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Species Abundance and Body Size Relationship of Bird Assemblages at Selected Sites in Western Sarawak

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ABSTRACT

The Energy Equivalence Rule (EER) is an unresolved issue in ecology. This rule states that the amount of energy used for each species in a population is independent of its body size. A study on the relationship between abundance and body size of bird assemblages was conducted in Western Sarawak. Abundance data of bird assemblages from seven selected sites in Western Sarawak were used to produce a regression line of log absolute species abundance versus log average body mass. Data from all selected sites were combined to represent bird assemblages in Western Sarawak and the slope produced was -0.216. The slopes obtained for each site were 0.808, -0.080, -0.258, -0.067, -0.161, -0.072 and -0.237, respectively. Statistical analysis shows that the slope of combined data did not differ significantly from -0.75, as expected under the EER. Thus, this study shows that the EER can be applied as a general rule of community structure of bird assemblages in Western Sarawak.

Keywords: Abundance, body size, bird assemblages, energy equivalence rule, regression

INTRODUCTION

Study on the relationship between abundance and body size has been widely examined since it has broad implications on the structure of energy flow in the ecological communities (Illius & Gordon, 1992). Early studies of this relationship showed a negative regression slope of -0.75 (Damuth, 1981). Damuth (1981) compiled 307 data of terrestrial mammals. By using ordinary least squares (OLS) regression model with both variables logarithmically transformed, the relationship of population density (D) on body mass (M) gave a negative relationship of slope -0.75, $D \propto cM^{-0.75}$. Since body weight scales with individual metabolic rate (R) is equal to 0.75, $R \propto cM^{0.75}$ (Kleiber, 1962), Damuth (1981) has taken this exponent of -0.75 between body size and abundance as evidence for the Energy Equivalence Rule (EER) as a general rule of community structure. These two relationships were assumed inversely proportional to each other (King, 2010). In other words, the abundance of a species is limited by its energetic requirement and each species of different body size in an assemblage used equal amounts of energy that were available in a community (Damuth, 1981; 1987; Nee, Read, Greenwood & Harvey, 1991). Hence, Peter (1983) suggested that the negative slope of the relationship between abundance and body size is a reflection of the metabolic process where an animal with a larger body size should have lower abundance because it uses more energy per capita per unit time.

The EER remains an unsettled issue in ecology since there were criticisms on these studies (Blackburn *et al*., 1993). The main criticism is that energy used by all species of all sizes in a community is assumed to be equal (Lawton, 1989). This criticism was supported by the study done on North American birds, which showed that species with larger body size were found to control a larger proportion of resources compared to species with smaller body size (Maurer & Brown, 1988; Pagel, Harvey & Godfray, 1991). This is in complete contradiction to the EER. Another criticism is that the algebraic procedure used in the study conducted by Damuth (1981), seems to ignore the variation of slopes across studies (Marquet, Navarette & Castilla, 1995). The slope of -0.75 was taken to support EER since the relationship between individual metabolic rate and body mass produced a slope of 0.75 (Damuth, 1981). This could be just a coincidence since the comparison was conducted only by visual observation and not by statistical analysis.

Body size is a basic property of an organism since body size is related to and sometimes used as a convenient measure of lifespan, home range size and other aspects of life history and ecology (Brown, Gillooly, Allen, Savage & West, 2004; Peter, 1983; White, Ernest, Kerkoff & Enquist, 2007). Besides that, body size is also one of the primary determinants of metabolism and there is a relationship between the body size and abundance of animal in the ecosystem (White *et al*., 2007). In the study on the relationship between abundance and body size, body mass is widely used as the body size parameter (Peter, 1983). Body mass is used as the independent variable in the regression analysis of this relationship to predict the abundance of species since body mass always gives a sensible approximation to body size (Gosler, Greenwood, Baker & Davidson, 1998). Even when the only available measurement of body size was body length, it was first statistically converted to estimate body weight by using an appropriate coefficient from the length-weight regression (Gowing & Recher, 1984; Rogers, Buschbom & Watson, 1977; Schoener, 1980). Species abundance is used as the dependent variable where the abundance was estimated using body mass as the predictor.

Blackburn *et al.* (1993) studied the relationship between abundance and body size in natural animal assemblages. Blackburn *et al*. (1993) compile nine previously unpublished and five previously published data on animal assemblages. From the 14 assemblages, 12 showed a negative relationship between log abundance and log body size. The 12 negative relationships included the five set of bird assemblage data that were obtained from the abundance data on North American birds (Brown & Maurer, 1987) and British and Swedish birds (Nee *et al.,* 1991) and British Trust for Ornithology Common Birds Census that were done in woodland and farmland habitats (Marchant, Hudson, Carter & Whittington, 1990). However, when comparison was made by using the *F*-test, only the OLS regression line for the British and Swedish bird assemblages (Nee *et al.,* 1991) did not differ significantly from -0.75. The other 12 assemblages had a slope greater than -0.75.

Bini, Coelho and Diniz-Filho (2001) summarised the results from the previous studies on the relationship between abundance and body size. They combined 74 slopes of the relationship between population density and body mass of mammals and 53 slopes of birds (Blackburn *et al*., 1993; Brown & Maurer, 1987; Carrascal & Telleria, 1991; Damuth, 1981; Ebenman *et al*., 1995; Peters, 1983; Nee *et al*., 1991; Silva, Brown & Downing, 1997). They found that the combination of these 127 slopes of mammals and birds produced a slope of -0.65 with a variance of 0.00007. However, when they combined the slopes separately for mammals and birds, the slopes were -0.755 and -0.321, respectively. Based on these results, Bini *et al.* (2001) did not argue the validity of EER on mammals since the combination of 74 slopes of mammals still did differ significantly from -0.75. However, the combination of 53 slopes of birds gave a significant difference with -0.75.

A more recent study by Russo, Robinson and Terborgh (2003) on body size and abundance relationship of Amazonian bird community found that the slope of the relationship between log population density and log body mass was -0.22. This was found to be significantly different to the EER expected slope of -0.75. Field metabolic rate of avian species was estimated in order to produce the relationship between individual metabolic rate and body mass. The relationship between individual metabolic rate and body size for all species in the assemblages shows a significantly positive slope of 0.46. This relationship does not seem to reflect the relationship between abundance and body size as proposed by the EER. This indicates that population energy used for larger species was greater than for smaller species (Russo *et al*., 2003).

The results of the relationship between abundance and body size based on the previous studies seem to be unstable (Bini *et al.*, 2001; Blackburn *et al.*, 1993; Russo *et al.*, 2003). This paper reports on the analysis of the relationship between abundance and body size of bird assemblages to gain a better understanding of this relationship.

MATERIALS & METHODS

In this study, all the abundance data were obtained from Western Sarawak. Western Sarawak covers an area from Tanjung Datu to Batang Saribas (Kaur, 1995). A total of seven published and unpublished data sets from Western Sarawak were utilised in this study. These data sets include the data of bird abundance in Permai Rainforest Resort Santubong (PRRS), Kubah National Park (KNP), Gunung Gading National Park (GGNP), Bako National Park

(BNP), Mount Singai (MS), Mount Jagoi (MJ) and Samajaya Nature Reserve (SNR) (Figure1). The mist-netting method was used to capture birds. At least five continuous days of sampling were allocated each data collection in order to standardise the sampling.

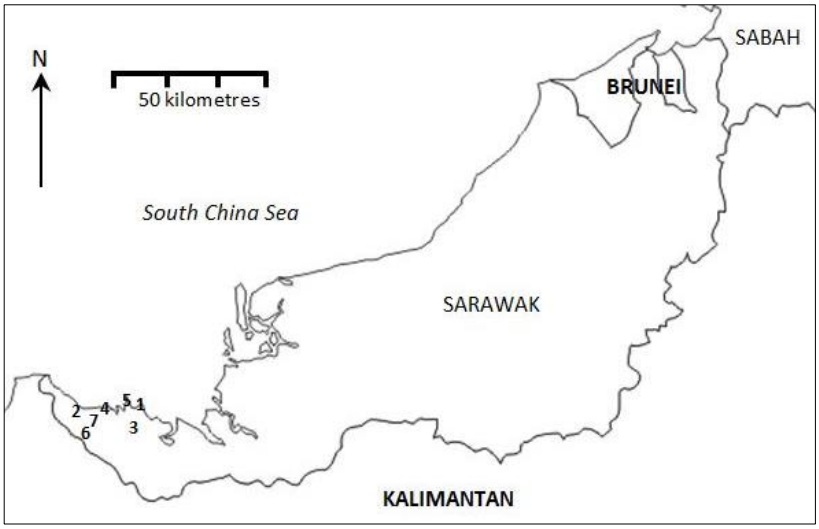

Figure 1. Map of study areas in seven selected sites around Western Sarawak. Bako National Park (1); Gunung Gading National Park (2); Samajaya Nature Reserve (3); Kubah National Park (4); Permai Rainforest Resort Santubong (5); Mount Jagoi (6); Mount Singai (7).

The Statistical Package for the Social Sciences (SPSS) Software Version 21.0 was used to perform correlation and regression analyses in this study. Regression analysis is a statistical technique for modelling the relationship between a dependent variable and one or more independent variables (Lewis-Beck, 1993). The OLS regression model was applied in this study. This model assumes that there is no error variance in the independent variables in the regression analysis (Blackburn & Gaston, 1996). The study by Damuth (1981) on the relationship between abundance and body size mentioned abundance measured as population density. In the absence of population density data in this study, species abundance data were used as the dependent variable in the OLS regression analysis. The dependent variable was log absolute species abundance. Absolute species abundance was the exact number of individuals per species in the sample. Meanwhile, log average body size was used as the independent variable. Body mass is the measurement used to indicate body size in this study. Average body mass was calculated as:

$$\text{Average Body Mass} = \frac{\text{Total body mass of a species}}{\text{Total number of individuals in a species}}$$

Slopes of the regression line of log absolute species abundance (dependent variable) versus log average body mass (independent variable) for each selected study site was produced. Data of bird abundance from these seven sites were combined to represent bird assemblages in Western Sarawak.

