considered if a proper inspection of the base can be done or constructed in dry hole or base grouting is adopted. From back analyses and calculation of test piles, Toh et al. (1989) determined the value of K_{bu} is in between 27 to 60 and Chang & Broms (1991) determine the value of K_{bu} as in between 30 to 45. Lower values of K_{bu} between 7 and 10 were adopted by Tan et al. (1998). Chow (2016) designed the pile ultimate end bearing capacity based on 15% of pile working load. In this case study, the values of K_{su} and K_{bu} were adopted based on the derivation from Tan et al. (1998). The design parameter of end bearing capacity followed Chow (2016)’s recommendations.

Geotechnical Design for Bored Piles in Rock

In general, there are three major rock formations in Malaysia which are known as sedimentary, igneous, and metamorphic rocks. The geotechnical design approaches could vary significantly when designing bored pile capacity over these rock formations. Therefore, local experiences play an important role in determining a particular formation characteristic. Wong and Liew (2016) mentioned that to achieve a desired geotechnical capacity, bored pile is required to be socketed into competent stiff residual soils or bedrock for high shaft friction between rock mass and concrete. Therefore, conservative approach and semi empirical methods also need to be considered to ensure the bored pile socketing into desired length. According to Mustafal et al. (2016), empirical equations have been widely used for pile capacity calculation in current practices at Malaysia. In other words, design of bored pile capacity is usually based on the results of Standard Penetration Test SPT N value. Bored

pile which socketed into rock area can be give higher capacity strength due to higher unit friction values. The Empirical equations of Qs and Qb at rock can be estimated as:

$$Q_s = A_s \times 0.05 \times q_{uc} \quad (5)$$

$$Q_b = A_b \times 1/3 \times q_{uc} \quad (6)$$

Where, A_s is Shaft area of the socketing length, A_b is Cross-sectional area of the pile, q_{uc} is Unconfined compressive strength of rock

According to Shoib et al. (2017), socketing the pile shaft into bedrock to transmit high foundation loads is becoming a common practice at Malaysia. The design load capacity of bored pile base is limiting due to relying upon on end bearing in rock due to soft toe issues. Unless pile base cleaning, works can be done properly. Thus, the alternative to bored piles have been to design an optimum length for shaft resistance in rock. Table 5 summarises the typical design socket friction values for various rock formation in Malaysia.

Table 5: Summary of Rock Socketing Unit Friction Design Values (Mustafa, 2016)

Rock Formation	Working Rock Socket Friction*	Source
Limestone	300kPa for RQD <25% 600kPa for RQD =25 – 70% 1000kPa for RQD >70% The above design values are subject to 0.05x minimum of {q_{uc}, f_{cu}} whichever is smaller.	Neoh (1998)
Sandstone	$0.10 \times q_{uc}$	Thorne (1977)
Shale	$0.05 \times q_{uc}$	Thorne (1977)
Granite	1000 – 1500kPa for q_{uc} > 30N/mm^2	-

Where, RQD is Rock quality designation, q_{uc} is Unconfined compressive strength of rock

Based on the Soil Investigation boreholes, the limestone at BH1 is found at depth of 22.5m from ground level (0.0m). Next, for BH2, sandstone is found at depth of 22.5m as well. For BH3 and BH 4, sandstone is found at depth of 25.5m from ground level. The Rock Quality Designation (RQD) at BH1, BH2, BH3 and BH4 are equal to nil. These show the rock quality is very poor and completely weathered rock. Therefore, the allowable rock socket unit friction of 300kPa is adopted based on the limestone and sandstone conditions.

RESULTS AND DISCUSSION

Alternative Design Piling Layout Plan

The drawing of Alternative Piling Layout has is presented as shown in Figure 4. A total of 4 types of bored piles with diameter sizes of 600mm, 1350mm, and 1500mm were proposed. The bored pile diameter sizes and capacity strength were designed to optimum based on the given column loading. The layout plan was categorised into 4 zones. Each zone represents the borehole data characteristic and details. The geotechnical capacity of bored piles was designed based on each boreholes data.

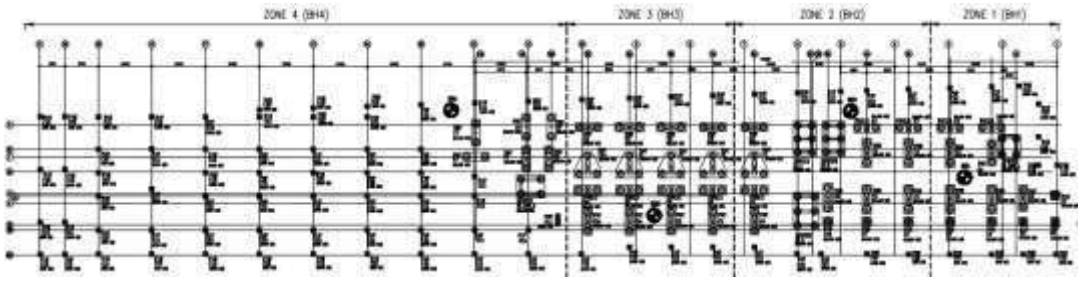

Figure 4: Alternative Piling Layout with Zoning Area

Table 6 shows Piling Table of Original Foundation Design tabulated based on original foundation layout plan. The total number of bored piles were 112 and micro piles were 241. The total number of piles for both bored piles and micro piles were 353.

Piling Numbers Comparison between Alternative and Original Foundation Design

Table 6: Piling Table of Original Foundation Design

	Bored Pile					Micro Pile	
	A	B	C	D	E	F	G
	750mm	1050mm	1350mm	1500mm	1800mm	200mm	300mm
Zone 1	0	4	6	9	2	28	16
Zone 2	0	0	20	20	2	5	22
Zone 3	0	0	10	26	0	0	24
Zone 4	1	0	8	3	1	0	146
Total in Zoning	1	4	44	58	5	33	208
Total =	353						

Table 7 shows Piling Table of Alternative Foundation Design tabulated based on alternative foundation layout plan. For bored piles types E and F have similar diameter sizes but different capacity strength. The bored pile capacity strength for type E was 130ton and type F was 240ton. The total numbers of bored piles were 227.

Table 7: Piling Table of Alternative Foundation Design

	Bored Pile			
	C	D	E	F
	1350mm	1500mm	600mm	600mm
Zone 1	25	3	19	2
Zone 2	33	13	2	8
Zone 3	24	12	0	8
Zone 4	16	0	25	37
Total in Zoning	98	28	46	55
Total = 227				

Pile Length Comparison between Alternative and Original Foundation Design

Table 8 shows Pile Length Requirement of Original Foundation Design tabulated based on original foundation layout plan. The Table 8 compromised pile length for both bored piles and micro piles.

Table 8: Pile Length Requirement for Original Foundation Design

	Type	Estimated Pile Length (m)	Rock Socketing Length (m)
Bored Pile	A	14.5	1.5
	B	12.5	10.0
	C	12.5	12.0
	D	12.5	13.5
	E	12.5	13.5
Micro Pile	F	12.5	4.0
	G	12.5	4.0

Table 9 shows Pile Length Requirement of Alternative Bored Piles Foundation designed based on semi empirical methods. The geotechnical capacity of bored piles in soil and rock are described under Methodology in Geotechnical Design part.

Table 9: Pile Length Requirement for Alternative Foundation Design

	Zone 1 (BH1)		Zone 2 (BH2)		Zone 3 (BH3)		Zone 4 (BH4)	
Bored Pile Type	Pile Length (m)	Rock Socket Length (m)	Pile Length (m)	Rock Socket Length (m)	Pile Length (m)	Rock Socket Length (m)	Pile Length (m)	Rock Socket Length (m)
C	19.5	5.4	19.5	5.4	23.0	5.4	23.0	5.4
D	20.0	6.0	20.0	6.0	23.5	6.0	23.5	6.0
E	10.0	NIL	10.0	NIL	10.0	NIL	10.0	NIL
F	12.0	NIL	12.0	NIL	12.0	NIL	12.0	NIL

Bill Quantities Comparison between Alternative and Original Foundation Design

Table 10 shows Bill Quantities (BQ) between original and alternative foundation designs calculated based on the number of piles required, pile length into soil and rock, piling equipment, piling records, pile tests, and total amount of concrete and steel reinforcement. The Bill Quantities of total amount for original foundation design was RM 8,859,487.50 and BQ for alternative foundation design was RM 6,037,383.10.

Table 10: Bill Quantities (BQ) Comparison for Foundation

	Amount	
Original Foundation Design		
BQ for Bored Piles	RM	7,783,744.00
BQ for Micro Piles	RM	1,075,743.50
Total	RM	8,859,487.50
Alternative Foundation Design		
BQ for Bored Piles	RM	6,037,383.10

Test Results for Bored Piles

According to Hussein (2021), the Static and Dynamic Pile Testing Methods are two main types of pile tests used to access bored piles load capacity and settlement behavior of pile. Thus, Static Load Test (SLT) and Pile Dynamic Load Test (PDA) were applied in this project to check the bored piles performances overall. The pile test results for each type of bored piles are shown in below Table 11 and Table 12.

Table 11: Pile Dynamic Load Test Results

No.	Pile Diameter (mm)	Date	Working Load (tonne)	Test Load (tonne)	Total Load (tonne)	Factor of Safety	Working Load Settlement (mm)	Test Load Settlement (mm)
BP35	600	20/3/2017	240	480	620	2.6	2	8
BP13	1350	16/6/2017	1520	3040	3750	2.5	4	10
BP17	600	19/6/2017	130	260	500	3.8	2	3
BP72	1500	5/7/2017	1850	3700	2460	1.3	14	-
BP108	1350	8/7/2017	1520	3040	3100	2.0	6	15
BP58	1500	6/7/2017	1850	3700	4100	2.2	4	9
BP178	600	7/8/2017	240	480	490	2.0	2	5
BP215	600	7/8/2017	240	480	678	2.8	2	5

Table 12: Static Load Test Results

No.	Pile Diameter (mm)	Date	Working Load (tonne)	Test Load (tonne)	Total Load (tonne)	Factor of Safety	Working Load Settlement (mm)	Test Load Settlement (mm)
BP96	1350	3/6/2017 - 5/6/2017	1520	3040	3156	2.1	3.879	8.434
BP158	600	17/6/2017 - 19/6/2017	240	480	498	2.1	4.638	7.004

The dynamic load test was used to provide field estimates of the mobilized static load carrying capacity of the bored piles. In addition, it can be used to check the bored pile structural integrity and to obtain field data for later computer signal matching to determine capacity and soil resistance distribution. The Static load test or Maintained load test can be used to determine the settlement that can occur at working load, or a multiple of it, and can also be used to verify the ultimate bearing capacity of a pile. Pile settlement was recorded using the dial gauges or electrical displacement transducers. The applied load was monitored using calibrated load cells, and up-to-date systems can be controlled automatically using a portable computer and a compressed air pump.

DISCUSSION

The selection of appropriate pile foundation, pile capacity, diameter sizes for high rise loading are critical to ensure an optimal design for foundation could be carried out successfully. In this case, bored pile foundation was selected due to suspect of floating boulders at intermediate level of boreholes BH1, BH2 and BH3. The designed bored piles were required to penetrate through the boulders and socket into sound bed rock or desired hard layer. The alternative design for bored pile capacity was tailored carefully based on the lowest, intermediate, highest column loading. Thus, four types of bored piles were proposed for the alternative design. Technically, the foundation piles with a greater diameter or a higher capacity could be used to replace the original diameter pile sizes to reduce the number of piles required. For example, the 3-pile group of micro piles were replaced by 1 pile group of bored piles. Eventually, the number of piling requirements could be reduced based on this conceptual idea which would lead to cost saving.

Analysis of data was carried out by comparing the Original and Alternative Foundation Designs as shown in Table 13. According to Table 13 results, the number of piles difference is 126. Therefore, the total number of piles required for the high-rise project was reduced to 126. Furthermore, the pile length requirement for Original and Alternative Foundation Designs is presented in Table 8 and Table 9. The geotechnical design for bored pile was carried out based on a semi empirical equation. The semi empirical equations correlating to the value of the ultimate pile shaft resistance (f_s) and ultimate end bearing pile resistance (f_b) to SPT N values were applied. In this case, the values of K_{su} and K_{bu} were adopted based on the derivation from Tan et al. (1998). The design parameter for end bearing capacity in rock followed Table 5 recommendation. In fact, the alternative geotechnical design for bored piles was designed based on recommendations of local experiences and a conservative approach.

Table 13: Original & Alternative Design Comparison in Cost Saving & number of Piles

	Total Cost	Total Piles
Original Design	RM8,859,487.50	353
Alternative Design	RM6,037,383.10	227
Total Saving	RM2,822,104.40	126

The pile length requirements for alternative foundation design are lesser when compared to the original foundation design. In other words, the amount of concrete, steel reinforcement, and pile testing requirements are reduced as well. Thus, there was some saving of piling numbers and pile length requirement in the alternative foundation. Therefore, it could lead to cost-effectiveness as well. Refer to Table 13, the total cost for the original foundation design was RM 8,859,487.50 and the total cost for the alternative foundation design was RM 6,037,383.10. Therefore, the total cost saving was RM 2,822,104.40 based on the alternative bored pile foundation design.

In addition, the time for piling construction works could reduce as well since the numbers of piles, pile length requirement, type of pile proposed were reduced. If the bored pile sizes are too many, it could affect the drilling works and prolonged construction works. In fact, the type of rotary rig for drilling works have to be changed constantly due to the different types of piles. Eventually, it will affect the piling construction progress.

A total of Pile dynamic load test (PDA) and two Static Load test (SLT) were conducted in this project. The PDA test and SLT test are presented in Table 11 and Table 12 respectively. According to Mustafa et al. (2016), Jabatan Kerja Raya (JKR) standard specification for pile load test, a pile test shall be deemed to failed if: (1) the residual settlement after removal of the test load exceeded 6.5mm.

(2) the total settlement under working load exceeded 12.5mm (3) the total settlement under twice the working load exceeded 38mm or 10% of pile diameter whichever is lower value. In this case, the PDA test and SLT test results for bored piles are deemed to have passed as it was able to meet the pile settlement criteria and pile capacity requirements which is more than FOS of 2.0. In fact, 87.5% of PDA test results and 100% of SLT test results passed the specifications.

CONCLUSION

The alternative design of bored pile capacity was tailored based on the given loading of lowest, intermediate and highest column loading. The alternative design of bored pile sizes or capacity are greater when compared to the original foundation design which could lead to a reduction in the number of piles required. The geotechnical capacity of bored piles is designed to optimum level which led to a reduction of the pile length requirement. Besides that, micro piles are not recommended for high loading building structure due to its limitation in capacity strength. Therefore, the alternative bored pile design saves time and is cost-effective when compared to the original foundation design. A few of the bored piles were selected to conduct PDA and SLT tests. The bored piles test results were mainly deemed to have passed as it satisfied the pile load bearing capacity requirements and settlement criteria. In conclusion, the value engineering approach in bored piles design for high rise building was carried out successfully in terms of cost-wise, save time and comply the factor of safety (F.O.S) requirements.

RECOMMENDATION

The project site is located at Kuala Lumpur area. The soil strata of 737 Happy Residency project is underlain within Kuala Lumpur Limestone and Kenny Hill Formation. The characteristic of limestone area could post various problems to geotechnical engineers such as steeply inclined bed rock, floater, cavities, collapsed cavity underneath and so on. Besides that, one pile group and two pile group post a greater risk in remedial cost due to piles eccentricities issues. Therefore, additional remedial costs have to be taken into consideration in the Value Engineering Design Works. Value Engineering in Foundation Design not only aims to cut cost but also add value to the foundation works such as improving pile performances, cost-effective and sound safe in technically.

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AUTHORS BIOGRAPHY

Seow Kok Thong, Master of Civil Engineering in Infrastructure University Kuala Lumpur. He was finished his degree of civil engineering in University Tunku Abdul Rahman. For career background, he has 6 years' experiences in civil, structural and geotechnical consultancy works and 2 years' experiences in project management works. He has been registered as graduate engineer under Board of Engineer Malaysia (BEM) and Institute of Engineer Malaysia (IEM) to further pursue professional engineer.

Wani Kasmiah Binti Mohd Sapuan (Ir., Ts.) has experience in civil engineering education and the construction management industry for almost 15 years. She has been Professional Engineer and Professional Technologist for these recent years. Roles as an academician at IUKL since 2012 after had experienced in Industry, including private and government agencies. Her main interest is in the Geotechnical Engineering field, and she is a group member of Institute of Engineer Malaysia (IEM) under the Geotechnical division.

Lim Khay Hun (Ir.), principal for civil, structural and geotechnical engineer at KH Perunding. He has about 30 years' experiences in geotechnical & foundation works, R. C. buildings and foundations, steel structures, water retaining structures, dams, structure assessment reports, geotechnical assessment reports, and temporary works. He has registered as accredited checker for geotechnical in Board of Engineer Malaysia (BEM).

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From Abandoned Tin Mine Opencast Site to Urban Regeneration.

Yi Huan & Golnoosh Manteghi
[1]*Infrastructure University Kuala Lumpur, MALAYSIA*

ABSTRACT
Over the past few decades, Malaysia's economic system has significantly changed from physical industrial production to services. As a reaction to this process, the productive function of Malaysia's opencast tin mining areas has become obsolete. Local governments have actively sought to address the problems posed by industrial development. This threatens to end their former productive, social, and economic role, and the communities to which they belong face severe environmental and socio-economic problems. The current reuse strategy for opencast mines is challenging, as mining destroys the original land structure and affects the local ecology. It also poses a considerable challenge to urban planners, natural resource managers, and policymakers. This paper presents the realisation and successful implementation of an open pit mine rehabilitation project (Mines Wellness City (MWC)) in Malaysia over the past 20 years. A comparative approach is used to systematically analyse the economics of property development around Equine Park in the same area as Mines Wellness City (MWC). The results found that the addition of the industrial context of Mines Wellness City (MWC) was a decisive factor in the local economic impact and the sustainability of urban regeneration compared to the normal development of Equine Park. The study discusses and demonstrates the relevance of the project's landscape restoration to the local economy and environment through questionnaires and (SWOT) analysis. This study explores the impacts and benefits of industrial land restoration projects and sustainable urban planning.

Keywords:
Industrial Heritage; Sustainable Urban Development; Urban Regeneration; Industrial Landscape; Multifunctional Landscape;

INTRODUCTION

Abandoned urban industrial land would become a valuable resource for society as it reintegrates into the urban environment. This is a human endeavor found anywhere both in developed and undeveloped countries. It is an activity that can take place almost anywhere on the earth's surface. In the last few decades, industrial globalisation has had a profound effect on traditional industrial areas around the world. Previous traditional industrial management during the industrial revolution has not only caused a large number of industrial debris disposal problems but also resulted in the birth of many abandoned industrial sites, mines, and pits. Facilities, buildings, and ruins that are remained today are now faced with the problem of having to live in harmony with contemporary society. This is a major problem that the younger generation now must face because they are the ones who have to deal with the remnants of the previous generation.

Pit sites that no longer serve their original productive function will be abandoned, the abandonment, backfilling, or scrapping of these tin mining sites by the Malaysian government, in this case, is a relatively common method of disposing of industrial remnants designated as 'surplus'. However, the development of new and more challenging environmental legislation in Malaysia, and public pressure associated with the need to protect the environment, have increased the need to convert post-industrial sites into multi-purpose landscapes. Large-scale landscape reclamation can restore natural processes and functions as well as revive city areas. The creation of multi-purpose industrial landscapes in disused pit areas can protect the local environment while also promoting sustainable urban development.

According to Country Heights Holdings Bhd (CHHB), sound design should be the goal of all involved in the development process and it should be encouraged everywhere necessary. A good design can

help promote sustainable development, improve the quality of existing industrial sites, attract businesses and investments, strengthen civic pride, and have a sense of place.

This research paper discusses the development of a multi-purpose landscape as an opportunity for urban regeneration and sustainable development at the abandoned industrial pit site of Mines Wellness City (MWC) in Malaysia. The Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis and questionnaire data analysis were conducted on the Sungei Besi Mine industrial site. The renewal of Mines Wellness City (MWC) is developed and utilized in the context of industrial heritage whereas the Equine Park project has no such industrial history. The focus of the study here is to figure out although both these projects are of the same region but why are there significant differences in the economic development of the surrounding real estate in terms of the market value and price.

LITERATURE REVIEW

The current authoritative global definition of industrial heritage is the 2003 (Charter of Nizhny Tagil), which reflects the international community's interpretation of the basic concept of industrial heritage. The (Charter States) that "industrial heritage is the industrial, cultural heritage of historical, technical, social, architectural or scientific research value. It includes buildings and machinery, workshops, mills, factories, mines and related processing and refining sites, warehouses and shops, production, transmission sites, and energy and transport infrastructure. The Mines Wellness City (MWC) pit site in Malaysia is an industrial heritage site under the Lower Tagil Charter. This study addresses the adaptive reuse of the Mines Wellness City (MWC) in an open pit site in Malaysia. Tin lakes are usually isolated with the same overall landform, but a tin lake created by the reclamation of an industrial landscape may have different types of topography and vegetation that appear all in the same area. This is a result of tin mining lakes, and it is one of the characteristics of the industrial heritage. Therefore, it would have a higher heritage value.

Internationale Vereinigung für Theoretische und Angewandte Limnologie： Mitteilungen, 1994) The National Heritage Board of Malaysia (2005) defines heritage sites, objects, and underwater cultural heritage as Underwater cultural heritage, whether listed or unlisted. Heritage significance or value concerning a cultural place can be defined as the ability or potential of the site to demonstrate or symbolise our understanding or appreciation of the human story (Sim, 1997), cited in (Pearson & Sullivan, 1995). Mining heritage sites are places where minerals and other valuable minerals have been dug out of the ground. The broader context in which mining takes place and in other places, including entire landscapes, may be of value in their own right. Landscapes themselves may have a heritage significance as a result of mining (Pearson & McGowan, 2000). By assigning human value judgments to natural landscape functions, multifunctional landscapes are closely related to land use decisions and have become an important development direction in the current study of landscape functions, a key area of integrated multidisciplinary landscape research and a new disciplinary growth point for landscape ecology (Peng et al., Advances in Earth Sciences (Peng, 2015.) Adaptive reuse of industrial heritage is an approach that can be used to help reduce abandoned or unused industrial heritage as well as prevent the destruction of industrial, cultural heritage assets; therefore, introducing new projects and functions into a structure and contributing to the maintenance, restoration, development and redevelopment of targeted areas within a community (Sugden E., 2018). Urban areas are complex and dynamic systems, they reflect the many processes that drive physical, social, environmental, and economic transformation. They themselves are the primary agents of many of these changes. Urban regeneration is a source of impact due to the interaction of these many factors and, more importantly, of the opportunities and challenges presented by urban degradation (Sage, 1999.

From an abandoned tin mining site to a quality urban landscape: Mines Wellness City (MWC)

Figure 1: Original Pre-Development Industrial Site of Mines Wellness City (MWC) Photo Credit Mines Wellness City (MWC) Developer's Website

Figure 2: Mines Wellness City (MWC) Development Plan Source: Project Developer's Official Website

Figure 3: Mines Wellness City Multifunctional Landscape and Urban Regeneration Landscape Images

By 2020, the city is expected to be a RM5.5 billion development, playing a central role in tourism and becoming Malaysia's foremost wellness destination. The city's expansion is part of the government's Economic Transformation Programme (ETP), led by PEMANDU (Performance Management and Delivery Unit) under the Prime Minister's Department. The development of Mines Wellness City will lead and contribute to increased economic activity, employment opportunities as well as gross national income.

Situated around the 150-acre lake in Kuala Lumpur, Mines Wellness City is a green sanctuary for local and foreign wellness visitors seeking to enhance their physical and mental health in a holistic environment. The city serves as a one-stop destination showcasing the facility that integrates and supports the spread of Lifestyle of Health and Sustainability (LOHAS), as well as a central hub for LOHAS where people, businesses, and networks are connected in one city.

Mines Waterfront Business Park offers the advantage of excellent connectivity and access to nature's richest resources. The view from the business offices is a panoramic vista that inspires many great ideas. It is fully equipped with vibrant business facilities, including convenient banking facilities, shopping centers, hotels, and all sorts of entertainment.

Figure 4: Mines Wellness City Tourist Attraction Route Map, Source: Google Images

Mines Wellness City is one of the most iconic examples of the adaptive use of an abandoned tin mining site in Malaysia. It is also one of the best examples of post-industrial landscape reclamation. Before becoming a tourist resort area, the area consisted of several open pits caused by the tin mines—an industrial heritage object with a high index of pollution and degradation. According to the design plan of Country Heights Holdings Bhd (CHHB), this project's future development is a long-standing one and it is also a social development necessity.

The development of the Mines Wellness City project will play a vital role in the area's economic growth. The result of Mines Wellness City will also directly impact property prices in the surrounding area. The following section will provide a detailed summary of the survey questionnaire used to examine the real estate and condominium developments around Mines Wellness City. The project's main objective is to create a new public space that will redirect the urban sprawl and establish a relationship with the city. The connection between the city and the river is also re-established based on the changes in land-use patterns and land values. Changes in land-use patterns and land values caused by urban growth, territorial specialisation, and new infrastructures make the area an increasingly attractive location. The solution for this project also includes structures of the ecological and multifunctional landscape of functional significance, contributing to establishing a spatial organisation of the same intentions organised to transform into a coherent and formal group. Landscape values are crucial in developing the concept of Mines Wellness City. The exceptional views of the river and the greenery are observed through the creation of visual corridors by creating elevated platforms in the surrounding areas.

The project has developed spaces with various uses with a wide choice of services such as sports and recreation such as the Golden Horse Health Reserve, cultural activity areas, a Chinese medicine health centre, the Palace Vacation Club, and an environmental education area. The sports and recreation area includes a golf course, jogging tracks, a fishing pier, boat ramps, themed arcades, a horse farm, the Mines Cruise boats as well as an equestrian centre. The sports competition area includes:

- An international standard golf course.
- A traditional international equestrian track competition centre.
- Several tennis courts and lawns for high-intensity sports such as football and rugby.

The cultural activity area is a casual space for music exhibitions, theatre, and other cultural activities at the Malaysia International Exhibition and Convention Centre (MIECC). In this way, the features of this programme promote flexibility for a wide range of activities. The organisation of Mines Wellness City has created several relaxed spaces built as parks offering a variety of social, cultural, and sporting activities.

Figure 5: Mines Wellness City Tin Mining Site and The Current State of The Industrial Site After Its Transformation as well as Its Future Development Plans. Source: Facebook, Google Maps Screenshot and Development Company Website.