Further statistical analysis was done to test whether the slope of the relationship between log absolute species abundance and log average body size produced for each selected site was significantly different from -0.75. In this analysis, the *t*-test was used with a significance level of $\alpha = 0.05$ (one tailed-test). In this study, the data of population density were absent. The only available were species abundance data. The abundance data had to be used as the dependent variable in the regression analysis of the relationship between abundance and body size. In the literatures, some researchers used the total number of individuals in sample, or species abundance as the dependent variable in the regression analysis (Blackburn *et al*., 1993; Maxwell & Jennings, 2006; Oindo,

Skidmore & Prins, 2001). Meanwhile, most researchers used population density as the dependent variable in the study of the relationship between abundance and body size (Bini *et al.,* 2001; Russo *et al.,* 2003; Silva *et al.,* 1997).

There are two main reasons to test the significant difference of the slope produced with -0.75. The first is to confirm whether the regression slope produced by the log absolute species abundance on log average body mass for each study site can be used as evidence to support the EER. If it is significantly different from -0.75, then the result of this study cannot be used to support the EER as proposed by Damuth (1981). The second reason is to test whether species abundance (A) can be used instead of population density (D) as the dependent variable in the regression analysis.

RESULTS

The relationship between log absolute species abundance and log average body mass of bird assemblages for seven study sites with various population abundance are presented separately in this study. Subsequently, all seven sites were combined to represent a relationship between log absolute species abundance and log average body mass of bird assemblages for Western Sarawak, as shown in Table 1.

Table 1. Regression statistical value of the relationship between log species abundance and log average body size of bird in seven data sets.

Data Set	n	r	β	SE	*p*-value	95% CI
BNP	9	0.453	0.808	0.321	0.221	(-0.614, 2.230)
GGNP	37	0.070	-0.080	0.349	0.681	(-0.472, 0.312)
MJ	52	0.205	-0.258	0.434	0.144	(-0.607, 0.091)
KNP	29	0.052	-0.067	0.392	0.788	(-0.576, 0.441)
SNR	9	0.385	-0.161	0.149	0.307	(-0.507, 0.184)
PRRS	7	0.103	-0.072	0.252	0.826	(-0.876, 0.731)
MS	19	0.213	-0.237	0.359	0.381	(-0.792, 0.319)
Western Sarawak	91	0.150	-0.216	0.157	0.157	(-0.516, 0.085)

Note: n is the number of species found in every site. *r* (correlation coefficient) is the amount of variance in abundance explained by the correlation with body size across all species in each assemblage. β is the regression slope through all species in each assemblage. The standard error (SE) and 95% confidence interval of each slope are given. *p*-value used in the *t*-test to determine if there is any significant difference.

The correlation coefficients (*r*) for these relationships, together with the slopes of the regression lines for these data, the standard error of the estimates, the *p*-values and 95% confidence intervals are given in Table 1. The combined species abundance data from all seven study sites shows a negative relationship of log absolute species abundance versus log average body size (Figure 2a). The *r* value for the combination set is 0.150, which is less than 0.2 ($r < 0.2$) indicating that the body size explains less than 20% of the of the data variation in abundance.

Data sets from GGNP, MJ, KNP, SNR, PRRS and MS show negative slopes for the relationships between log absolute species abundance and log average body size. Only the data set from BNP shows a positive slope on log absolute species abundance versus log average body size (Figure 2). GGNP, KNP and PRRS produced *r* values

less than 0.2 ($r < 0.2$). The value of less than 0.2 indicate that the body size explained less than 20% of the variation in the abundance.

The SNR and MS show *r* values greater than 0.2 ($r > 0.2$) which indicate that the body size explains more than 20% of the variation in the abundance. BNP is the only data set to show *r* value greater than 0.4 ($r > 0.4$). This indicates that more than 40% of the variation in the abundance was explained by the body size. Although slopes (β) produced in each study site are greater than -0.75 (less negative) and one of the data set shows a positive slope, all the data sets show no significant difference with -0.75, including the combined data set when comparison was made by using the *t*-test. The *p*-values for all data sets are greater than 0.05 significance level ($p > 0.05$) in the one-tailed test.

DISCUSSION

As expected under the EER by Damuth (1981), the relationship between abundance and body size gives a negative slope where species with larger body size tend to live at lower abundance compared to species with smaller body size. In order to represent the bird assemblages in Western Sarawak, the abundance data of bird assemblages from the seven study sites were combined. The slope for the combined data was -0.216.

When the regressions between log absolute species abundance and log average body size were performed separately, the regression slopes produced in six out of seven assemblages show negative values. The data sets in GGNP, MJ, KNP, SNR, PRRS and MS produced slopes of -0.08, -0.259, -0.067, -0.161, -0.072, -0.237 and -0.216, respectively. Two assumptions were made from these negative relationships. First, these negative relationships indicate that birds of larger body size lived at lower abundance compared to birds of smaller body size in the assemblages. Second, equal amount of energy is being used by birds of different body size in the assemblages.

However, confusion may have occurred regarding the dependent variable being used in the regression analysis of the relationship between abundance and body size (Blackburn *et al*., 1993; Harvey, 1982; Harvey & Lawton, 1986; Nee, Harvey & Cotgreave, 1992). There are arguments on how Damuth (1981) was able to use population density as the dependent variable in the regression analysis of the relationship between abundance and body size since the data used in the study did not come from the whole local assemblages of one habitat. However, it came from the literature (Brown & Maurer, 1987; Lawton, 1989; 1991; Morse, Stork & Lawton, 1988). The data sets were the compilation of the abundance of species aggregated at the continental or global scale, which were then converted into density (Blackburn & Gaston, 1996). Blackburn and Gaston (1996) further argued that the dependent variable used by Damuth (1981) was impractical, as the population density were gathered from different part of the continents, which probably the animals were not interacting with each other.

Even if there is a method to measure population density across continents or at the global scale, there is still a problem that Damuth (1981) might have overlooked: the data samples, which came from the literature probably ignored the number of small species and rare species (Brown & Maurer, 1987; Lawton, 1989; 1991; Morse *et al*., 1988). These densities might be biased toward the maximum population densities because ecologists tend to study populations where they are abundant (Blackburn *et al*., 1993). Although, there are criticisms and debates regarding this problem, the relationship between abundance and body size is still the most attractive measure of how the energy equivalence is explained (Currie, 1993). Indeed, the relationship between abundance and body size has been cited as a good model of a general ecological rule (Peter, 1991).

It is inappropriate to use the literature as evidence to enable the usage of species abundance as a variable in the regression analysis of this relationship. Thus, *t*-test was used to test the significant difference of the slope produced with -0.75. There is no doubt in the usage of species abundance data as the dependent variable in the OLS regression analysis of the relationship between abundance and body size since the *t*-test provided the evidence that there is no significant difference in the usage of population density or species abundance.

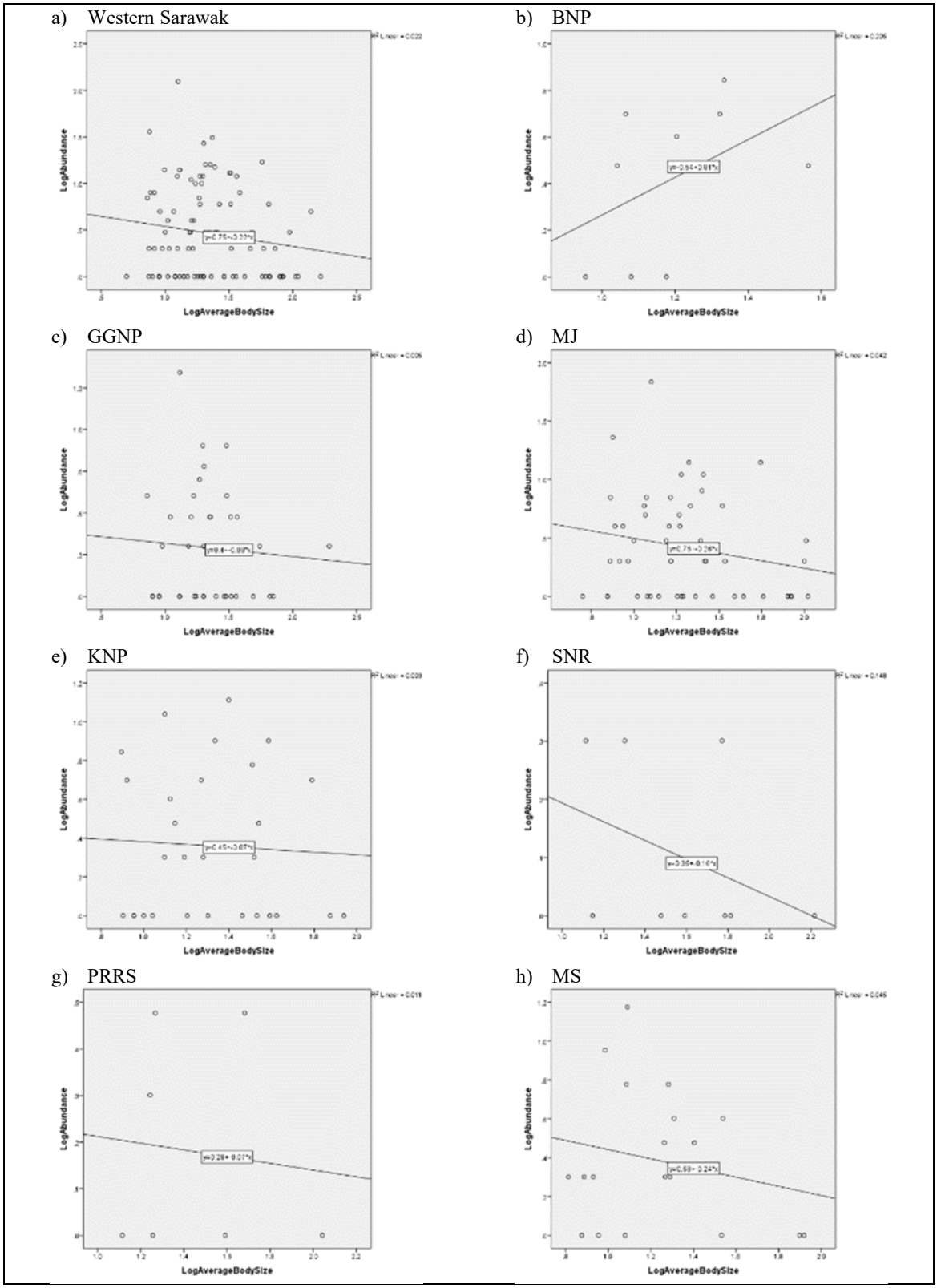

Figure 2. Correlation between log absolute species abundance (total number of individuals per species in sample) and log average body size (weight) of bird assemblages.