The transformation of the Mines Wellness City from a formerly uninhabited tin mining site to an industrial area is a classic example of urban regeneration, it has transformed the city and given it a whole new vision and opportunity to reshape the town and beyond. The tin mining site, which was previously a single tin mining industry, has now transformed to include the Golden Horse Health Reserve, Cultural activity area, a Chinese health centre, a Palace Vacation Club, an environmental education area, and a sports and recreation area. As more and more industrial sites are being transformed into multifunctional landscapes, these projects are not going to just become regular ornamental landscape features. This project is transformed into a complex and neat multifunctional landscape corridor with an artificial lake, a bicycle track, an exhibition hall, a swimming pool, a horse racing arena, an art gallery, a park, a golf course, a mall, as well as surrounding landscape facilities. With the simple transformation of an abandoned industrial site, the area has not just become a simple urban park but a collection of public facilities, landscape facilities, and landscape architecture designated to the community. It has also become a multifunctional landscape that can and will continue to provide more convenience and satisfaction to the citizens.

METHODOLOGY

The research methodology aims to systematically collect information for the study through a (SWOT) analysis method and a questionnaire survey. The four-part research phase framework focuses on the core areas of data collection. The primary purpose of the two research methods was to examine the interplay of environmental and economic impacts of the transformation of the pit site in Malaysia, where I needed to systematically collect data to justify my research questions, ultimately discussing and justifying the economic and environmental relevance of the transformation of the project. The implications of the pit site rehabilitation project and sustainable urban planning are explored. The adaptive reuse of the industrial heritage of Sungei Besi Mine, one of the concentrated industrial sites of the Malaysian tin mines, is explored from concept to implementation possibilities, mainly with the (Mines Wellness City (MWC)) case study to explain the need for adaptive reuse of industrial sites in the context of contemporary society, the development of (Mines Wellness The development of a Mines Wellness City (MWC) project can improve the natural habitat of an industrial site and at the same time contribute to the economic development of the surrounding area, defining the path for sustainable urban regeneration. At the same time, to compare the specificities of the Mines Wellness

City industrial site regeneration project with those of a normal socio-economic development area, we have selected another project in the same area, Equine Park, and conducted a SWOT and questionnaire survey to summarise the factors influencing the economic purchasing power of the two. A SWOT and questionnaire survey was carried out on another project in the same area, Equine Park, to summarise the economic purchasing power factors that influence the surrounding properties.

During the qualitative phase, we analyzed the data through constant comparative methods. The findings were retrieved from the available documents. These are two tables that summarize the key findings of the overall analysis.

Table 1: Background to The Development of The Two Projects

Mines Wellness City		Equine Park	
Background of the Mines Wellness City development	Tin mining site	Background of Equine Park development	Has convenient transportations
	Industrial transformation		Walking distance with MRT
	Industrial Culture		Beautiful natural environment
	Industrial Landscape		Furniture Mall
	Man-made Lake		Shopping Mall
	Convenient lifestyle		Close to Putrajaya
	Walking distance to KTM		
	Shopping Mall		
	Brownfield Golf Course		
	Exhibition Hall		

RESULTS AND DISCUSSION

A case study of the Mines Wellness City tin mining site adaptive reuse project found its cultural, economic, and environmental aspects to be relevant, the Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis was conducted to demonstrate the relevance of this tin mining site adaptation project. Cultural, economic and environmental aspects were considered.

Strengths

- Idyllic location.
- Possibility of using renewable resources.
- Soil and climate characteristics and high bioenergy potential.
- High heritage value due to history with tin mining sites.
- Abundant resources and a wise investment.
- Easy access to places such as Kuala Lumpur, Putrajaya, and Kuala Lumpur International Airport.

Weaknesses

- A relatively short tradition of landscape reclamation.
- Low articulation of urban planning tools.
- Lack of specific principles for urban renewal.
- Difficulty in convincing the government (municipality) to provide immediate funding for the reclamation of derelict land.
- The municipal is interested in transforming this valuable masterpiece into a residential area (profit maximisation).

Opportunities

- Improvement of the quality of soil and water.
- Multiple functions for different water bodies.
- Creation of commercial clusters and expansion of existing ones.
- Even after the maximum usage of new areas there is a potential to reuse old abandoned areas
- Creation of a wide range of recreational facilities.
- Re-create its potential as a traditional landscape with strong links to other towns in the area.
- Redevelop the cultural landscape of the old industrial tin mines and strengthen the links between the area and the surrounding regions.

Threats

- Ambitious projects for landscape change lack funding sources and are slow to develop;
- Lack of awareness of the importance of the industrial heritage landscape for the ecological balance and stability of the area;
- Limited possibilities for financial support for municipal development;
- Lack of political will to establish and fund institutions to support cultural and environmental development;
- Failure to implement policies to protect the heritage of the tin mining industrial sites;
- Urban regeneration and expansion.

Table 2: SWOT Analysis Comparing Similar Developments in Two Locations

Similarities	**Mines Wellness City**	**Equine Park**
1	Has convenient transportations	Has convenient transportations
2	Walk to public transport station	Walk to public transport station
3	Shopping Mall	Shopping Mall
Differences	**Mines Wellness City**	**Equine Park**
1	Tin mining site	Beautiful natural environment
2	Industrial transformation	Furniture Mall
3	Industrial Culture	Close to Putrajaya
4	Industrial Landscape	
5	Man-made Lake	
6	Brownfield Golf Course	
7	Exhibition Hall	

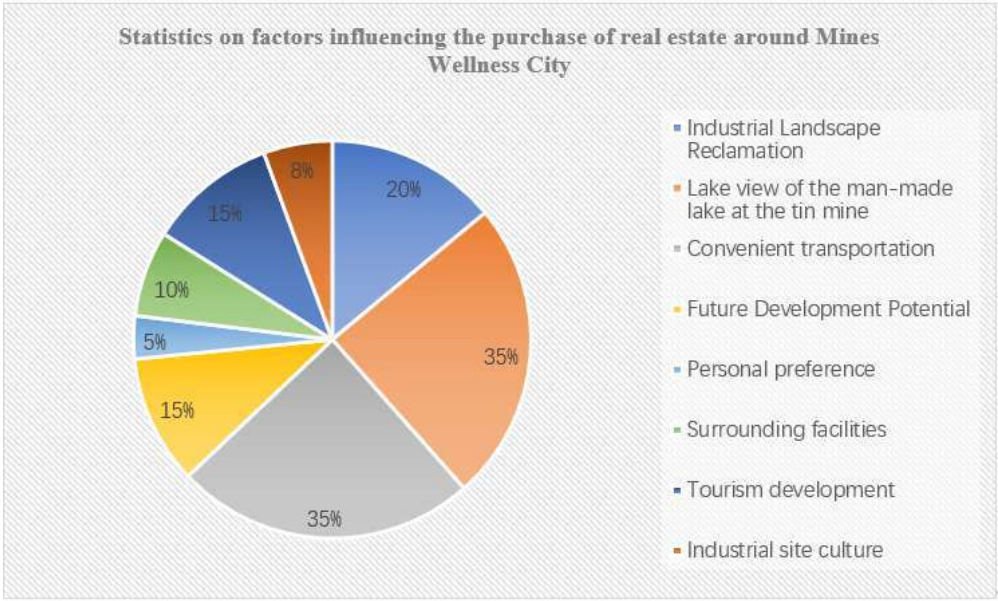
Comparison between the two sites proposed for parallel development by adding SWOT analysis and Significant similarities were found between the two site developments. Again, the development sites are centrally located in the area and are progressively growing in size concerning the shopping centre. The differences are also evident because the Mines Wellness City development site has a well-established industrial background and a strong and sustainable development ethos. Equine Park is a simple urban development with a shopping mall and residential development. The similarities and differences between the two are evident in the fact that research has shown that the industrial background and culture, and the increasing maturity of the sustainability concept, have impacted the sale and rental prices of properties in the Mines Wellness City area. On the other hand, Equine Park is a traditional development model, and the surrounding area lags far behind the Mines Wellness Cit area in terms of sale and rental prices.

However, the analysis and restoration of this landscape constitute an opportunity that is often lost over time, given the increasing urban pressures that have led to the loss of various mining industry infrastructures, some of which have high heritage values and are of local and national importance, but yet little has been done to preserve and restore them.

A questionnaire survey of the residents of Mines Wellness City was carried out, and it was found that the reclamation of the tin mine site and the surrounding landscape had a significant environmental and economic impact on the project. This is reflected in the difference between the landscape with and without the industrial site in the same area. For this reason, we have produced a detailed comparison between the two projects using bar graphs and a pie chart of the economic influences around Mines Wellness City. Mines Wellness City and Equine Park are projects within the same area, the only difference is that Mines Wellness City is an urban regeneration project of an abandoned industrial site dependent on industrial culture, landscape, and values. At the same time, Equine Park is an economical construction project under normal social development. The statistics were obtained from interviews with iProperty Malaysia, a local rental software, and Wikiprop, a rental and sales agency.

Table 1: Average Selling Price and Average Monthly Rental Fee of Properties Around Mines Wellness City

Table 2: Average Selling Price and Average Monthly Rental Fee of Properties in The Equine Park Neighbourhood



Pie Chart 1: Statistics on Factors Influencing the Purchase of Real Estates Around Mines Wellness City

In the study of the transformation of the Mines Wellness City tin mining site, the environmental and economic impacts, particularly the impact of the industrial landscape reclamation on the sale and rental prices of the surrounding properties, were investigated to verify the transformation and development of the surrounding economy through the urban regeneration of the industrial tin mining site and the integrated development of the multifunctional landscape. Comparing data from two shopping centres in the same area shows that social infrastructure, accessibility, and

commercial facilities are similar. The transformation of the site of tin mining and the formation of the artificial lake in Mine Wellness City will significantly diverge between the two development centres under similar conditions. There is a substantial difference in the property's sale price and the rental fees in the market. The process of transforming the tin mining site does have a positive effect on the surrounding economy. The multifunctional landscape has also perfectly reflected in the project's development, and the urban regeneration has delivered a wonderful result.

Finally, a questionnaire survey on the environmental and economic impact on the real estate economy in the vicinity of Mines Wellness City has led to a scientific conclusion, with 133 responses out of 202 surveys sent to citizens with 69 of them being disabled. As shown in Pie Chart 1, data were collected to show why the public is more willing to pay higher prices for properties around Mines Wellness City whereas the property price presented in Equine Park is much lower. The results of the study are known to be mainly due to the reclamation of the tin mining industrial landscape, the formation of an artificial lake at the tin mining site, and also the easy accessibilities around the city. This suggests that preserving the tin mining industrial culture and the reclamation of the industrial landscape as well as urban regeneration, it would lead to a sustainable and prosperous aspect of the area.

Through a systematic comparison of the two projects above, it is clear that there is a certain economic influence on the property prices and rents around the two areas with and without an industrial heritage cultural background. The reclamation of the industrial landscape has led to environmental improvements, which have caused an inclination to own a property near Mine Wellness City, which has an industrial landscape as its backdrop, thus resulting in a lower property price in Equine Park. The impact of real estate development is therefore significant.

CONCLUSION

This case study found that environmental improvements significantly impact the local economy, the best example being the Mines Wellness City tin mining open pit rehabilitation project driving economic development in the surrounding areas. The questionnaire research methodology concluded that there is a strong relationship between the impact on the sale price and monthly rental fees of properties around Mines Wellness City and the improved environment of the Mines Tin Mining artificial lake. This typical success story also has a positive effect on urban development. The goal of urban regeneration is perfectly reflected in the transformation of what started as a lonely, abandoned tin mining area, into an environmentally friendly and sustainable multi-functional significance. As compared to the Equine Park project, which is under normal economic development, Equine Park lacks the industrial factor as the background of its whole project. This will then directly affect the economic strength of the real estate around the area. Instead, the presence of industrial landscape, industrial culture, land reclamation, and adaptive reuse of abandoned land are important factors that boost the economic value of a particular land. This is a significant study that will allow urban development planners and government officials to look at the decisions made on the adaptive reuse of industrial sites.

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AUTHOR BIOGRAPHY

Yi Huan, B.A., West Anhui University, China, Environmental Design, Faculty of Art. M.A., University of Infrastructure Kuala Lumpur, Master of Science by Research. His academic interests are industrial heritage adaptive reuse sustainable development, green architecture, rooftop garden popular preference, and industrial landscape design research. Email: 203922256@s.iukl.edu.my

Golnoosh Manteghi, Ph.D., is a Professor and Researcher at the University of Infrastructure, Kuala Lumpur, Malaysia. Her main areas of interest are urban design, urbanist urban sustainability, urban planning, architecture, built environment, urban planning, sustainable architecture, landscape architecture, sustainable green architecture, landscape planning, landscaping, green building, and sustainable architecture. Email: golnoosh.manteghi@iukl.edu.my

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Stagnancy of Wealth: A Metaphoric Rhetorical Criticism on Torch Movement Speech 3 by Aminuddin Baki

Dil Froz Jan Sayed Halem Shah
Infrastructure University Kuala Lumpur, MALAYSIA

ABSTRACT

This article scientifically looks at the Torch Movement Speech 3 by Aminuddin Baki, also known as *Ceramah Obor 3*, and a metaphor, "Stagnancy of wealth" or simply, *"Beras secupak tidak akan jadi segantang," which* is an ancient Malay metaphor. This is qualitative research using the content analysis method based on the Neo Aristotelian Criticism perspective. The metaphor will be analysed and discussed based on four main aspects namely metaphorical elements, metaphorical meaning, metaphorical impact, and finally a metaphorical comparison. The research used the theory by Sonja K. Foss. Its main aim is to identify the metaphor employed within a certain context, and also to determine the structure of the metaphor in modern-day communication interaction. After analysing the metaphor of the "Stagnancy of Wealth", the study found that the metaphor was focused on emphasizing deep reasoning to sensitize the Malays. This metaphor was stapled by the idea of progress in order to deliver a message to the Malay audience that their weakness in the ability to adapt had prevented them from staying relevant to the benefits of progress in their environment. The study concluded with a recommendation that was related to the attainment of progress from a particular point of view.