CONCLUSION

The relationship between log absolute species abundance and log average body size of bird assemblages for all sites show slopes not significantly different from -0.75. The combined data of bird assemblages from all seven study sites show a negative relationship with regression slope of -0.216. Since the slope produced for the combined data sets, used to represent bird assemblages in Western Sarawak, did not differ significantly from -0.75, this study can be taken as evidence to support EER as a general rule of community structure and body size is a good predictor of bird abundance in Western Sarawak.

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Foraging Behaviour of Three Sympatric Babblers (Family: Timaliidae)

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ABSTRACT

We investigated the foraging ecology of three species of babblers in Kampung Gumbang, Kampung Padang Pan and Dered Krian National Park, Bau. Vegetation in Kampung Gumbang include tall trees, shrubs and patches of kerangas. Dered Kerian National Park consists of mixed dipterocarp forest and limestone forest, which is surrounded by orchards and few villages. In Kampung Padang Pan, the vegetation is a mixed fruit orchard and secondary forest. Foraging data were obtained to compare foraging behaviour in three species. From 133 observations, suspended dead leaves was the most frequently used substrate by the three species. *Stachyris maculate* showed the most general foraging behavior, and it adopted probing strategy. *Cyanoderma erythropterum* and *Mixnornis gularis* obtained food items by gleaning. These three babblers utilize different foraging strategies and substrates, irrespective of their resemblances in other characteristics. *C. erythropterum* and *S. maculate* forage mainly among dead and curled, twisted leaves in understory vegetation at significantly different heights. *M. gularis* forages on dead and living leaves and this species can be found abundantly in disturbed forest and plantation or farm habitats. All the three areas were observed never lacked falling leaves and structural complexity required as foraging substrates by those three babbler species. All three babblers occupy different foraging niches, and therefore interspecific competitions among themselves are minimized.

Keywords: babbler, foraging strategies, live and dead leaves, niches, substrate,

INTRODUCTION

Babblers (Family: Timaliidae) occupy nearly all tropical and subtropical regions, including in Sundaland. They are one of the main groups of insectivorous birds (Yong *et al*., 2011). Most babbler species are restricted to the forest interior and have limited distribution. In Borneo, they are comprised of 11 babblers (Phillips & Phillips, 2011; del Hoyo & Collar, 2016). They are poor flyers and forage mostly in the understory or near the ground, often in small groups (Smythies, 1999). They mostly have similar bill morphology (slender and either straight or slight decurved) and body size in the range of 11 to 15 cm in total length. The behavioural ecology of small numbers of babblers in Sunda region has been studied in Peninsular Malaysia and Malaysian Borneo (Styring, Ragai, Zakaria & Sheldon, 2016; Mansor & Ramli, 2017).

In this study, we compared the foraging behaviour of three sympatric babblers where they coexist in the secondary, disturbed forest. There are Chestnut-winged babbler *Cyanoderma erythropterum*, Chestnut-rumped babbler *Stachyris maculate*, and Striped-tit babbler *Mixnornis gularis*. These three species are remarkably similar to one another in plumage, voice and social behaviours, and they coexist in secondary, disturbed primary and some plantation forests of Borneo (Smythies, 1999). The *C. erythropterum* is known to be the greatest generalist, being able to exploit different resources in different environment conditions, while the other two species forage mainly on dead leaves suspended in understory vegetation at significantly different heights (Smythies, 1999; Styring *et al*., 2016).

We chose the three species as the models for this study as we hypothesized that the three species would occupy different foraging niches. Therefore, interspecific competition among themselves would be minimized and allowing coexistence within the same habitat. To test our hypothesis, we investigated on how the three babblers forage in the wild and use substrate to obtain food materials. In addition, we would examine foraging strategies

of these three sympatric species in relation to substrates, foraging heights, foraging manoeuvre, and searching behaviours.

MATERIALS & METHODS

Study area

This study was conducted in three sites in Bau from August 2016 to February 2017. The sites were Kampung Gumbang (1˚16'0''N, 110 ˚3'0''E), Kampung Padang Pan (1˚18'47''N, 110 ˚3'25''E) and Dered Krian National Park, Bau (1˚23'45''N, 110 ˚8'55''E) (Figure 1). The sampling period in Kampung Gumbang was 4 days, Dered Kerian 5 days and Kampung Padang Pan 4 days. The Kampung Gumbang sampling site consists of lowland dipterocarp forest, kerangas forest and a few patches of limestone shrubs with stream disappears through the permeable limestones. The Kampung Padang Pan site consists of mixed dipterocarp forest, fruit orchard and secondary forest. As for the Dered Krian National Park, it consists of both mixed dipterocarp forest and limestone forests that grow on the limestone hill areas, which is surrounded by orchards and few small villages. Selection of these three sites, allowed plentiful opportunities to observe babblers foraging under a variety of habitat environments.

Figure 1. Three sampling sites in Bau; Kampung Padang Pan, Kampung Gumbang and Dered Krian National Park.

Data for habitats are comparable among the three sites by integrating variables such as percentage of canopy cover (%) and leaf litter depth (cm). Percentage of canopy cover was estimated by using a spherical densiometer that uses a convex mirror with a grid of 24 squares. Canopy cover was calculated from the number of squares on the mirror filled with vegetation. Leaf litter depth was recorded in 2 x 2 m quadrats which placed on the ground where the birds gathered their food items. This was done at each point at each sampling site. The leaf litter depth was measured with a 30 cm ruler at the four corners of each quadrate.

Foraging data

Birds were surveyed along a 1,000 m transect trail for each sampling site (Figure 2-4). Points were spaced at the minimum distance of 50 m apart along transect (20-point counts for each 1,000 m transect trail). This was to prevent spatial pseudo-replication (Melo & Guilherme, 2016).

Observations using a Nikon 8 x 42 binocular, were performed for four days in each sampling site. Foraging observations started from 0700 h to 1100 h, when birds were actively searching for foods and light was enough for observation. At each point, a 5-minute survey was conducted using distance sampling. Babblers were detected either by sight or sound. Foraging observations were recorded once per individual per species per transect per

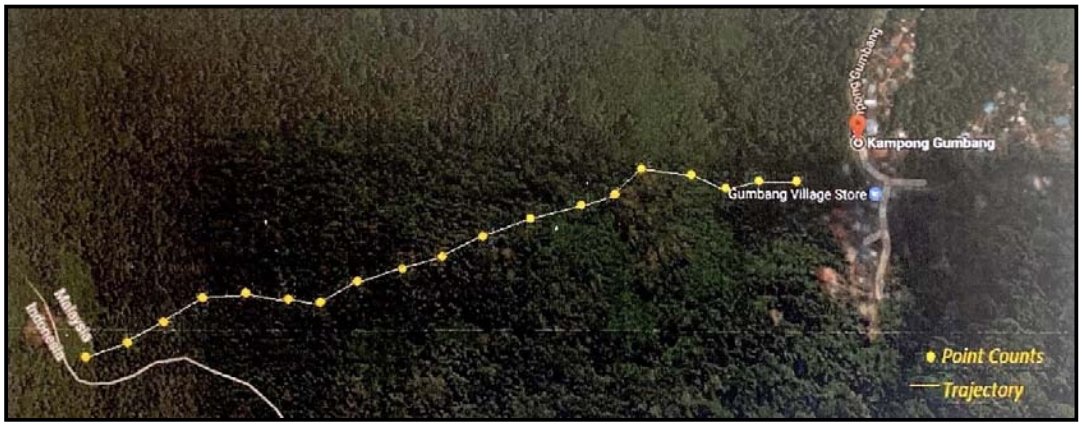

Figure 2. Point counts and the trail in Kampung Gumbang.

Figure 3. Point count and the trail in Dered National Park.

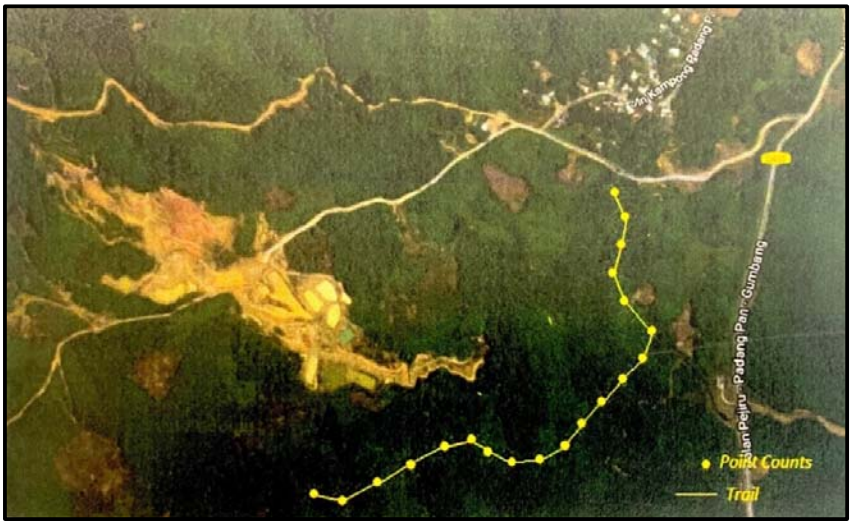

Figure 4. Point counts and the trail in Kampung Padang Pan.

survey (Styring *et al*., 2016). For every individual, it was observed until it has successfully obtained a food item (determined either by the observation of the food item and by eating behaviour). Following Morisson (1984), at least 30 independent observations were conducted for each babbler species to accurately represent the observed foraging behaviour.