Keywords:
Metaphor, rhetoric, criticism, speech, stagnancy

INTRODUCTION

Naturally, people have an incline toward wealth (Little, DeBruine & Jones, 2013). This is not entirely surprising since most would tend to relate the comfort of life with wealth. With it, a person can acquire worldly needs and desires. The compulsion to amass wealth, however, is often associated with greed.

Greed can be quite destructive to society (Chaubey, 2006). It compels a person to victimize others for his gain. In light of this, the community may employ various strategies to combat greed. One of the simplest ways to do this is by reframing the idea of wealth itself through the use of the rice metaphor as included below. If the totality of wealth is perceived as a stagnant entity, therefore, to be greedy.

LITERATURE REVIEW

The usage of metaphor in speeches or oral communication is the main strategy in rhetoric. A metaphor is a form of figurative speech we use in order for communication to take place. External concepts are adopted as a metaphor to impart meaning. It may not be apparent at first sight in interpreting the dual ideas. To examine the theory of Metaphor (Lakoff, 1993) is employed in mapping, reasoning, and in problem-solving.

a. Metaphor

Is a term from rhetoric that refers to a figure of speech or a linguistic device in which a word or phrase that denotes one thing is used figuratively for something else as a way of suggesting a likeness or analogy between the two (Fauziah & Faridah 2004).

b. Rhetoric

Stoner and Perkins (2005) define rhetoric as a message that relies on verbal and non-verbal symbols that are more or less intentionally influenced the social attitudes, values, beliefs, and actions. It consists of three cannons of rhetoric namely, Ethos, Pathos, and Logos.

Ethos - is the charisma of the speaker. For instance, in an academic forum, if the speaker is an expert within a field and has published several articles in high-impact journals, then his ethos is favourable to the audience (Rodriguez Sedano, Rumayor & Paris, 2011).

Pathos - requires an intricate understanding of the issue that would be best moved the audience. It is vital to be sympathetic to the audience's needs (Higgin & Walker, 2012). The rhetor must be able to put himself within the calamity of those he addresses, to feel connected to the predicaments faced, and then devise a persuasive response.

Logos - would apply bounded rationality (Todd & Gigerenzer, 2003) and proceed by showing evidence (McCrosky, 1969) for example the amount of cost that can be maximally incurred for the company to stay afloat.

Rhetoric is becoming more and more popular across the English-speaking mass media world and it should be specified that it is here taken in the classical sense of the word. The main function of rhetoric is to convince the hearer or audience about the necessity to address a specific topic. The speaker needs to be aware of the emotional state the audience finds himself in, so as to adapt his speech and trigger the necessary emotions such as sadness, joy, friendship, or hatred which will lead to persuasion.

c. Criticism

Is the dissemination of ideas, an unprejudiced and impartial effort to study and spread what is known and thought in the world? The goal is to see the object in itself as it is (Arnold, 1964).

d. Speech

Speech is considered a guiding principle for business prose and a persuasive force in helping to establish the image of an organisaton. A study conducted by Myers and Kesslers (1980) on speeches by the leaders in large organisations in America stated that three general corporate strategies were introduced to minimize problems - they were influencing government policy, education on economics for the public, and increasing the social responsibility of the business.

METHODOLOGY

This is a content analysis research that uses the Neo-Aristotelian criticism approach. The content analysis used is based on the qualitative research tradition which is primarily exploratory in nature (Kartini & Faridah, 2022) that generates data in the form of words rather than numbers. According to Punch (2013 cited in Kartini & Faridah, 2022, pp 56) qualitative research is illuminative and manifestations of the phenomenon of interest. For this study, the content is coded based on metaphoric criticism which is an approach that mostly emphasizes the specific strategy implemented within rhetoric. This study analyses the metaphoric contents in the Torch Movement Series 3 which emphasizes the metaphor, "Stagnancy of wealth."The speech by Aminuddin Baki was chosen because he was a prominent, prolific, and influential Malay scholar in the 1960s era.

Rezeki secupak tidak akan menjadi segantang
a bowl of rice will never grow into a bag (Torch Movement Series 3)

An individual can perform numerous deeds to increase his wealth (Pawasutipaisit & Townsend, 2011) for a particular duration of time. According to the metaphor nonetheless, doing so will not increase his total wealth. Instead, a portion of the wealth will be merely transferred from one part to another, to make it appears more at a certain point, when in fact, the totality remains the same.

Imagine that wealth is divided into four separate timelines as shown below (Figure 1). Each period involves a certain allocation of wealth. Although wealth might fluctuate with the passing of time, the totality is believed to be the same. As such, assume that the person increases wealth at the time (1). What would happen? There is no increase in total wealth. He is merely relocating the wealth of future time (3) to the current time (1). Thus, at the time (3), he will receive no wealth. This metaphor can be very effective in dealing with greed since it presupposes is an unchanging totality of wealth that consequently demoralizes avarice.

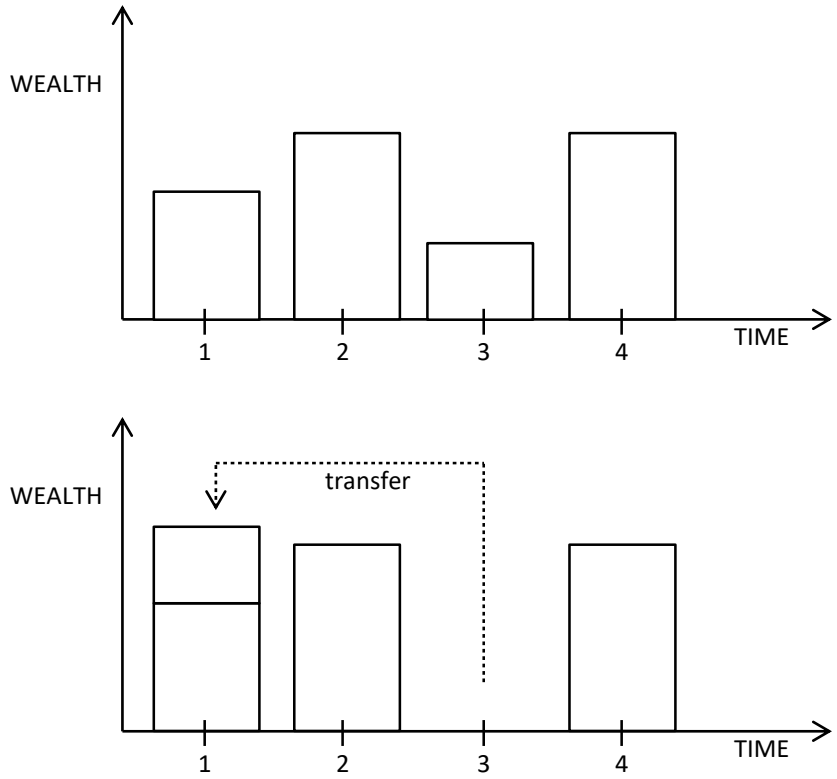

Figure 1: Implication of Rice Metaphor

Metaphorical Element

In the past, the standard for quantifying rice is not based on weight (Clark, 1877). Thus, the conventional measure of rice such as kilogram or pound is not prevalent in the community because they do not have the luxury to define the exchange of goods in terms of precise scientific quantity. This can be attributed to the lack of technology, even simple ones, suffered by the people at that time.

The most convenient way to determine the amount of rice and its value is thus dependent on the container it fills (Marchiori et al.,2012). Ergo, society can regard the totality of rice based on what it occupies whereby it can either involve a cup, a bowl, a pot, or perhaps, a bag. Quantity can be arranged in the form of an order (Wadhera & Capaldi-Phillips, 2014). Ascending order refers to the arrangement that places the entity from that of the lowest degree to the highest. On the other hand, descending order sequences objects from the highest amount to the lowest. In this respect, the measure of rice can be ordered in an ascending manner. For example (Figure 2), the order would be a cup, bowl, pot, or bag.

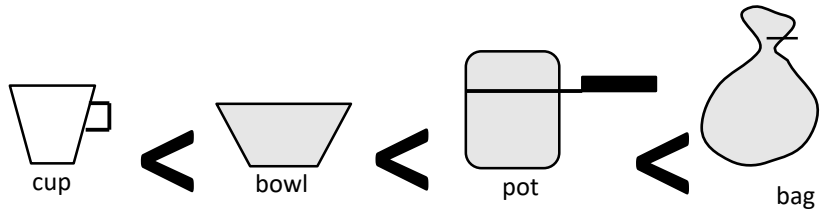

Figure 2: Ascending Order of Rice

The symbol '<' between the entities implies 'less than.' As such, cup < bowl signifies the semantics that the quantity of rice in a cup is less than the one in the bowl. It must be reminded that less than ramification is transitional. This means that if it is known that cup < bowl, and bowl < pot, then by inference it can be said the cup < pot or cup is less than pot although there is no direct interaction between them.

Given the notion of order and transitivity (Díaz et al., 2008), it is quite possible to compare the quantity of rice between two containers that are not explicitly linked to one another. Although it is an approximation, the act is quite apt. For instance, it can be deduced that a bowl of rice is less than a bag of rice (bowl < bag), or a cup of rice is less than a bag of rice (cup < bag). Now, suppose a cup is filled with rice and there is no space left within it. Later, the rice in the cup is transferred entirely into the bag. Since the amount of space offered by a bag is so much larger than a cup, it can be reasoned (Forbus et al., 1990), almost with complete certainty, that the aforementioned transfer will leave a significant space in the bag, although none was available earlier in the cup.

By comparison, it is rather apparent that the amount of rice in a cup is nearly insignificant when contrasted to a bag (Parrish & Beran, 2014). Observe the amount of untouched space in the bag that is yet to be occupied. However, if the transfer allows repetition, and a sequence of rice can be transferred within a certain duration between the two, then the contribution of the cup in filling up the bag will gain significance. In other words, time is the factor when it comes to making an impact on quantity, assuming that a repetition is a viable option at hand. Now, from the perspective of economics (Dobson & Palfreman, 1999), wealth is defined as the difference between assets and liabilities (Figure 2). An asset is any form of economic resource that is both tangible and intangible. For instance, if an individual owns a series of shops in town, they are considered tangible assets. On the other hand, if he possesses shares in a publicly owned company, then the shares are intangible assets.

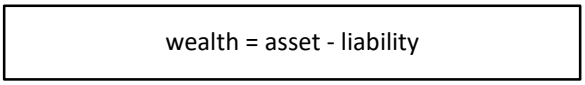

Figure 3: Definition of Wealth

Contrary to assets, liabilities (Giné & Karlan, 2014) are economic obligations that must be fulfilled by an individual or company. These obligations often involve the transfer of assets from the obliged to the receiving party, either in the form of cash, commodity or services. To illustrate the idea, when a person takes a loan, the monthly payment required to clear part of the stipulated debt is a form of liability.

Based on the definition of wealth, the construct can either exhibit positive or negative value (Park & Jang, 2014). A positive value occurs when there is more asset than liability while a negative one transpires when the liability is higher relatively. In its most simplistic sense, wealth can be conceptualized as how much money a person has compared to his debt. If he has more money than debt, his wealth is positive. Else, it is negative.

To conclude, these two measures, assets and liabilities, practically determine the state of wealth for a person at a particular time. It must be understood that wealth is not static (Chade & Vera, 2014). Instead, it is dynamic and changes with time-based on the actions performed by the individual about his economic standing. In effect, how a person responds economically to his environment determines wealth.

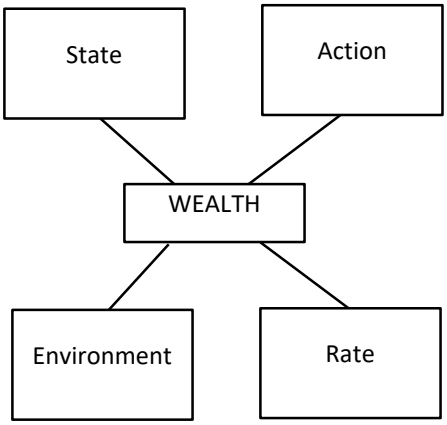

Figure 4: Construct of Wealth

The construct of wealth involves four elements (Figure 4) – State, Action, Rate, and Environment. The state is basically what has been explained before. Action (Van Rooij & Teppa, 2014) is the Economically significant transaction that is deployed by the individual which affects wealth as a whole. The action need not be exclusive. In other words, a particular action can affect both assets and liability at the same time.

For instance, when an individual buys a new house (Holmans, 1994), the state of his wealth changes. He acquires a new asset and at the same time, committed himself to liability. The house is the new asset while the payment that he makes every month to procure the entity at the end of the 20-year period, is the liability. Here, the wealth related to the purchase depends on the value of the asset through time.

To demonstrate the idea more clearly, assume that the house is bought at $1,000,000. Every month, the person pays $10,000 for the next 15 years. Let us consider two cases that may happen. For

the first case, imagine that a new complex is being built by Google near a residential area. Approximately 1000 new people with high income (Madsen, 2012) will be coming to the place.

Due to increasing demand compared to supply, the house now boasts a value of $1,500,000. This is a 50% increase from its original price. For the sake of simplicity, assume that if the house is priced at $1,500,000 then a payment of $15,000 instead of $10,000 must be made every month. Since the person is paying $10,000 / month for the house, it can be said that he is now making $5,000 every month.