In this study, foraging data collected consisted: (1) foraging height above the ground, (2) foraging substrate, (3) foraging maneuver, and (4) searching behaviour.

Foraging height: A foraging height is the level from which a food item is obtained by the birds. At each point count, a Suunto clinometer was used to estimate the foraging height (m) of each bird.

Foraging substrate: A foraging substrate is an underlying substance or layer (microhabitat) form which food items are taken by the birds. These substrates consist of dead leaf (suspended or on ground), live leaf, liana, rattan, palm, dead wood (dead liana/ rattan, dead branch), loose bark. In this study, the height of substrate from the floor was measured using a measuring tape (meter).

Foraging manoeuvre: The foraging manoeuvre refers to few methods that are taken (foraging) by birds (Remsen & Robinson, 1990). The babblers adopt few types of manoeuvre such as: (1) glean – to pick food items from a nearby substrate, that can be reached without full extension of legs or necks, and no involvement of acrobatic movements, (2) reach/stretch – to extend completely the legs or neck upwards, outwards, or downwards to reach food items. (3) hang – to use legs and toes to hang the body below the feet to reach food items that cannot be reached from any other perched position; can be categorized into four positions (hang-up, hang-down, hang-sideways and hang-upside-down, (4) lunge – quick movement rather than flight are applied by birds to approach and capture preys that are beyond the range of "reach", (5) probe – to insert the bill into cracks or holes in hard substrate or straight into softer substrates such as moss or mud to capture hidden foods, (6) peck – to drive the bill against the substrate to remove some of the exterior of the substrate to reach the hidden foods, (7) flake – to brush aside loose substrate with sideways using the bill in sweeping motions, (8) sally – to fly from a perch to foraging a food item and then return to a perch.

Searching behaviour: Searching behaviour refers to movements used by birds to search for food or substrates that hide food. The searching activities will end once food or food-hiding substrates are spotted and foraged (Remsen and Robinson, 1990). Searching methods can be categorized as follows: (1) hop – similar to jump, but starts off with one leg, and lands with both legs, (2) jump (leg-powered jumps using both legs that cover more space than the typical hop), (3) climb – a perching technique which birds walk from bottom to top while their claws grasp on the branches, (4) glide – birds spread their wings and fall from branches to another branches, (5) flutter – the wings are flapped before taking off to another branches, and (6) fly – birds take off from a branch and flap their wings to reach another branch.

Statistical analyses

To compare foraging behavior among the three babbler species and to visualize substrate preferences, correspondence analysis was performed on substrates, foraging maneuvers, and searching behavior in SPSS version 25 (2017). This type of analysis is principally effective for showing variation in foraging data (Miles, 1990; Naoki, 2007). Foraging height was compared among species using Analysis of Variance (ANOVA), and post-host comparison were made using Tukey's Honestly Significant Difference in PAST 3 software (Hammer, *et al*., 2001). All obtained values were presented as mean ± standard deviation (SD).

RESULTS

Habitats

Two habitat variables were compared among the three sites: percentage of canopy cover and leaf litter depth. Habitat variables showed less variation among the three sampling sites. Percentage of canopy cover in Dered Krian National Park (mean = 85.65±14.89%) was higher than Kampung Gumbang (mean = 80.25±15.15%) and

Kampung Padang Pan (mean = 77.05± 6.0%). As for leaf litter depth, Kampung Padang Pan recorded higher (mean = 5.55±1.90 cm) than Dered Krian National Park (mean = 4.975±1.32 cm) and Kampung Gumbang (mean = 4.11±1.51 cm).

Bird occurrence

A total of 133 observations belonging to the three babbler species were recorded in the three studies areas. *Mixnornis gularis*, was the most observed in the study areas with a total number of 56 observations (17 in Kampung Gumbang, 15 in Dered Krian, 24 in Kampung Padang Pan). This species usually travels in a flock, or together with other species such as flowerpeckers and sunbirds. *Cyanoderma erythropterum* is the second most sighted with a total number of 42 observations (13 in Kampung Gumbang, 8 in Dered Krian, 21 in Kampung Padang Pan), followed by *S. maculate* with 35 observations (7 in Kampung Gumbang, 6 in Dered Krian, 22 in Kampung Padang Pan).

Foraging ecology

Most of the observed birds foraged over a wide variety of substrates (Figure 5; Supplemental Table S1) but suspended dead leaves was the most frequently used substrate by the three species. Live green leaves were the second-most used substrate. Correspondence analysis of substrate preference resulted in 2 dimensions (singular value dimension 1= 0.56; dimension 2=0.182) in the substrate data (Figure 6). *Stachyris maculata* showed the most general foraging behaviour, feeding on dead leaf (54% of the observation), dead branch (23%), and liana (6%). Meanwhile, the other two species foraged on two substrate types. *Cyanoderma erythropterum* foraged mainly on suspended dead leaf (60%) and liana (7%). However, *S. maculata* and *C. erythropterum* foraged at different height (Figure 7), with *S. maculata* higher (10.5 ± 1.08 m) than *C. erythropterum* (5.7 ± 0.50 m). *Mixnornis gularis*, foraged in dead leaf (20%), and on live leaf (57%) and stayed almost lower to the ground (4.9 ± 0.90 m).

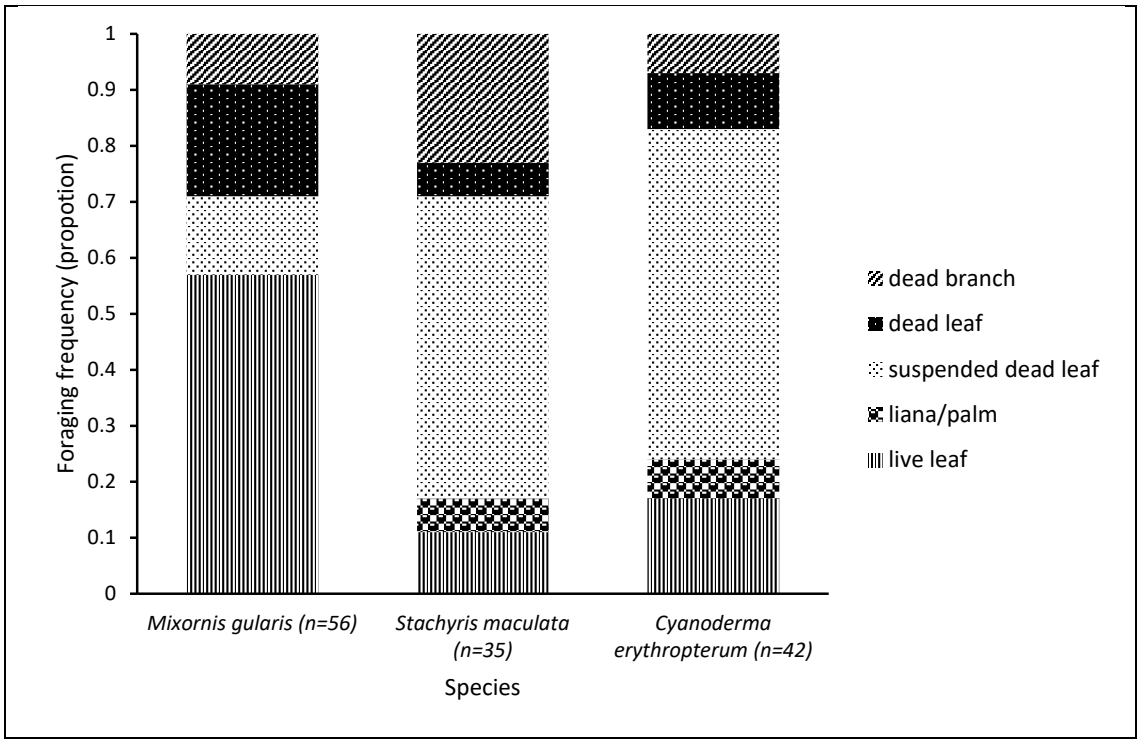

Figure 5. A stacked bar chart of proportional foraging frequency on specified substrates by three babbler species from the three studied sites in Bau.

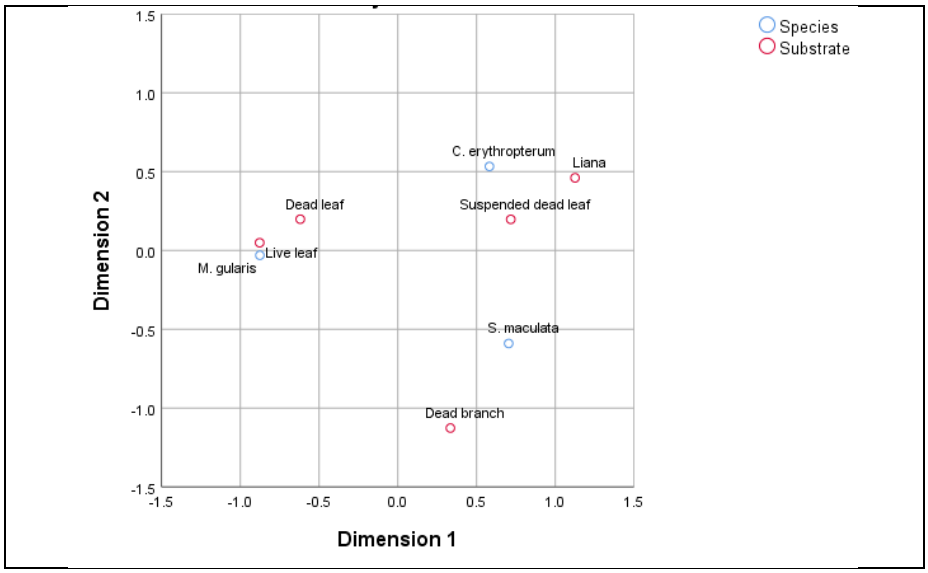

Figure 6. Correspondence analysis of substrate preference of three species of babblers.