In this scenario, the building of the new complex as well as the influx of people into the housing area signifies the environment that impacts wealth. Again, only economically related elements should be included within the environment. Other elements (such as the migration of harmful birds through the city) that do not contribute to the increase or decrease of wealth are not significant.

Now, consider an alternative scenario, supposed that a new nuclear plant (Yamane et al., 2011) is being built near the city instead. Given the high risk of residing near a nuclear reactor, people within the area started leaving the place. For argumentation's sake, assume 800 residents in total have left their houses. Here, the supply is higher than the demand and the price suffers a plunge. Thus, instead of paying $10,000/month and gaining a house of that value, the individual now suffers increased liability and a loss of wealth.

From both of the scenarios, it can be inferred that the rate of wealth (Sousa, 2010) or how much wealth changes through time will impact the entire state of wealth. If the rate increases, the asset would consequently appreciate and wealth becomes positive. On the other hand, if the rate decreases to the extent that liability is greater than an asset, then the state of wealth falls into a negative value. The state of wealth is changed by what the environment (Hajduová et al., 2014) provides and how the individual reacts through actions. The right action is defined as that which focuses on the cultivation of assets that will increase in value over time. On the contrary, the wrong actions involve the emphasis on liability that will increase periodically. The environment provides an opportunity for decision-making. Thus, selecting the appropriate action is crucial in the management of wealth

Metaphorical Meaning

Pragmatically speaking, the rice metaphor (Table 1) signifies the conception of wealth (Halik & Webley, 2011) from the perspective of the Malay community in the past. It portrays wealth as a non-increasing entity. This can be seen by the static interpretation of growth which does not include the idea of time. Furthermore, this is confirmed by the exclusion of an external source of wealth from the metaphor.

WEALTH AS RICE

Table 1: Rice and Wealth

THEME	RICE	WEALTH
Storage	Bowl or bag	Bank
Quantity	Bowl of rice	Small amount of wealth
	Bag of rice	Large amount of wealth
Progress	Bowl growing into a bag	Small to large amount of wealth
Impossibility	Bowl never growing	Cannot increase wealth
Source	None	Non-recurring

Storage (Castro & Sousa, 2012) is a rather pivotal notion in the accumulation of wealth. For this metaphor, the different type of containers applied, such as a bowl or bag, constitutes the storage of wealth as a whole. It can be mapped to the actual place of storing wealth, such as a bank, or perhaps, a company in which investment resides. Either way, the metaphor establishes storage as the central point of its argumentation.

When speaking of placing a commodity within a storage facility, the entire quantity of the entity becomes of great interest. The metaphor accentuates two levels of quantity. They are represented by a bowl and a bag of which the former signifies a small amount of wealth, while the latter, great wealth. Although in reality, the amount of money to be kept, either small or large will not determine the bank, the metaphor distinguishes quantity by varying the storage involved.

The progress of wealth (Walder & He, 2014) is implied by the growth of rice from a bowl to a bag. Here, however, the idea of growth is simplified into the act of transferring rice from one container to another. It conveys the idea that wealth can move from one form to another. Perhaps to imply that when people resort to bartering, like exchanging chicken with rice, the equivalence is maintained to a certain extent.

Asserting the impossibility of growth, the metaphor treats wealth as a non-evolving entity (Sotomayor, 2008). It states the absurdity of assuming that a bowl of rice will grow into a bag by clarifying that the content of the storage does not change with time, and will never do. Wealth can transmute between forms, but the entirety of its being remains unequivocally constant.

The metaphor also excludes any alternative sources of wealth (Elston & Audretsch, 2010) to stress the principle of rigidity. There is no mention of other sources from which more rice can be attained besides the one already retained within the bowl. In its own way, it projects a strong image of exclusivity. That is a firm belief that severs the possibility of performing any action that can potentially increase wealth.

It is assumed that the Malays posit a rather strong belief in the unchangeable attribute of wealth based on an inaccurate interpretation of hadith (Zarabozo, 1999). The hadith mentions that the sustenance of men is defined before their birth. However, it does not state the finality of sustenance such that it will not transform through the course of life.

On the authority of Abdullah ibn Masood (may Allah be pleased with him), who said: The Messenger of Allah (peace and blessings of Allah be upon him), and he is truthful, the believed, narrated to us,

> *"Verily the creation of each one of you is brought together in his mother's womb for forty days in the form of a nutfah (a drop), then he becomes an alaqah (clot of blood) for a like period, then a mudghah (morsel of flesh) for a like period, then there is sent to him the angel who blows his soul into him and who is commanded with four matters:* ***to write down his rizq (sustenance)****, his life span, his actions, and whether he will be happy or unhappy (i.e., whether or not he will enter Paradise). By the One, other than Whom there is no deity, verily one of you performs the actions of the people of Paradise until there is but an arm's length between him and it, and that which has been written overtakes him, and so he acts with the actions of the people of the Hellfire and thus enters it; and verily one of you performs the actions of the people of the Hellfire, until there is but an arm's length between him and it, and that which has been written overtakes him and so he acts with the actions of the people of Paradise and thus he enters it."*

In actuality, there are numerous ways to increase wealth as recommended by Islam. For instance, asking for forgiveness from God is an effective way to induce the ascension of wealth. Here, those who do so, are promised 'heavenly blessings abundant' which is interpreted as wealth. Apart from that, they are also promised additional strength in life.

> 11:52 *Hence, O my people, ask your Sustainer to forgive you your sins, and then turn towards Him in repentance-[whereupon] He will shower upon you* ***heavenly blessings abundant****, and will add strength to your strength: only do not turn away [from me] as people lost in sin!*
> (Asad,)

Finally, It is said that *takwa*, or the sincere fear of God can open the fate of men to the kind of wealth unimagined by the mind.

> 65:2 – 65:3 Thus when they fulfill their term appointed, either take them back on equitable terms or part with them on equitable terms; and take for witness two persons from among you, endued with justice, and establish the evidence (as) before Allah. Such is the admonition given to him who believes in Allah and the Last Day. And for those who fear Allah, He (ever) prepares a way out, And He provides for him from (sources) he never could imagine. And if any one puts his trust in Allah, sufficient is ((Allah)) for him. For Allah will surely accomplish his purpose: verily, for all things has Allah appointed a due proportion. (Ali)

Metaphorical Impact

At first glance, the rice metaphor brings forth a negative impact on the audience. It compels the listeners to believe that economic-related effort is irrelevant to the increase of wealth when in fact it is not (Thompson & MacMillan, 2010). As such, no matter how much input is invested into the act of accumulating wealth, no increment would be experienced by the individual. This can result in torpidity among the community.

Although greed is a compelling possibility, it is inconclusive as to what actually motivated the inception of this metaphor (Xu, 2000) within the Malay community. Rationally speaking, propagating systematic helplessness or apathy through a common saying among the people of the nation would unequivocally be counterproductive to the development of the economy. Then again, perhaps it is intended to promote humility or moderateness, with regard to wealth. The role of humility with respect to the economy is rather intriguing. If wealth is assumed to be preordained and immutable, then the community will not be competing against each other to gather wealth (Hilbig et al., 2013). In this sense, they would be less calculative in their economic exchange. Especially, when indulging in the activity of buying and selling from one another.

It is a well-known fact that when it comes to making sales, one of the main principles is to maximize profit (Xu et al., 2012). Engaging in business solely based on profit may make the individual very calculative in his exchange. This is not commendable from the perspective of the Malays because it impedes the person from contributing back to the community for the sake of helping others per se.

Consider the opposite scenario of that mentioned earlier. By not being calculative, the seller can be more considerate with the business dealing. For instance, when a somewhat poor customer comes to his shop, he can offer a more promising discount (Curry, 2008) even when doing so would involve sacrificing a major portion of the profit. In retrospect, the metaphor can help inspire this behavior to take place.

A downside of this is excessive altruism (Wilson, 2004) whereby an individual stretches his resources to help another. This occurs to the point of causing a series of self-defeating repertoires whereby the person repeatedly endangers his own economic well-being for the sake of others. Failing to survive, he may transfer the inconvenience to those around him. It is hypothesized that the rationale behind the use of the rice metaphor by Baki is not to instigate apathy or unwarranted altruism. Instead, it is meant as a form of provocation to elevate the mentality (Darya, 2013) of the Malays to a higher

level within the dimension of economic progress. In effect, the metaphor should not be perceived from the context of commonality.

To appreciate the intended impact of the rice metaphor, its negation (Hasson & Glucksberg, 2006) must be considered with a greater inspection. Without the loss of generalization, the rice metaphor is translated into the simpler principle that 'no amount of effort will increase wealth.' Hence, the negation would be, more or less, as shown below. Notice that Baki proposed the increment of effort to improve wealth.

A bowl of rice will never turn into a bag
No amount of effort will increase wealth

Negation (no amount of effort will increase wealth)
the full amount of effort will increase wealth

It must be reminded, however, that when one speaks of effort from the Islamic perspective, it is not confined to actions performed in the name of economy. Rather, it includes effort that may invite the cultivation of prosperity from the treasures of God. For instance, it is explained again and again in Islam that God will help a person as long as he is helping others (Brito et al., 2014).

The accrual of wealth, therefore, as explained by Baki not only involves an economic effort but those related to Islamic principles as well, whereby wealth is signified as a form of responsibility (Park et al., 2014) from God. In this respect, the rice metaphor is practically delivered as a catalyst to induce the Malays to start investing in the development of wealth.

Despite the honorable intention of the rice metaphor in creating a positive impact on the audience, the actual effect may not be as intended. The Malay community can be quite resilient to change. When provoked, they may resort to withdrawal instead of revival to maintain harmony (Ahmad & Majid, 2010), where the zest to enhance their economic standing may deteriorate altogether.

The reason for the Malays' withdrawal in the presence of change might be attributed to their commitment to tradition (Sua, 2013). Here, it would be appropriate to mention a metaphor that was quite prominent among the community in the past, of which tradition is equated to biological legacy. Although realistically, the notion sounds a bit of malarkey, it was actually in use before.

Biar mati anak, jangan mati adat
Better to sacrifice your child than to lose your tradition

Examine the way a child is compared to tradition in this metaphor. Tradition is revered so highly to the point that rhetorically, it is implied of being worth more than the life of a child (Andrushko et al., 2011). Some may argue that tradition is crucial because it integrates society as a whole where as a child would only impact a particular family. Despite the absurdity of the notion, this obsession could be the reason that propels the Malays to reject positive change, which in turn would stymie the process of improvement.

Instead of being fettered by unreasonable tradition, Baki proposes a paradigm shift that centralizes not on cultural dogmatism, but rather, on practical advancement (Mannan & Waldram, 2014), coupled perhaps with Islamic virtues. The Malays can revolve their economic stature by adopting the way of life recommended by Islam. It is can be shown that in Islam, the search for economic progress is not prohibited as long as the effort adheres to the stipulated boundary of the religion.

> 28:77 (Y. Ali) But seek, with the (wealth) which Allah has bestowed on thee, the Home of the Hereafter, nor forget thy portion in this world: but do thou good, as Allah has been good to thee, and seek not (occasions for) mischief in the land: for Allah loves not those who do mischief. (Ali,)

From the Quranic verse above (Ali,), Muslims are encouraged to seek both the wealth of the afterlife and that of this life (*nor forget thy portion in this world*). However, in doing so, one should not indulge in transgression (*seek not (occasions for) mischief in the land*). As such, it is permissible to strive for prosperity but such an act must never involve the victimization of others or any other forms of disruption.

Metaphorical Comparison

To analyze the impact of accumulation the metaphor of wealth here contends against another one that portrays it as a shed that protects the individual on rainy days (Raymond, 2010). Now, although the former is more concerned with the process of building wealth as opposed to the deliberation of collecting it for emergencies, both refer to the notion of storage.

A bowl of rice will never grow into a bag
WEALTH IS LIKE RICE IN DIFFERENT CONTAINERS

Saving for the rainy day
WEALTH IS LIKE A SHED ON RAINY DAYS

From the perspective of goal, the rice metaphor indirectly speaks of the notion related to the significant increase in wealth. It is apparent that the aim is imparted in a negative connotation, and perhaps to a certain extent, quite inversely from the textual description, but the truth remains pure and simple. The metaphor acts in a manner that is remorseful of wealth (Mungan, 2012).

The shed metaphor, however, paints a more positive light on wealth. It is not ladened with the pressure of collecting wealth, but rather, saving it for the purpose of impending crisis (Johnston, 2014). Should there be a day when the individual is burdened by a particular calamity; the wealth saved might be able to offer assistance in resolving the problem at hand.

Perhaps a concrete scenario can demonstrate the role of wealth in an emergency. For instance, when an individual suffers a certain disease such as cancer (Svatek et al., 2014) and must be admitted to the hospital, the wealth he had gathered earlier can be used to support the extremely high financial requirement of being at the medical facility. Such financial support may only be available through years of saving.

In reality, the accumulation of wealth reflected by the rice metaphor suggests the need of incorporating actions that enable its increase. These actions are practically active in the sense that they must contribute to extending the input of wealth. For instance, the individual may have to work more or invest (Foucault & Fresard, 2014) more wisely in his ventures to instigate the realization of additional income.

Contrary to the active contribution that relies on the expansion of input, the shed metaphor proposes that the output should be minimized such that more wealth can be contained or saved (Berger, 2014) for future emergencies. The contained wealth must be conserved diligently by rejecting any trivial requests that are not entirely urgent in their nature. Instead, it should only be disbursed when a truly pressing situation arises.