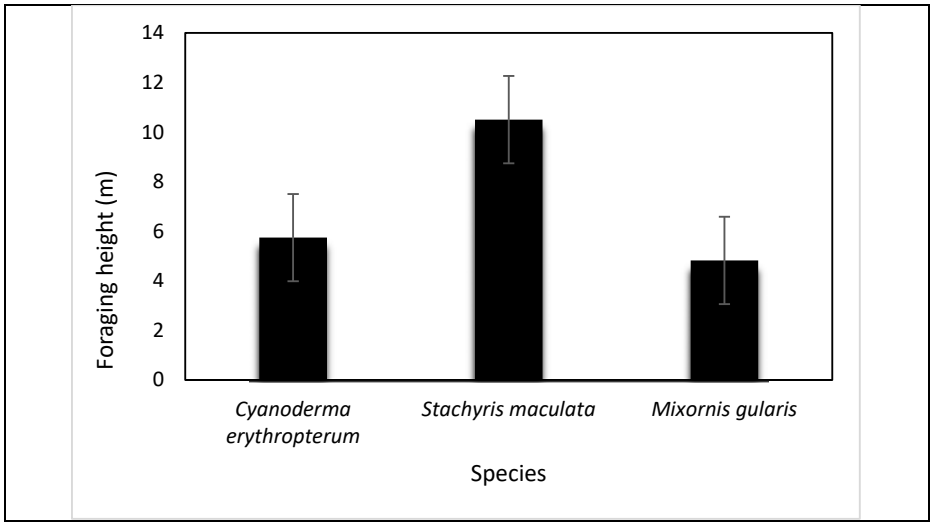

Figure 7. Average foraging height of 3 species of babblers. Error bars represent 95% confidence intervals. ANOVA results ($F_{2,130}$= 511.6, *P* <0.001), Tukey's HSD comparisons indicate that *S. maculata* forages at significantly greater heights than the other two species (P<0.001 in all cases).

Correspondence analysis of foraging manoeuvres resulted in two dimensions explained 67% of the total inertia (Figure 8; Supplemental Table S2). Of the species that foraged on suspended dead leaves and dead leaves, *S. maculate* probed significantly more than other species (53% of observation) and obtained food items by pecking (35%) and hanging down (11%). *Cyanoderma erythropterum* obtained food items frequently by gleaning (46%), hanging (42%) and pecking (12%). *Mixnornis gularis* frequently gleaned (59%), but also pecked (30%) and hung down (10%).

Finally, correspondence analysis of searching behaviours resulted in two dimensions explained 35% of the total inertia (Figure 9; Supplemental Table S3). *Cyanoderma erythropterum* was observed to hop (54% of observation) and fly (40%) in searching for foods in dead leaf, while *S. maculate* was observed to jump (35%) and fly (39%). *Mixnornis gularis* adopted flutter (7%), fly (38%) and jump (29%) to find foods.

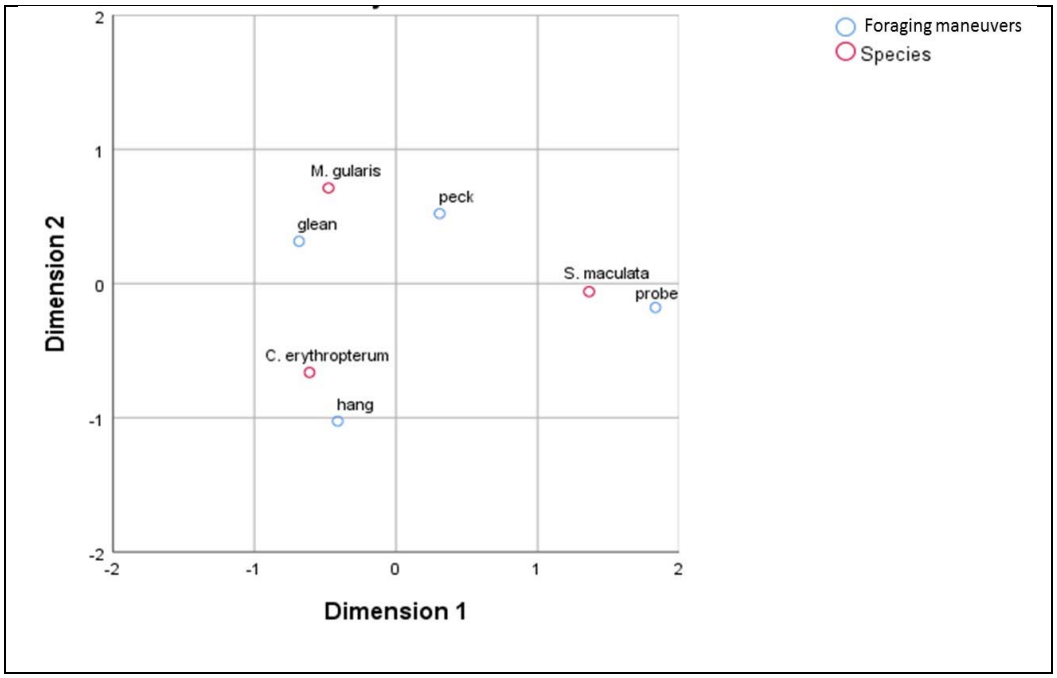

Figure 8. Correspondence analysis of foraging maneuvers in three species of babblers.

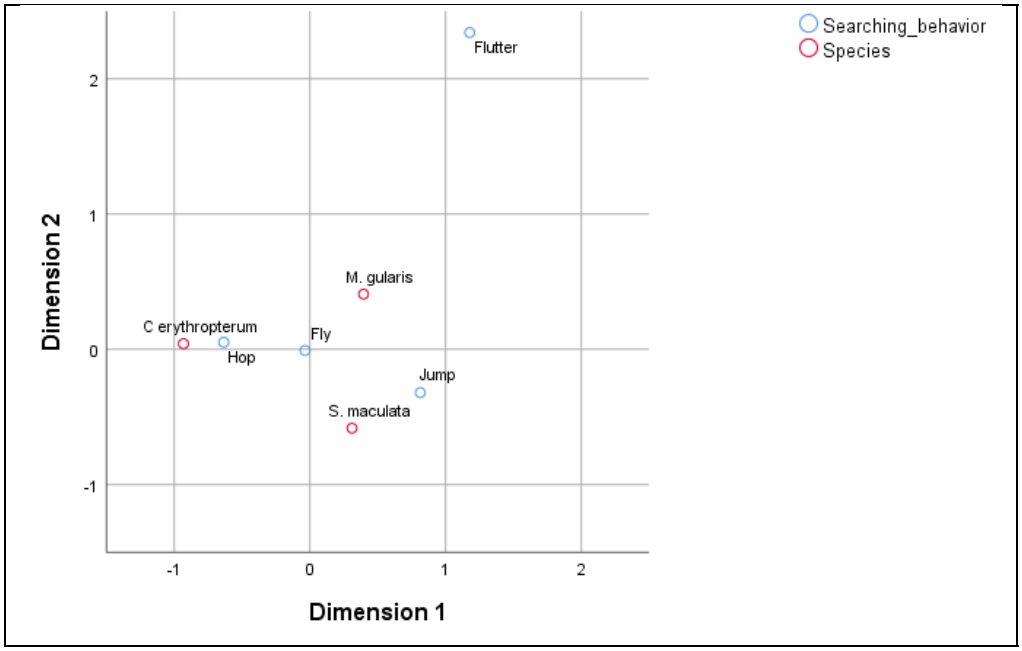

Figure 9. Correspondence analysis of searching behaviours in three species of babblers.

DISCUSSION

The three babblers compared in this study, utilize largely different foraging strategies and substrates, regardless of their similarities in other characteristics. *Cyanoderma erythropterum* and *S. maculata* seem to focus on dead and curled, twisted leaves, which serve as hiding and nesting sites for arthropods. *Cyanoderma erythropterum and S. maculata* pursuit leaves suspended in liana tangles, plus *S. maculata* focusing on sites higher in the

understory than *C. erythropterum*. These two babblers are not interested to forage among the living leaves as the concentration of arthropod prey is low (Leme, 2001). However, dead leaves are more unevenly distributed and seemingly need more time and energy to search and extract food items from than green leaves (Rosenberg, 1993).

Due to their dead-leaf strategy, *C. erythropterum and S. maculata* occur in abundance in regenerating logged forest and older plantation groves, where greater light access helps the growth of a thicker understory (Sheldon, Strying & Hosner, 2010; Styring *et al*., 2011; Styring *et al*. 2016), and where leaf litter is expected to be sizable (Stratford & Stouffer, 2013; Styring *et al*., 2016). Within these habitats, chances for capture of falling leaves by understory vegetation is boosted by the plentiful development of lianas, vines, and shrubs (DeWalt, Maliakal & Denslow, 2003; DeWalt, Ickes, Nilus, Harms & Burslem, 2006; Styring *et al*., 2016). In addition, *C. erythropterum and S. maculata* can also be found in habitats such as pole forest growing on ultrabasic soils, bamboo thickets and river edges (Sheldon *et al*. 2010; Styring *et al*., 2016). In contrast, these two species are not as abundant in actively managed habitats in which the understory is stripped, such as oil palm, trimmed rubber, young industrial tree groves, and repaired logged forests (Sheldon *et al*. 2010; Styring *et al*., 2016). This could be explained that the understory in mature forest is more open which causing suitable microhabitats to be more widely spaced, and that competition from insectivorous birds is expected to be greater (Styring *et al*., 2016).

Mixornis gularis was considered a generalist of the group. The species search for food items on dead and living leaves (Figure 5). It was common in the largest assortment of disturbed forest and plantation or farm habitats. (Smythies 1999; Mansor & Mohd. Sah, 2012). The foraging patterns of *M. gularis* in this study is similar as the results obtained by Mansor and Mohd. Sah (2012). Both found *M. gularis* to be a leaf gleaner, focusing on the underside of living leaves, while *C. erythropterum* foraged on dead branches and curled up dead leaves. In addition, they observed that both species occurred mainly in forest of intermediate foliage density. The foraging height of *C. erythropterum* in their study was similar as the foraging height in our study which was between 0 m to 5 m. However, in their study, foraging height of *M. gularis* was at > 6 m, while in our study the foraging height were between 0 m to 5 m.

All three studied areas consist almost similar vegetations. Besides, habitat variables (e.g. canopy cover and leaf litter-depth) showed less variation among the three areas. Canopy cover percentages in all three studied areas are above 70%. This high percentage of canopy cover reveals that many trees in the areas can be as high as 60 m which eliminate most light from the forest floor. However, a number of plants especially adapted to low-light do grow on the forest floor. We observed all the three areas never lacked falling leaves and structural complexity required as foraging substrates by those three babbler species. A habitat that lacks foraging and nesting substrates will result in reduction of bird species diversity (Sheldon *et al*., 2010).

CONCLUSION

From this study, each babbler species adopts different foraging strategies relative to substrates used, foraging height, foraging manoeuvre, and searching behaviours. They occupy different foraging niches, and therefore interspecific competitions among themselves are minimized and they coexist within the same habitat.

ACKNOWLEDGEMENTS

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Supplemental Table S1. Information on the substrate preference of the three babbler species.

Substrate	***Mixnornis gularis***	***Stachyris maculata***	***Cyanoderma erythropterum***
Live leaf	32	4	7
Liana	0	2	3
Suspended dead leaf	8	19	25
Dead leaf	11	2	4
Dead branch	5	8	3

Supplemental Table S2. Information on the foraging manoeuvres of the three babbler species.

Attack manoeuvres	***Mixnornis gularis***	***Stachyris maculata***	***Cyanoderma erythropterum***
Glean	41	1	32
Probe	0	29	0
Hang	7	6	29
Peck	1	19	8

Supplemental Table S3. Information on the searching behaviours of the three babbler species.

Aerial manoeuvres	***Mixnornis gularis***	***Stachyris maculata***	***Cyanoderma erythropterum***
Hop	28	21	39
Jump	31	28	4
Flutter	7	0	0
Fly	41	31	29

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Geospatial Monitoring on Land Surface Temperature and Vegetation Dynamics: A Case of a City Area in Khulna, Bangladesh

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ABSTRACT

Land surface temperature and vegetation cover are two important parameters to evaluate the climate change and environmental condition. The current study is carried out in respect of monitoring the changing phenomena of climate and environment. The area selected to conduct the study was ward number 1, 2 and 3 of Khulna City Corporation), from the third largest city of Bangladesh. This study is corresponding through the calculation of Land Surface Temperature (LST) and Normalized Differential Vegetation Index (NDVI) for two different years, 2010 and 2018. LST and NDVI are observed to realize the association between surface temperature and amount of vegetation. With the help of ArcGIS 10.5, LST and NDVI calculations are done using Landsat 5 Thermal Mapper, Landsat 8 Operational Land Imager and Thermal Infrared Sensor images (for 2010 and 2018, respectively) collected from USGS Earth Explorer. The findings of the study specify that the highest temperature in 2018 is 32.5˚C in ward 2 and in 2010 it was 27.5˚C in ward 3, though the overall vegetation amount decreased in 2018, About 18, 900 square meter of very low canopy area has increased in ward 3 from the period of 2010 to 2018 and in the same time 35, 100 square meter of low canopy area has been decreased for the overall study area. However, parts of the study area of ward no. 3 had faced a significant increase in vegetation cover which is the cause of low temperature compared to ward 1 and 2 in 2018.

Keywords: LST, NDVI, Surface Temperature, Vegetation.

INTRODUCTION

Bangladesh is a fast-developing country which is aiming to be a developed country very soon. Bangladesh is lying at the front line of climate change which is a global challenging issue in 21st century (Islam, Islam, Chakraborty & Alam, 2019). The geographical location and hydro-meteorological situation have made Bangladesh vulnerable to the climate change (Esha & Ahmed, 2018). The process of development, urbanization and industrialization, have made the environment and ecosystem to come at a risk, which is also being disturbed at a high rate and this may be a threat to the population of the country. Among the cities of Bangladesh, Khulna is the third largest one (BBS, 2011). Besides, the city is also developing day by day. The construction of Padma Bridge will fasten the development process of the city which might result in more cutting down of trees and rise in temperature. Thus, the goal of the prerequisite is to analyze the land surface temperature and vegetation covering to the selected wards of Khulna comparing over two years which may help in further management of environment in the area. The objective was to analyze the environmental surface temperature condition focusing on the amount of the vegetation through the GIS and remote sensing approach.

Vegetation index is a quantitative way of measuring the vegetation vitality using different combination of red and infrared bands. Among many other vegetation indices, Normalized Differential Vegetation Index (NDVI) is widely used for vegetation cover estimation, productivity assessment, variation in trend assessment of vegetation (Jiang *et al*., 2006; Li, Liu, Cao & Xue, 2015). NDVI values differing from -1 to 1 indicate different land conditions for land cover. Here, negative values around -1 stand for water. Near zero values represent sand, snow or rock, positive values around 0.2 - 0.4 stand for grass and shrub and high positive values near 1 represent temperate and tropical rainforests (Babu, Hemalatha & Naik, 2016; Kovalev & Tokareva, 2016; Li *et. al*., 2015;

Weier & Herring, 2000). The skin temperature of the earth surface, which can be measured from ground and satellite data, have great influence on physical, biological and chemical process like heat and energy exchange between the surface and the atmosphere, can be demarcated as land surface temperature (LST) (Mia, Bhattacharya & Woobaidullah, 2017; Paruelo, Epstein, Lauenroth & Burke, 1997).

Song *et al*., (2018) have featured other studies to analyze the relationship between the LST and NDVI. The northeastern part of Guizhou Province in China is a karst area, has shown an opposite pattern of spatial distribution of LST and NDVI across the area. North America has shown seasonal difference of relationship between LST and NDVI. Positive relationship can be seen in cold season and negative relationship in the warm season. Some studies have researched on drought according to the monitoring of the LST and NDVI (Deng *et al*., 2018; Fathizad, Tazeh, Kalantari & Shojaei, 2017; Wang *et al*., 2011; Zhao, Cong, He, Yang & Qin, 2017).

Esha & Ahmed (2018) and Islam *et al*., (2019) have demonstrated the necessity of sharing an integrated approach to analyze and assess the spatio-temporal land cover monitoring along with temperature in north-western region of Bangladesh. Esha & Ahmed (2018) have done the assessment of finding the relation between LST with NDVI through the GIS approach of making NDVI and LST maps.

Islam *et al*. (2019) have conducted their research in the Khulna Metropolitan area, considering the year 2001, 2011 and 2018. It is clearly revealed that LST has increased over the time and land cover have also changed towards to the urban built up area (Islam *et al*., 2019). Mondal and Uddin (2018) have conducted a research in the drainage basin of Atai-Bhairab-Rupsha river confluence, which covers mainly Khulna district. Due to the barren soil area, highest temperature was greater during the year of 1995 than 2006 and 2015. Temperature has increased at a significant level in the year 2015 than 2006. This can be an indication of the transformation of the barren soil area into urban built up area during the time period of 2006-2015 (Mondal & Uddin, 2018).

Although there are studies that address various issues of geospatial techniques to investigate the dynamics of land surface, but they have some common limitations. For instances, the first group of studies examined the role of geospatial tools in broad perspective (Anandababu, Purushothaman & Suresh Babu, 2018; Avdan & Jovanoska, 2016; Grover & Singh, 2015; Guha & Govil, 2020; Li *et al*., 2015; Saha, Paul, Gupta & Saha, 2016; Song *et al*., 2018; Tran *et al*., 2017). The second group of studies (Islam *et al*., 2019; Mia *et al*., 2017; Mondal & Uddin, 2018; Shimu *et al*., 2019; Uddin & Mondal, 2020) explored the factors that affects the land surface elements in city/regional territory. Very few studies address the monitoring issues from very micro unit often in ward boundary setting. Additionally, some of them put sophisticated weight on the impact of climate change on the dynamic behavior, a bit intuitive in nature with limited practical perception. Very light efforts are observed to address the assessment of geospatial monitoring on LST and NDVI in a temporal scale, especially in urban unit context. This research fills these gaps in numerous ways by fixing Khulna city corporation as a candidate study area.

In this sense, the research will contribute by assessing the land surface behavior with the vegetation health in geospatial environment in a very micro perspective. Geospatial environment can help to connect the real-world scenario through the satellite image. Again, Satellite based LST mapping has a wide range of application in the field of science and technology such as for deducting climate change pattern, land/atmospheric feedback or modelling studies, monitoring and prediction of land cover changes, for the use of crop and water resource management, for geological applications and so on (Tashnim & Anwar, 2016). NDVI is a measurement of plant health, as how a plant reflects light at any specific frequency (Raynolds, Comiso, Walker & Verbyla, 2008). Bare soil, waterbody and built-up area, plants under stress, crops and crops stage are fully detectable through NDVI (Li *et al*., 2015). Hence it will help to visualize the actual fact/scenario from bottom-up approach and help to take decision locally to monitor the issues.

METARIALS & METHODS

Exploring the research area

Among the cities of Bangladesh, Khulna is the third largest one, located at the south-west region. Khulna is a renowned river port situated by the bank of rivers, Bhairab and Rupsha. It is the centre of industrial prosperity of Bangladesh and many national companies depend on it. The encompassing Khulna City Corporation (KCC) had a projected population of 1.022 million in 2014 whereas the population of Khulna is 1, 342, 339 in the year of 2019 (World Population Review, 2019). The northern most area of the Khulna Metropolitan city, is the location of Ward No. 1, 2, 3. Figure 1 displays the location of study area and Table 1 shows the area and population of each ward under the study area.