RESULT AND DISCUSSION

The rice metaphor covered within this section touches mostly on the idealism related to the static portrayal of wealth or rather, how the community believes that it is a fated quantity that can never be changed. This may have resulted from their erroneous interpretation of a hadith in Islam that explains the nature of creation and wealth that is decided prior to birth. However, this is refuted by various Islamic preaching that describes the manner in which wealth can be increased through virtuous

actions. This metaphor is subsequently compared to another that insinuates wealth as a form of assistance in moments of emergency. More wealth should be contained or saved immediately at that particular time for future pressing needs as emphasised by communication and industrial psychology scholars Katz and Kahn (Huda & Faridah, 2021) who aptly put it: *What you are today is what you will be tomorrow* – which emphasised that current saving on wealth will assist in our future needs, especially in times of difficulties.

CONCLUSION

The metaphor used by the late Aminuddin Baki was focused on emphasizing deep reasoning to sensitize the Malays. This metaphor was stapled by the idea of progress in order to deliver a message to the Malay audience that their weakness in the ability to adapt had prevented them from staying relevant to the benefits of progress in their environment. This was analyzed based on the metaphors used endowed with a recommendation that was related to the attainment of progress from a particular point of view.

The other conclusion of this study includes metaphorical methods of conveying messages which are still relevant in the current society due to the fact that the Malays are culturally sensitive to direct messages as often practiced by Westerners. For decades, Malay people do not express their feelings or ideas openly but would rather use metaphors to convey their intentions. Hence the use of metaphor is still an effective method to sensitize the audience to respond to a certain situation due to its subtleness in addressing the issue while at the same time being impactful enough to urge the audience to compel to the situation as envisioned by the creator. This can be seen in how Aminuddin Baki's speech managed to invoke the urge in the Malay society to pace more actively towards advancement despite their inability to adapt. All three canons of rhetoric were wisely used when conveying his speeches in the early sixties.

AUTHOR BIOGRAPHY

Dil Froz Jan binti Sayed Halem Shah, Ph.D., is a senior lecturer attached to Infrastructure University Kuala Lumpur in the Faculty of Business, Information Technology, and Human Sciences. She was the Head of the Communication Department in 2012 looking after three undergraduate programs. Currently, she is the Head of the Postgraduate Programme for Communication at the Centre for Postgraduate Studies, IUKL, for a second term. Email: dilfrozjan@iukl.edu.my

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The Role of Narrative Expression in Ethnographic Films in the Mechanism of Aesthetic Communication: A Case Study of *"Free Goose".*

Geng Site[1,2] & Faridah Ibrahim[1]
[1]*Infrastructure University Kuala Lumpur, MALAYSIA*
[2] *Fine Arts College of Guangxi Arts University, CHINA*

ABSTRACT
This paper sets out to explore the influence of "Free Goose" in Guangxi ethnographic filmmaking field by observing the narrative expression and aesthetic features. In the narrative tradition of observing human culture and life, ethnographic films often present the existence of ethnic groups and regions in rough and simple film language. Individual gazes and their aesthetic expressions are skewed in the mainstream creative paradigm, but in ethnic culture, an increasingly multi-dimensional texture appears in its interpretation. This paper focuses on a selected research sample on the visual narrative language and aesthetic artistic characteristics of the ethnographic film "Free Goose". This paper is qualitative research that used the comprehensive observation and interpretation of anthropology, narratology, and film language to carry out a case study on the film "Free Goose". The study used in-depth interviews and text analysis in order to sort out the cultural significance of ethnographic films in Guangxi, China through aesthetic principles, and explore the reason and way that narrative mode can constitute aesthetic form. The study concludes the communication mechanism of aesthetic art is an important element that should not sideline.

Keywords:
Ethnographic film, narrative expression, aesthetic features, communication mechanism

INTRODUCTION

Aesthetics, as a branch of philosophy, has been developed since ancient Greece and its speculative nature has always existed and guided and fed back technology and academics (Cottingham, 2021). It has always followed the academic viewpoints of philosophers such as Kant, Hegel, Adorno and so on-aesthetics belongs to the category of philosophy. The research questions which are studied in this article are based on the academic background of philosophical aesthetics and narratology that have academic foundations to follow in the field of ethnographic film production. Particularly, according to Pippin (2021), aesthetics cannot exist independently from the support of philosophy. Moreover, with the evolution of philosophy and the development of human industrial civilization, the birth of film art is accompanied by aesthetic characteristics and styles. The aesthetics of visual image art has always been a topic of concern and discussion by researchers, and this kind of research started from the beginning. Reason tilts toward later sensibility, and it also branches into various refined types of aesthetics and technical aesthetics (Waki, 2021).

To understand the situation from the making of this iconic film, this paper discussed the characteristics and contributing factors for shooting and editing the ethnographic film "Free Goose" by using data from in-depth interviews. The preliminary findings from the director who made this film in this in-depth interview found that an individual's observation and gaze play a crucial role in the formation of aesthetics. When it comes to content creation, dramatic conflict, and gender identity were mentioned by directors, it is concluded that audience acceptance is highly regarded with the protagonist's life-changing stories.

The ethnographic film "Free Goose" is a masterpiece of Guangxi ethnography film that has emerged in the Chinese ethnography film. The awards for this film "see the big from the small" incisively pointed out that it is an anthropological film and television language. The highlight of

narration and recording is the balance between individual gaze and ethnic culture. On the basis of the classic structuralist narrative, "Free Goose" is biased towards the narrative of spectacles. Its video narrative opens up a "gender identity" cut from the most basic traditional linear sketches, although the middle and later sections are interspersed with flashbacks of time and space relations, and it does not follow the narrative. Break away from the classic paragraphs, the core is always clear, and the narrative text is regular.

Its "spectacle" lies in the aesthetic indications of narrative ideology shown in the narrative text. This "spectacle" has nothing to do with elements such as imagination, surrealism, and absurdity. The director has no intention to make a record with ethnographic attributes. The film exaggerates the narrative level, and does not focus the narrative on queer stories, it is not the core of a typical Chinese transgender and homosexual popular story (Zhao, 2020). Besides, it is intended to use narrative reflexivity as a narrative driving force to drive the audience into the field of spiritual experience and empathy. This is not only different from the paradigm of an anthropological documentary showing the appearance of foreign cultures and customs, but also different from the previous focus of humanistic documentaries on the exposure and shouting of the bottom. Its signifier-"life" reflects the aesthetic image trend of ethnic culture in Guangxi minority areas. Field shooting and recording and observation of individual life growth give this film new aesthetic characteristics, "The transition of contemporary film narrative aesthetic experience from participation, context to 'hybridity' echoes the needs of audiences and the background of the times, and reflects multiple aesthetic meanings." (Ma & He, 2019, p.141).

LITERATURE REVIEW

The literature review about the narrative element analysis and aesthetic concept of the ethnographic film began with the collection and assessment of relevant literature published in recent decades. For paper collection, CNKI academic websites were utilized and updated up to September 2022. The keyword search included "ethnographic film, narrative, aesthetic," and then the title (and abstract) was screened. Bao (2021) clarified the direction of this research path. He believes that from the macroscopic human language system to the appellation of family kin to the concern for human unity, anthropology is always exploring the path of exploration of the "human" object. Turning the perspective to the micro level, the German philosopher Husserl proposed the concept of "Life-World", putting life before the world. According to Husserl's phenomenology, life is the first, and life is the most precious thing. It can be said that this kind of thinking echoes the spirit of Chinese culture, such as the morality described in "The Analects". When you hear the news of the fire in the horse ring, you should first ask if the person taking care of the horse is hurt; as in the narrative style of "Historical Records", with characters as the center. How does Husserl's concept of the world of life be used in anthropology? Bao Jiang (2021) provides a path for the study of the life world of film and television anthropology, including topic selection, academic history combing, fieldwork, locking the protagonist of the film, starting shooting, and sharing with the public.

It is worth noting that the anthropological theory of the gaze and the particular treatment of the gaze in an ethnographic context are often in trouble because they are theoretically tied to reality due to the shortcomings of anthropological theory. They also often fail due to the opposite problem as they believe that they need to be anchored to extract abstract theoretical benchmarks and fail to take experience into account. This ambiguous oscillation often causes anthropological narratives to be discarded by philosophy and common sense, especially making any discussion about gaze meaningless (Hamzah-Osbourne, 2021). According to Li (2021) at the China Anthropology Conference Forum: "The development of academia is going step by step, marked by milestone events and films, and it is always supported by academics. There definitely will also be shortcomings of support from the industry such as the technical and economic constraints of television cameramen,

independent documentary directors, and ethnography workers." These challenges are then followed by a multi-modality formed by the confluence of academics and technology. In response, Francesco (2021) is more explicit in warning that on the whole, the current limitations partly stem from the curious contradictions within the discipline, because they are caught between a lack of concrete theory and a lack of abstract practice. This is a reminder that film, part of the context, has the social and cultural norms of film origin. However, based on the fact that film has the characteristics of interacting with individuals through language, these representations can be returned to society in a "digested" or "redefined" manner.

On the other hand, the language of cinema is composed of both the visual and the auditory. The use of visual narrative in ethnographic research is not only an observation tool, but also reflects and produces different knowledge processes, and well-designed methods can represent a unique writing style. Audio-visual narration is part of social reality and also of the process of establishing a collective identity. It itself is the object of anthropological research. These images are understood as part of social reality and capable of dialogue with cultural norms, directors, and researchers. Therefore, like other social reality norms, visual resources are not yet ready to operate and identify individuals. It is part of a complex process that is constantly updated. This kind of mutual influence has an aesthetic effect on the visual resources and the narratives and images that constitute the representation of the theme in its social reality. Visual resources in communication are acknowledged to be powerful in cognition and memory (Paivo, 1991), but they are not just transmitters of information; they are the products of cultural histories and the cognitive resources we use to create meaning (Kress and van Leeuwen, 2001; Mirzoeff, 1999).

Ryan（2019）explained that the term "aesthetics" comes from the Greek word "aesthetics" and refers to sensory perception. Until recently, the field of aesthetic inquiry in the Western philosophical tradition has been dominated by questions about the beauty and taste of art. Aesthetic philosophers have been committed to deriving the standards and principles for making correct aesthetic judgments. The foundation is that aesthetics constituted an autonomous value field, which should be isolated from social concerns, moral considerations, or power relations. Høgel (2018) believes that in the face of materials representing various forms, material conditions, and styles of different ethnographic fieldwork eras, we choose not to target any homogenization of materials. Instead, we try to highlight the aesthetic heterogeneity and diversity of the methodological discourse we encounter. The purpose of art is to convey the feeling of things because they are perceived, not known. In recent years, more and more art historians, sociologists and anthropologists have begun to pay attention to the aesthetics of ethnographic video art, to what role images and sounds would play in the field investigation of ethnographic films, they have begun to publish some noteworthy research results, especially in the aesthetic presentation.

According to Lee (2021), in film, the camera should be used as the same "light and shadow" brush as in painting, calligraphy, sculpture, poetry, music, opera, etc. It can be used to transform itself into something big or go into the depths, to show the realm of transcendence and earthly feelings, to look down on the vast and endless universe of heaven and earth, and to see all the active and rhythmic lives and their beautiful hearts. Lee further explains that "air" is the core direction of Chinese film aesthetics. This study extends this concept to the field of ethnographic cinema, as it embodies a poetic and anxious consciousness that assimilates the emotions of the largest audience and tries to guide the audience's mind. This is a very ideal state and a future-oriented spiritual aim of Chinese ethnographic film aesthetics, which exudes the light of Eastern humanism from the beginning to the end. Lu (2022) clearly asserts that ethnographic films fulfil the purpose of anthropology in three layered dimensions: visual, everyday life, and emotional, and provide an intuitive lifeworld. Their understanding and analysis of aesthetics emphasized the production process and artistic expression of influence. Hediger (2019) believes that the inconsistency of form is the reason for the definition of practical films as aesthetic means, which also makes them a model of film historical aesthetics. Although this is not a

view raised for ethnographic films, it discusses the rules of using audio-visual language skills in the production and editing of ethnographic films from a technical perspective.

Balázs (2010) pointed out that in the field of film, what we need is to understand film and such an aesthetic theoretically. It is not to draw conclusions from existing works of art, but to require or expect some kind of artwork. In response to this, Jin and Xu (2008) responded that in fact, this view is to explore movies from a cultural perspective, and cannot be regarded as a true aesthetic theory. As mentioned above, theorists such as Metz's discussion on film language is worthy of reference, because "classic film theory starts from the traditional aesthetic point of view as the expression of film as art." (Brown, 1994, p.166-167). And the change of artistic thought was not isolated at the time, it appeared with the advent of western social thoughts. Benjami recognized this change, cut into photography, analyzed the difference between classical art and modern art from the perspective of art manufacturing technology, and predicted that mechanical reproduction would lead to the emergence of popular culture. This is Benjamin's technical reproduction aesthetics. This aesthetic thought of his is mainly reflected in the completion of "Works of Art in the Age of Technological Copy" in 1936 (Mourenza, 2020).

Ethnographic films usually transcend the artistic or decorative sense of images and use them as cognitive tools to suggest abstract concepts. The discovery of real events aims to reflect as much as possible the opinions, experiences, and feelings conveyed by participants regarding a particular culture (O'Regan, et al., 2019), which will inevitably produce new aesthetic meanings and the study of cultural groups and individuals will produce the subjective aesthetic expression of the recorder himself. This will inevitably inspire new aesthetic meanings and trends: the study of cultural groups and individuals will produce subjective aesthetic representations of the chronicler himself. Although the director must objectively and emotionally distance himself from the subject in order to conduct effective research, and the new trend should focus on balancing cultural group and individual research, how to deal with all the photographic material captured is a process that reflects the recorder's aesthetic concept. (Zhu, 2019)

In ethnographic film communication, regions and ethnic groups would have differences in all aspects. Difference in language, culture, economics, religious beliefs, customs, etc., may exist between communities, groups, or individuals. From the perspective of the dynamic social impact theory of communication, the social space where people meet each other, know each other, and communicate with each other is a tangible space. In this tangible space, if people know each other or share the same identity, they would easily become a group. Otherwise, the further they are away from this space, the weaker the impact of the space may have and the less effective the communication would be（Hong, 2018）.

Based on the above research questions and literature review, this study, therefore, aims to identify and discuss aesthetic trends in ethnographic films in the context of narrative expression and aesthetics, and to dialectically discuss the contextual background that gave rise to this particular study, this article explores from the perspective of aesthetic communication It discusses how the ethnographic film "Free Goose" touches and empathizes with the audience in the communication mechanism.

Objectives—By collecting and analyzing relevant data, perspectives and narratives to answer the questions formulated below：

1. How does the narrative strategy of the ethnographic film "Free Goose" unfold?
2. How does the narrative of the ethnographic film Free Goose influence the aesthetic features?
3. What is the aesthetic transmission mechanism of the ethnographic film "Free Goose"?
4. What are the factors influencing the aesthetic communication of the ethnographic film "Free Goose" that can touch the audience?

The recorder in this study refers to the film director. It is a process to embody the recorder's aesthetic concept in how to deal with all the image materials shot, although the recorder must be

objective and emotionally distanced himself/herself from the subject in order to conduct effective and objective research.

METHOD

Based on narrative and aesthetic theories, this study adopts a qualitative research method through in-depth interviews from the perspective of audience reception in communication research. This study analyzes the narrative rhetoric of the ethnographic film "Free Goose" by carefully observing the dramatic conflicts of the characters' actions and plots. This paper discusses how the aesthetic characteristics produced by narrative influence the dissemination of aesthetics and ultimately reach audiences. Since this study focuses on the growth of characters and the aesthetic characteristics formed by the narrative of the story, the important elements that have received the most attention include plot, character growth and change, and the event setting. The resulting aesthetic features include the independence of the protagonist's personality, the emphatic meaning of individual gaze, and the coarse but authentic audio-visual language. In the process of these aesthetic features entering the communication mechanism and reaching the audience, the narrative strategy, the application of audio-visual language, the selection of the broadcast platform, and the communication between the communicator and the audience after the broadcast are important indicators to test the communication effect.

This study had chosen the ethnographic award-winning film "Free Goose" as a sample. The film "Free Goose" is a story about the growth of a small-town youth and his way of making a living, as well as the formation of his own gender identity in the process. "Free Goose", directed by Zhuang writer Zhou Lei, tells the inspirational story of a young man Li Enping who perseveres in learning Tian Qin. Li Enping, a student majoring in music performance at a college in Tianjin, his father has been out for many years and is almost no longer responsible for his family; his mother raises his younger brother at home alone and takes care of the elderly. Li Enping, who has no family to rely on, can only rely on Tian Qin to make money to support his family and pay expensive tuition. In order to attract attention, the Tian Qin he performed was charming and enchanting and was often denounced as a "shemale", but he insisted on taking the reverse path of performance. This film is now in the collection of the China Ethnographic Museum. The reason is that this museum is the largest carrier that reflects the current ethnographic documentary in China with public screening media. With the largest collection of government units and the most intensive cultural protection, academic exchanges and the compilation of film and television materials and documents are relatively rich, inclusive, and diverse. They have become the academic tools and the largest platform for anthropological and ethnological investigation and research, and represent current China's status as the creative dynamics and trends at the forefront of ethnographic films. This film is a high-quality film that has won awards in the national academic exhibition of ethnographic films held by the museum which can be discussed from the perspective of narrative and aesthetics. It can be an item that researchers of Chinese ethnographic film history and Chinese ethnographic film history, the directors, artists, and anthropologists of front-line creation conduct academic research to provide space and topics for discussion. The textual content of this study is an in-depth interview with the director of the film. The interview was conducted for one and a half hours. The entire interview process was recorded and all interviews were compiled into texts for research use.

The location of this research is the area where the ethnographic film "Free Goose" is located. The creative concept is based on the development of "descriptive" and "expressive" shooting records under the cultural background of the nation. The narrative of the local context is true to the sample. "Deep description" has natural advantages for the regional culture and visual style (Zhu, 2019). The area where the protagonist was born and grew up in "Free Goose" is a small border town in Guangxi

that has strong ethnic characteristics in cultural form. The performance on which he lives is one of the most famous art forms of this ethnic group.

FINDINGS AND DISCUSSIONS

This paper reports the findings of an investigation into how the narrative strategy of the ethnographic film's award-winning "Free Goose" formed its aesthetic characteristics and entered the communication mechanism to finally reach the audience. They are divided into four themes according to the question:

The findings are based on the elaboration and discussion of the director's personal creation of the ethnographic film "Free Goose" compiled during the in-depth interview.

Findings for RQ1

How does the narrative strategy of the ethnographic film "Free Goose" unfold?

In this in-depth interview with the director, he believes that there are several clear themes in the narrative strategy of his film - ***personal story focus, scene selection, and editing logic***.

Personal Story Concerns

The rejection of alienated performances in regional culture constitutes the character arc and confrontation spirit of the protagonist Li Enping. The narrative structure abandons the grand and expressive narrative of national propaganda films and instead presents the plot conflict by entering the characters' life experiences through subtle glimpses of life. The film does not simply mention ethnic folklore such as funerals and divination, but as events in the character's storyline, the development of the plot is formed sequentially. The character growth is combined with the local culture, in line with the narrative logic of the inner perspective and the real observation.
The director emphasizes that his films are not about the group but the individual:

> *"Because the protagonist is a female sexually oriented person, and his family belongs to a disadvantaged category in society, then I plan to start from these two entry points, how to integrate them into society."*
> *When choosing the focus of his film, the director did not consider the relationship between the larger ethnic group, the community culture and the small individual life, he explained:*
> *"I didn't really think about it that way, because I had no experience with queer people before making this film. So my focus was always on Lee Eun-ping himself, and I didn't know there was such a huge community in our world until after the film was released."*

As Bao (2021) believes: "Filming is to try to present a person's life world as completely as possible in the limited audio-visual time and space. This is really difficult, requires creative work, and there is no ready answer, but it is worth exploring." (Bao, 2021, p.59). The "presentation" he proposed, from a practical technical point of view, refers to the selection of narrative topics and the perspective and method of penetration, the information details of the composition, and the narrative processing under the aesthetic concept of post-editing. The interview results reveal how the director completed the "presentation". The results show that imagery is the narrative strategy of the ethnographic film "Free Goose", where the director hides the psychology of empathy with the audience, and he focuses the narrative theme of the film on the emphasis and attention to the fate of individuals, which is an exemplary use of individual narrative and presents a poetic film language beyond the narrative itself. In other words, the poetry of this national film does not lie in the romantic and light-hearted narrative language, nor in the humanistic intentions captured by the camera, but in

the fact that Li Enping deals with his own spiritual growth alone, and the context of his life is the poetry itself. Bao (2021) believes: “Filming is to try to present a person’s life world as completely as possible in the limited audio-visual time and space. This is really difficult, requires creative work, and there is no ready answer, but it is worth exploring.” (Bao, 2021, p.59). The “presentation” he proposed, from a practical technical point of view, refers to the selection of narrative topics and the perspective and method of penetration, the information details of the composition, and the narrative processing under the aesthetic concept of post-editing. It can be found that image is the narrative strategy of this film, and the director hides the psychology of empathy with the audience. The poetry of “Free Goose” does not lie in the romantic and relaxed narrative language, nor does the camera capture the purpose of humanistic care, but Li Enping's alone coping with spiritual growth and his life background is the poetry itself.

Scenario selection

The narrative line of “Free Goose” is clear, showing events and plots gradually in accordance with time, the external plot line is not cost-effective, and the spatial relationship expresses traditional regularity. The internal emotional line presents a metaphor with great imagination and insight. For example, there is a scene where the protagonist has an infusion at the clinic on the night of the Spring Festival. The voice of the news broadcast on TV is no different from any environmental sound to Li Enping. He looks at his mobile phone like all the mentally self-lonely young generations and suffers from physical suffering and endless fate. The ruthless presentation of reality in the documentary will make viewers feel ethical resistance. This segment has been criticized by the audience for being overly straightforward and rude on ideological issues. The narrative logic and metaphors for documentary films and the cruel life itself constitute a kind of landscape.

The director stated that,

> *“This scene was deliberately designed to move my camera that way. Because I believe this is a strongly contrasting narrative scene. Most of the audience watch from the perspective of human nature, while the minority of extreme viewers who stand out and challenge me are those who are influenced by the solidification of ideology. These two are in opposition. Then the normal mental and emotional judgment of most people is human. Those who are enslaved and enlightened by so-called knowledge always think that what is glorious, great and right is worth filming. This kind of audience is a "tool", which I think is pathetic.”*

The narrative is not deliberate, and the editing is not hypocritical. It naturally flows out of a series of narrative lines related to growth such as Li Enping’s funeral to his relatives in his hometown, going out to study in different places, running to work and performing social relations, and dealing with social relations. The antagonistic dark lines hidden everywhere are the formation of Li Enping’s personality that accentuates the technical expression of characteristics. There are two representative scenes of this kind of confrontation: the first is an interview with Li Enping. His self-report is a self-analysis of the Rejection of homosexual advances and confusion about heterosexual relationships, so the story is conveyed through the characters themselves. Although this is not a first-person documentary it is self-explanatory. The form of self-talking gives the audience a more conclusive sense of reality and the meaning of resistance is more obvious. The second confrontation scenario is the comparison of social identity and status between Li Enping and his peers. Li Enping’s performance is defined as a kitsch or tacky performance that runs counter to tradition in the social evaluation and the merchant invites him to perform for the purpose of entertainment. While, Li Enping, who is looking for a way out of his livelihood, is noncommittal about his artistic expression because the essential problem lies in economic interests. However, the plot that appeared in this situation created a new confrontation and the organizer temporarily decided to cancel Li Enping’s performance. Li Enping, who was well prepared in the background, responded calmly as the habitual

numbness would not make him feel dissatisfied. When young people of the same age gathered to sing and dance with joy and laughter, the camera turned to Li Enping, who was idly watching his mobile phone because of the cancellation of the performance. The viewer could not know that Li Enping's heart was as calm and indifferent as his behavior, but the two life states presented by the camera were self-evident.

Editing logic

From the interviews, it was found that the use of the material in the cuts gave the film a symbolic meaning to the characters and times. As Foucault (2003) said, "the main problem in today's society is resistance and obedience." The director's exposure to the characters' privacy is moderate and absolutely respectful, including the appearance of other sideline characters in the film, the presentation of some religious ceremonies, and family funeral scenes. The record and the expression of the character's emotional state always contain a kind of resistance. Each character lives with a certain resistance. In the editing logic, the director does not sell or expose. He prefers to delete and not abuse to make the film a more intriguing space for discussion. He emphasized that:

> *"Hundreds of gigabytes（GB） of materials. I will choose to interview him where there is some real information in his shooting and fill in the information. I USED ALMOST 80% OF my footage. I chose representative shots, and deleted unused something that was repetitive information. I only used the most useful items. I haven't use anything that wasn't relevant to the overall theme of the film."*

As an important audio-visual language processing tool, the director has done an excellent job of using visual narrative in his editing work for the ethnographic film. His camera is appropriately selected as a tool of observation, which maximizes the protection of the human rights of the film's subjects. Although the audiovisual narration is a very important means of expression in ethnographic films, the director still uses editing logic in the later stage to echo the content that cannot be reflected in the live shooting. Among them, the images in a large number of materials are indeed understood by the director as a part of the social reality, which reflects a cultural norm in the director's editing work. He uses audio-visual language to identify individuals and complete the discussion of social issues. At the same time, he also uses montage to constantly adjust audio-visual language into a clear narrative line. This interaction produces an aesthetic effect on audiovisual language and the narratives and images that constitute the subject representation in social reality.

Findings for RQ2

How does the narrative of the ethnographic film Free Goose influence the aesthetic features?
The themes that emerge from this research question are – ***Patriarchy, Female image.***

Patriarchy

"Free Goose" has an aesthetic experience in the sense of true construction. The narrative of the film is set aside in the contradictory situation of individual growth, and the character's spirit is castrated and resisted to achieve reconciliation in his growth. The classic narrative routines used in Hollywood fictional films still have a heavy aesthetic texture in the context of ethnographic films, which not only follows the narrative ethics but also does not break away from the aesthetic poetic boundary. For the aesthetic drive and core elements of ethnographic documentaries, the key to transformation is human, human existence in society, human spiritual and emotional appeals in the family, and human self-contradictions and struggles. The group nature behind people forms a cultural state, only reflections and discussions can be achieved. The paradoxical situation of people in "Free Goose" always takes documentary aesthetics as the prerequisite, and is slowly reflected in the essence of life, resulting in

an increasingly sharp aesthetic expression. The director has very clear intentions for his aesthetic formation:

> *"The original intention of my shooting is to present the problem between a weak man and his native family and social relations. He has the contradictions and struggles at the bottom, but the social level which suppresses such a weak man strongly is complex."*

In Li Enping's family ethics structure, the image of the father is always absent. The reality contrast of running away from home many times and having family responsibilities replaced by the son constitutes a symbolic spiritual reference through the perspective of the father on the motorcycle dodging behind the door frame in the picture. However, the film does not use the father as a hostile image as a narrative strategy, patriarchy is a signifier that reflects Li Enping's personal growth. Li Enping frequently supports his father financially and this inverted funder status conversion brings Li Enping not to "killing". "Father", but his inner sympathy for the mother to help her regain the integrity of the family and her own return to the identity of the "son" drive, so Li Enping's patriarchal "Oedipus complex" structure is not released in the film. But weakness does not mean passing away, like his father, who returns from time to time for reasons such as "can't hang on" or "come back for the holidays", makes Li Enping desires a kind of stability and peace of mind on the psychological level, but he clearly knows that the essence of patriarchy is hidden for him. On the negative side, he put aside this patriarchal dilemma. His father is a functional figure. The way he strives to get rid of the predicament is to face and solve all problems by himself. It is worth thinking about that, despite this, patriarchy will inevitably have an impact on Li Enping's gender context, and it can even be said that such patriarchy is an accomplice that leads to the vague self-recognition of Li Enping's gender.