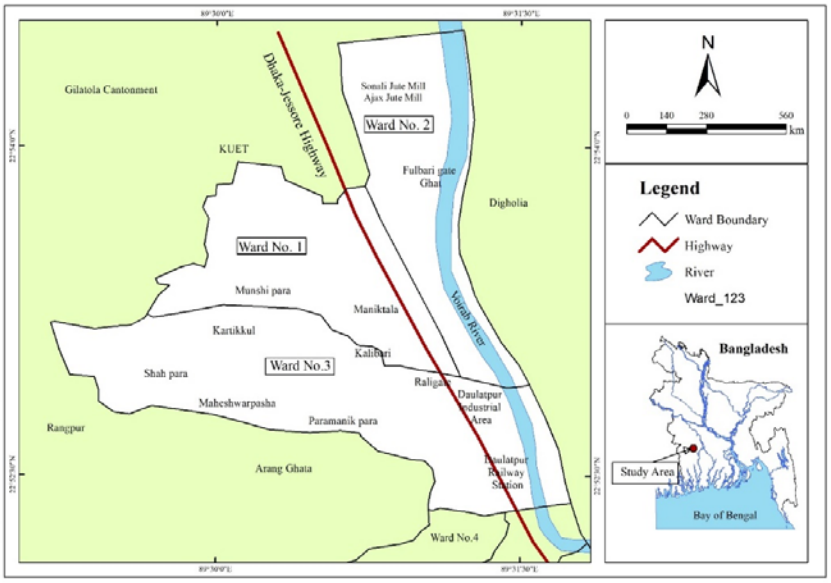

Figure 1: Location of study area; Source: KCC, 2019

The selected area (ward 1, 2 & 3) is known as a residential area with a great amount of vegetation cover. Ward 2 is also renowned for the location of Bhairab River landing stage (at the eastern side of ward 2). Recently, like the prominent city Dhaka, Khulna city changed as a populated city (Azmain & Rahman, 2018). In future the rate will increase as it is the center of the division and after the construction of the Padma bridge it will be turned as a super city. So, the dynamic change of land use seriously affects the environment now and in future. Islam *et al*., (2019) have done the analysis on urban heat island effect in Khulna city for a period of 17 years. The current study focused on a 9 years' time interval of 2010-2018, when a massive change in temperature happened in 2018, by focusing more on the massive after effect on environment due to the cause of greater change in the amount of vegetation cover in 2008 for Aila. The major jute mills of the north-western part of KCC are closed in 2012. Travel demand is 13% at the rail crossing of study area which is rising at a significant rate due to the location of a major university, Khulna University of Engineering & Technology, bus stand and Fulbari gate market. So peak hour traffic congestion is most likely found over time (during the period of 2010-2018). The landing stage of Voirab River has drawn more people over the study period for the transportation of goods and individuals, for the purpose of work (sawmill, van stand by the river side), for the purpose of recreation (natural scenario by the river side).

Data collection and preparation

The natural extent of land cover and vegetation were explored with the help of LST and NDVI. On the perspective of the advancement in the contemporary technological field, remote sensing images were used in the current study.

Aerial images were collected from the United States Geological Survey website, for the area which corresponds with ward no. 1, 2, 3 of KCC. Landsat 5 Thematic Mapper (TM) has 7 bands and of them band 6 is the thermal band. Band 6 from Landsat 5 was used for extracting the land surface temperature data. While Band 3 and band 4 were the visible red band and the infrared band, used for the NDVI calculation. Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIS) images had 11 bands. Among those bands, the Red band (band 4) and Near Infrared band (band 5) are used for NDVI calculation. The TIR bands 10 was used for land surface temperature mapping (Long & Srihar, 2004). Table 2 represents the specifications of Landsat 5 and Landsat 8 imageries, used for the research purpose (Chander & Markham, 2003; Fensholt & Proud, 2012; Li *et al*., 2013).

Application of geospatial tools

Land surface temperature data was extracted from the Landsat 5 imageries for the year 2010 and Landsat 8 imageries for the year 2018. Landsat 7 Science Data Users Handbook and Landsat 8 Data Users Handbook had detailed specifications of USGS formulas, to extract surface temperature data from Landsat 5 and Landsat 8 imageries, respectively (Avdan & Jovanovska, 2016; Chander & Markham, 2003). Raster calculator was used to execute the USGS formulas and some required values for the equation were gathered from the metadata file of Landsat 8 OLI and TIS (value of ML, AL, K1 and K2 are given in Table 1). All the process, equation, list of variables from the USGS equations were specified in Table 1. After conducting the LST operation in ArcGIS, the research area was divided into some different LST classes (Table 1). The area under these classes (for NDVI calculation), the maximum, minimum and average temperature for ward 1, 2 and 3 were calculated with the help of ArcGIS and MS Excel. Number of square units for each type of distinctive NDVI classes were multiplied by the area of one square unit (900 square meters = 30-meter X 30 meter), to obtain the total area under each class (Table 3). The result of LST operation was in the form of raster which was further converted into vector format. The vector format data was further intersected with the ward boundary and then the vector format file was further exported into Excel. The exported data in Excel were used to calculate the maximum, minimum and the average temperature for ward 1, 2, 3 for the year 2010 and 2018 (Table 4).

RESULTS & DISCUSSION

Assessment of vegetation cover

Table 3 demonstrates the vegetation health status as per the NDVI values for ward 1, 2 and 3 and the amount of corresponding land area for different types of vegetation cover. The area under low canopy and average canopy are zero for ward 1 and ward 2, where the amount of bare ground has been increased over the 8-consecutive year of study. By following the physical pattern of vegetation cover over the area (Figure 2a), most high values of NDVI were found by the residential area of ward 1, 2 and 3 (Maniktala, Banik para, Mallik para in ward 1; the residential area for the workers of Sonali Jute Mill and Ajax Jute Mill in ward 2; Kartikkul, Maheswarpasa, Parmanik para, Kaliibari, Islambag in ward 3). As the Dhaka-Jessore Highway passes by the area under study, low amount of NDVI value was found on the both side of the highway. NDVI value decreased on the western part of ward 3 (Figure 2b), as for the establishment of fish hatcheries by replacing the vegetation cover (western side of Kartikkul). A major portion of vegetation cover loss happened during the study period in ward 2. As the Sonali Jute Mill and Ajax Jute Mill closed down in 2012, people have to look for replacement job in sawmill by the side of Voirab river. So, the number of trees has decreased in ward 2 at a great extent (Table 3).

Assessment of Land Surface Temperature

Table 4 shows the average, minimum and maximum temperature data collected from the Landsat imagery analysis for the year 2010 and 2018. There are not much of temperature difference due to the adjacency of three wards. Among the three wards, ward 1 had slightly low temperature rather than ward 2 and ward 3. Ward 2 has shown the highest temperature 32.5◦C in the year 2018. There are multiple factors to contribute for LST situation, like amount of greeneries, land use land cover pattern, amount and location of waterbodies. The spatial pattern of LST showed that the southeastern part of ward 3 has shown about highest temperature for the year 2010 and 2018, where Raligate, Daulatpur industrial area, Daulatpur Railway station are located. A very busy portion of Dhaka-Jessore Highway is located at this southeastern part of ward 3, which is a major crowded place of Khulna. People go on to Daulatpur for daily basis of work, for education (Government Daulatpur Muhsin High School), for shopping (Daulatpur bazar) and for passing by to go to Shib Bari or Dak-Bangla.

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Table 1: Specifications for Geo-spatial tools from Landsat 5 and Landsat 8 Imageries for the year 2010 and 2018.

Landsat Image	Process	Equation	Variables specification
Landsat 5	a) Conversion of the digital number (DN) to spectral radiance (L)	$L\lambda = LMIN + (LMAX - LMIN) \times DN/255$	$L\lambda$ = spectral radiance of Band 6, LMIN = 1.238, LMAX = 15.600 and DN = digital number.
	b) Conversion of spectral radiance to temperature in Kelvin	$TB_k = K2/\ln[(K1/L\lambda) + 1]$	K1= Calibration Constant 1 (607.76), K2 = Calibration Constant 2 (1260.56) for the thermal band of the TM data and TB_k = surface temperature in Kelvin.
	c) Conversion of Kelvin to Celsius	$TB_c = TB_k - 273$	TB_c = surface temperature in Celsius.
	d) NDVI Estimation	$NDVI = \frac{NIR-R}{NIR+R}$	NIR = Near Infrared Band (band 4), R = Red Band (band 3)
Landsat 8	a) Conversion into Top of Atmosphere (TOA) Radiance	$L\lambda = ML \times Qcal + AL$	$L\lambda$ = TOA spectral radiance (Watts/ (m^2 X srad X μm)), ML = Band specific multiplicative rescaling factor from the metadata (0.00033420), AL = Band specific additive rescaling factor from the metadata (0.10000), Qcal = Quantized and calibrated standard product pixel values (DN)
	b) Conversion to Top of Atmosphere (TOA) Brightness Temperature	$BT = K_2 / \ln(K_1 / L\lambda + 1) - 273.15$	BT = Top of atmospheric brightness temperature (°C), $L\lambda$ = TOA spectral radiance (Watts / (m^2 X srad Xμm)), K_1 = Band specific thermal conversion constant from the metadata=774.8853(for band 10), K_2 = Band specific thermal conversion constant from the metadata=1321.0789 (for band 10)
	c) NDVI Estimation	$NDVI = \frac{NIR-R}{NIR+R}$	NIR = Near Infrared Band (band 5), R = Red Band (band 4)
	d) Land Surface Emissivity (LSE)	$PV = (\frac{NDVI-NDVImin}{NDVImax+NDVImin})^2$ $E = 0.004 \times PV + 0.986$	PV = Proportion of Vegetation, NDVI = DN values from NDVI Image, $NDVI_{min}$ = Minimum DN values from NDVI Image, $NDVI_{max}$ = Maximum DN values from NDVI Image, E = Land Surface Emissivity
	e) Land surface temperature (LST)	$LST = (BT/1) + (W) \times (BT/14380) \times \ln(E)$	BT = Top of atmosphere brightness temperature (°C), W = Wavelength of emitted radiance, E = Land Surface Emissivity

Table 2. List of Landsat thematic mapper scenes used.