From the above information, we can conclude that the confrontation with the patriarchy is one of the aesthetic significance of this film. It embodies one of the most poetic humanism in life that remains even in the face of an anxious consciousness of the family structure. This spiritual goal absorbs the emotions of the largest audience and tries to guide their thoughts. This is a very desirable state and future-oriented aesthetic endpoint of the previous research view on the aesthetics of Chinese ethnographic cinema, that is, an anthropological purpose that is achieved on three levels: visual, daily life, and emotional, providing an intuitive life-world. This gives scholars an opportunity to remind them to revise the long-standing parochialism of the cognitive objects of anthropological research and the arrogance of insisting on a single cognitive approach, so as to examine the lifeworld of living individuals both rationally and poetically, and to recognize a more comprehensive heterogeneous culture in a more holistic way.

Female image

There are three female images in "Free Goose": the first two is closely related to Li Enping within the ethical relationship between his mother and grandmother. The third one is the "female image" given to Li Enping by social evaluation, this type is the ambiguous "female image" in Li Enping's self-evaluation. Li Enping's mother and grandma's female images are traditional and suffer from life. For Li Enping's grandma, "child filial piety" is blank, and for Li Enping's mother, her husband's betrayal has put her marriage to shame, and she longs for loyalty and family integrity, all "fortune-telling seeking method". Starting from the family structure, the collapse of his father's "male image" castrated Li Enping's spirit from the side, but he was well versed in the masculine voice of society and the law of survival of the family, so he himself was duty-bound to play the self-reconstructed "male image". This "male image" is absurdly based on female consumption. Li Enping makes full use of male scrutiny and transforms his stage appearances into images of feminine characteristics to achieve gender consumption.

However, female scrutiny also appears in this shelving. As a female audience, what kind of attitude, pastime, or sympathy, as a female audience toward male actors' assimilation performance,

is unknown. What is clear is the ambiguity of Li Enping's male self-spiritual portraits and the phantoms of psychological symptoms that formed the film "Female". The establishment of the aesthetic level of consciousness. Li Enping's artistic expertise in making a living stems from the traditional art forms in Longzhou. In the context of cultural protection and social norms, what the locals have criticized him is the appearance of gender identity and the pressure on him and society by public opinion. The male coveted and even sexually harassed his "female" flattery putting Li Enping in a conflict of contradictory beasts. He is unwilling to give up feminine performances and refuses to flatter women. The way of human nature and hesitation of position achieve aesthetic images in the narrative of the film. In particular, the beginning of the film's growth narrative is the isolation of luxurious and noisy hotels and restaurants and the streets of the square. The lens language of hand-held photography is simple and has a strong on-site openness. And the little girl who imitated Li Enping's dancing under the stage, which was suddenly and accidentally captured in the camera, replaced the director to complete the transition of the film's aesthetic meaning, which the director called the "stroke of the gods":

> *"In the film, at the banquet hosted by the successful businessmen, they sing songs praising the good life, and at the same time, they observe the weak people who perform for them through the glass, which is bound to produce a strong contrast relationship. I didn't expect the scene to come out so neatly."*

However, it is worth discussing that the ambiguity of the male mirror image in "Free Goose" does not mean that the "male image" is completely broken. The three "female images" have played a back-feeding effect on Li Enping's self-identity and gender recognition. Li Enping's deconstruction of self-gender awareness and the construction of "male images" should be based on the above three "female images".

Findings for RQ3

What is the aesthetic transmission mechanism of the ethnographic film "Free Goose"?

The director who just shot his first ethnographic film, frequently mentioned three key themes that influenced the film's communication during the in-depth interviews. These three key themes clearly explain the distribution mechanism of the film - ***Film festival, Economic benefits, and New platforms.***

Film festival

The director admits that currently participating in film festivals is one of the usual communication channels for filmmakers. Compared with the way commercial films enter the capital market through cinemas, at present, ethnographic films with small investments, long production cycles, and relatively simple teams are mostly transmitted in China through film exhibition projects of museums, film festivals organized by folk scholars, and some academic film exhibitions. He explained that:

> *"Cause I am shooting an ethnographic film, I've always pay special attention to the ethnographic film's updates, official accounts and so on. In the process of information crossing, I found this film exhibition. Because when the movie is over, I have to think about where it's going, what the promotional way it's going to go."*

Film festivals and exhibitions are one of the most traditional and reliable transmission mechanisms for this ethnographic documentary. As for his experience as a director, he said

"I also shortlisted in the Guangxi Ethnographic Film Festival which I was participated, but I was not shortlisted the FIRST Film Festival in Xining I supposed that the reason possible was the

rough production. I also participated in an independent documentary film exhibition organized by Zhang Xianmin, a professor at the Beijing Film Academy."

Economic benefits

One of the most important factors in the communication mechanism is economic benefits. The director said:

> *"My film was also played on a self-media video platform called iQiyi, but it was taken off the program soon. Maybe they thought there was something inappropriate about the film. I submitted the film to them myself because I could get a share of the box office from it, but the amount of money I got was so small that it wasn't worth mentioning."*

New platforms

The director provides a variety of examples of possible ways in which ethnographic films could be communicated in addition to film festivals and he also emphasizes the importance of constant experimentation. He claims:

> *"I submitted the film to CATHAYPLAY, an independent arthouse film platform in Singapore, where it is currently being screened. It was also shortlisted for the Beijing Aiku Film Week, which is a film project focused on queer group. For the screening, they felt that the aesthetic core of my film was very suitable for a film platform with a very clear theme like theirs."*

From his description, it can be found that more media platforms try to spread ethnographic films to the maximum extent, and the expectation of such a communication platform depends on judging whether the aesthetic preference of the platform is consistent with the aesthetic expression of the film.

Findings for RQ4

What are the factors influencing the aesthetic communication of the ethnographic film "Free Goose" that can touch the audience?
The themes that emerge from this research question are – ***Aesthetic proposition, Platform development***

Aesthetic proposition

Yan (2020) explained that western art studies rely on existential aesthetics. The philosophical attributes of aesthetics make it exist in the form of artistic philosophy for a long time. It is only in recent decades that scholars have begun to think about establishing real Art research methods. Aesthetics studies art from a philosophical level, and its research has philosophical implications. Aesthetics research is more speculative and abstract. When art studies art, it only involves the scope of aesthetics to a certain extent or to a certain extent and has an unconscious aesthetic nature. Art is more empirical and specific, and it pays more attention to artistic practice than aesthetics. Television and other specific artistic issues are the most notable feature of drawing conclusions through the inductive deduction of a large number of artistic phenomena. This is exactly what this article will discuss and determine. As the director defends his aesthetic claim:

> *"What I mainly want to discuss mainly is from the social level and between individuals. I want to present a sense of contrast and contrast. In the peaceful and prosperous times of singing and dancing, there will be difficulties of the weak. It was a deliberate expression on my part."*

Video text is used as a symbolic construction medium, and the artistry of ethnographic narrative language itself originates from the independence of people. “Free Goose” emphasizes the narrative strategy of individual observation, which benefits from the geographical relationship between the creator and the subject of the same race, and the video record of the individual life experience is undoubtedly engraved with the symbols of individual ideology in the collective narrative of the nation. Although the lens language of this film is still rough, it has successfully focused the narrative perspective on the time and plot development of the characters. The film's unexpected narrative entry point is different from the mainstream way of focusing more on groups in ethnographic filmmaking but instead focuses on the independence of the protagonist as an individual person. The biggest difference in creative techniques between documentary and ethnographic film shooting is the difference between active and passive. Documentaries can participate, can intervene, and control, while ethnographic films follow the record passively. In such a creative context, personal field shooting will be somewhat helpless and restricted. Regarding this aesthetic composition, the director explains his aesthetic proposition:

> *“There's another scenario, it is his mother on the border, help smugglers carrying contraband, although I was not allowed to enter but his mother used her mobile phone to help me shoot a lot of footage and clips, oh my! You know what? Hundreds of people were carrying smuggled goods across the border just like ants on the Sino-Vietnamese border, on the border line full of quagmire and thorns, they breaking through the bottom line of the law and the system in order to live. But when I attended the film festival, this clip was asked to delete because it involves a politically sensitive issue, they explained that although this is a good production of the film, but consider the broadcast platform, It was better to delete. I don't think it detracted from the overall narrative or the aesthetic point I was trying to make, so that's what I did.”*

The narrative center of “Free Goose” lies in the process of survival and growth of the photographed subject with national identity and social attributes, and it has indeed completed a kind of individual and common information transmission. Individuals independent of the national collection are the starting point that is more worthy of artistic language expression. It is not so much that “Free Goose” records the cultural state of the national collective, but rather the director experiences the individual in the collective state through the camera lens and his life philosophy of the subject.

Platform development

Based on the text of this in-depth interview, ethnographic film, as a piece of important information, has entered the communication link, and its aesthetic value can successfully reach the audience, which is a very important highlight -- the great role of the communication platform. As in the director's work "Free Goose", he describes the initial opportunity of his work:

> *“It was when I watched the short video that I found his performance was very special, a boy who tried to show his charm by acting in a feminine way, but was despised by the neighborhood. He is willing to insist on this way to earn tuition for himself. The short video is only five minutes long, but it has millions of views. I found him to be a good choice, can take me through communication with the boy told him about his own identity, and ask him if he can shoot a film for him, he very readily agreed, because he made it clear he after graduation to be an artist, he needs more awareness and exposure, he thinks, My shooting will be helpful to his future career. In fact, I shoot with the perspective of literature and the language of the lens. After all, I have rich experience in literary creation and writing. After my shooting, I participated in the film week with the theme of the third gender group. The exhibition made by this platform allowed my film to be seen by the audience and the same people. In my opinion, the broadcast is a way to express, and only by expressing can we*

> *discuss and reach the audience. Otherwise our film will be locked in a closet and what's the point? In order to maintain the integrity of artistic expression, but lose the opportunity to communicate with the audience, this is pyrrhic, because the film needs to consider the appropriate artistic and political context."*

As mentioned earlier, in terms of the dynamic social impact theory of communication, the social space where people meet, know, and communicate is a tangible space. The director did not lose the opportunity to communicate with the audience in order to maintain the integrity of artistic expression, because that is a very unsuccessful approach. It is important to consider the appropriate artistic and political contexts in ethnographic filmmaking. In a physical, tangible space where people know each other or share the same identity, it is easy for them to become a community. The director's appreciation and recognition by third-gender audiences after the film's broadcast is based on such a communication platform. They provide feedback and emotional resonance through comments. The platform gives them an exclusive space, a space that has a strong impact on the audience and profound and effective communication.

CONCLUSIONS

The formation of the gender aesthetic image of "Free Goose" is based on the long-term follow-up and the delicate capture of the lens. It also benefits from the director's keen and careful consideration of editing. As the leader of Guangxi's ethnographic film works, this film is invisible. The media brought a kind of enlightenment and "little wave" to the local ethnographic filmmakers in Guangxi. Can we "deeply describe" the identity of people behind the ethnic groups more artistically and patiently? For the current context of ethnographic films, exploring the relationship between people and ethnic minorities and the relationship between people and social culture is the meaning of ethnographic films. The gaze of individual living conditions will inevitably continue, but this is why the aesthetic image of the novel is worthy of further exploration. In the direction and path of creative expression, there is no doubt that it is necessary to follow objective and true narratives. However, what kind of presentation styles documentary aesthetics may have, how to highlight this style through narration, and whether it can be formed in the creation of ethnographic filmmaking will be issued for further studies. The new context is one of the questions that ethnographic films will continue to think about in future record shooting and editing creation, and it is also a new way of extending the expression direction of ethnographic filmmakers.

AUTHOR BIOGRAPHY

Geng Site is a Doctoral student at the Department of Communication, Faculty of Business, Information and Human Sciences, Infrastructure University Kuala Lumpur. She is currently a lecturer at Fine Arts College of Guangxi Arts University and a professional director in the ethnographic film industry. *Email*: 416788505@qq.com

Faridah Ibrahim, PhD is a Professor in Journalism and Communication at the Department of Communication, Faculty of Business, Information and Human Sciences, IUKL. She has been in academia for 37 years and was a professional journalist before joining the universities, UKM and IUKL. Her vast areas of research and publications cover war and peace journalism, organizational communication, film and broadcasting, media ethics and professionalism, and women in the media. *Email: faridah@iukl.edu.my*

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Infrastructure University Kuala Lumpur

Infrastructure University Kuala Lumpur
Corporate Block, Unipark Suria,
Jalan Ikram-Uniten, 43000 Kajang,
Selangor Darul Ehsan
Tel : (603) 8926 6993
Fax : (603) 87341021

www.IUKL.edu.my

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