Satellite	Acquisition date	Path/Row	Resolution (m)	Sun elevation	Azimuth	Cloud Cover
Landsat 5	2010-02-06	138/44	30	41.83708911	140.90683281	0.00
Landsat 8	2018-03-22	138/44	30	38.35907247	152.78285009	0.70

Source: Metadata file of Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIS)

Table 3. Vegetation Health Status and Corresponding Land Area (in square meter)

Label	Values	Area in square meter		Area in square meter		Area in square meter	
		Ward 1		Ward 2		Ward 3	
		2010	2018	2010	2018	2010	2018
Deep water	-1 to -0.1	900	0	3600	0	1800	0
Light water	-0.1 to 0	24300	900	72000	1800	71100	19800
Bare ground	0 to 0.1	49500	35100	81000	72900	87300	69300
Settlements	0.1 to 0.2	63900	9900	51300	31500	113400	39600
Very low canopy	0.2 to 0.3	55800	53100	46800	45900	67500	86400
Low canopy	0.3 to 0.4	16200	0	8100	0	13500	2700
Average canopy	0.4 to 0.5	0	0	0	0	0	0

Table 4. Status of Land Surface Temperature (in degree Celsius) for the year 2010 and 2018

Ward no.	2010			2018		
	Avg.	Min	Max	Avg.	Min	Max
Ward 1	22.5	19.5	25.5	28.5	26.5	30.5
Ward 2	22	17.5	26.5	30	27.5	32.5
Ward 3	23.5	19.5	27.5	29	26.5	31.5

So, the highest temperature is corresponded by high population density. On the south-western part of ward 3, there are the residential area (Kartikkul, Maheswarpasa, Parmanik para, Kaliibari, Islambag) where temperature is the lowest due to the amount of vegetation cover over the area. Over the 8-consecutive year of study, ward 3 has greater amount of vegetation and waterbody rather than other two wards. As the Dhaka-Jessore Highway passing from ward 3 to the Northern part of the area under study, on the eastern side of which ward 2 is located, on the bank of River Voirab. The average temperature of ward 2 are found by the side of Dhaka-Jessore Highway, 22◦C in 2010 (Figure 2c) and 30◦C in 2018 (Figure 2d). The maximum temperature of ward 2 is 26.5◦C in 2010, due to Sonali Jute Mill and Ajax Jute Mill, located at the Northern part of ward 2. The Jute Mills closed in the year 2012, which is the cause of high temperature area reduction on the Northern part of ward 2. But the maximum temperature has increased to 32.5◦C for ward 2 for the year 2018. Due to the closure of the Jute Mills, some peoples' have moved from the area of ward 2 (decreasing settlement area found for the year 2018 from Table 3). Some people get engaged working in sawmill, located by the Voirab river side. So, the amount of vegetation decreased for the year 2018 (Table 3). The

eastern most part of ward 2 (by the river side), the minimum temperature for ward 2 are found during the year 2010 and 2018.

Comparing with ward 2 and ward 3, ward 1 has the low level of temperature for the study period. Under the influence of waterbody and vegetation cover in ward 1, the maximum temperature is found by the side of Dhaka-Jessore Highway for both the year 2010 and 2018. The western and middle portion of ward 1 are occupied with residential area (Maniktala, Banik para, Mallik para) with a lot of greeneries and fish hatcheries. There is only one small plastic industry by the side of Khulna City Bypass road, on the northern part of ward 1.

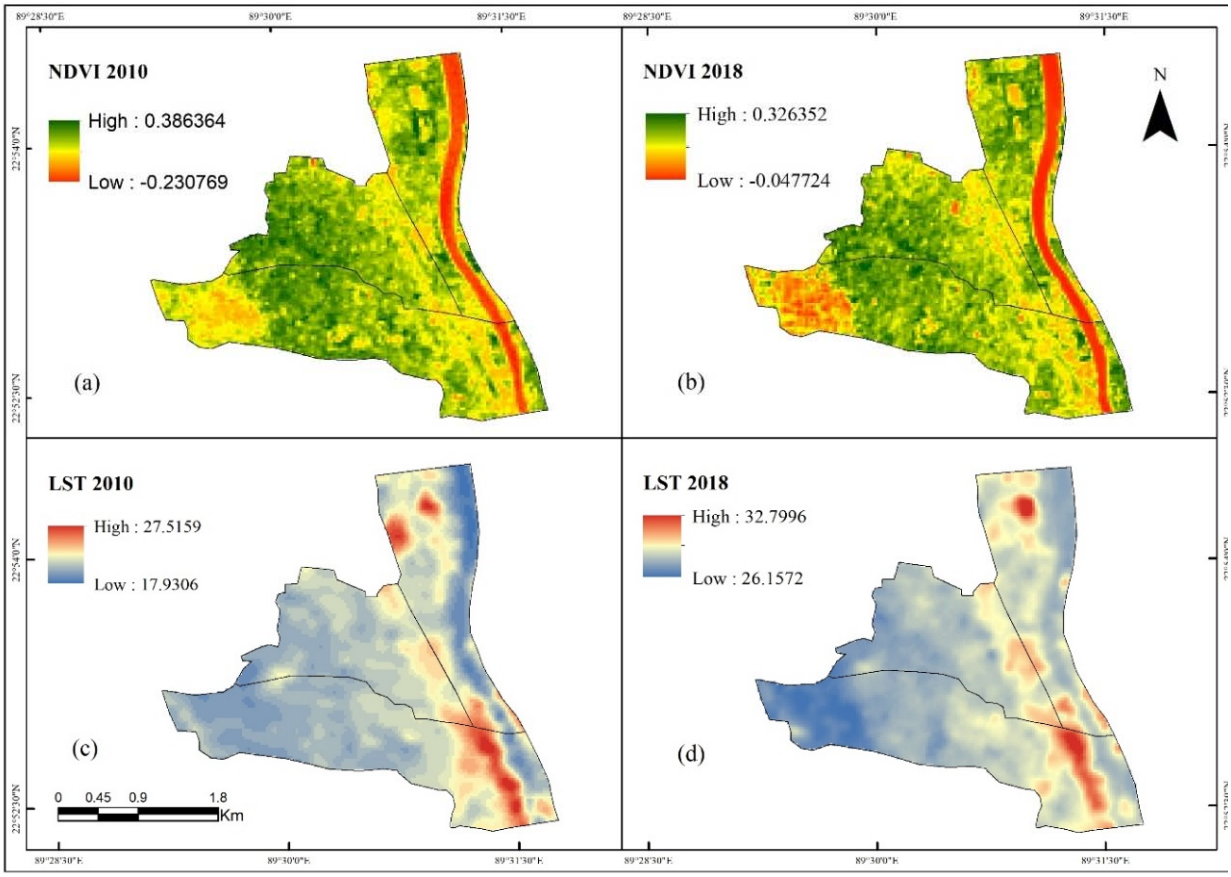

Figure 2. (a) NDVI for 2010, (b) NDVI for 2018, (c) LST for 2010, (d) LST for 2018; Source: Author, 2019

CONCLUSION

The overall vegetation has decreased in the year 2018 from the year 2010, parts of the study area had faced increasement in amount of vegetation which helped in decreasing the temperature eventually (for ward 3 in year 2018). Moreover, other factors like presence of waterbodies also have an important role in reducing surface temperature (for ward 1). The study was conducted in the north-western part of the large city corporation. So, the scenario for the whole city might have some differences which is a limitation of the study. More and vast studies are required to find the scenario of the whole city or the country. Again, as the presence of other factors seemed to have impact on the

temperature, further studies can be conducted to see if other factors are more impactful in this case. However, the paper might work as a framework for future studies related to vegetation and temperature monitoring in regard of environmental studies. Again, it will also serve as a document for understanding the factors associated with the changing pattern and trends of surface temperature of the area under study and the area adjacent areas with similar specifications.

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Mutagenesis Analysis of *ABCB4* Gene Promoter of *Danio rerio*

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ABSTRACT

Zebrafish *abcb4* gene (ortholog to human *ABCB1* gene) serves primarily in multidrug resistance (MDR) mechanism by effluxing chemotherapeutic agents, chemicals, xenobiotics, and numerous anti-cancer drugs out of the cells. This study aims to identify the specific transcription factor binding sites (TFBS) within the promoter region of zebrafish *abcb4* gene and determine the functional roles of these factors in *abcb4* gene expression regulation via mutagenesis analysis. First, primers were designed to target and amplify the promoter region of zebrafish *abcb4* gene through gradient PCR. The zebrafish *abcb4* gene promoter was then cloned into pGL3.0 vector and sent for sequencing. The sequencing results revealed high similarity to zebrafish DNA sequence from clone DKEY-24I24 in linkage group 16, indicating a successful cloning of targeted gene. Thereafter, consensus sequence of zebrafish *abcb4* gene promoter was generated with the length of 1,392 bp which was close to its expected size during primer design (1,500 bp). Using MATCH tool, 155 TFBSs were found within zebrafish *abcb4* gene promoter region. Activator protein 1 (AP-1) TFBS at 1,255 bp was chosen to be mutated through site-directed mutagenesis. Mutagenic primers (forward primer: 5' GGG CAA GGC AGT ATA AAC GTG 3' and reverse primer: 5' TTA TGT TTC TAG GGA TTA CGT CAC 3') were designed to substitute AGT with GGG to remove the AP-1 TFBS. By mutating the zebrafish *abcb4* gene promoter, the MDR phenomenon driven by zebrafish *abcb4* gene can be elucidated and this might provide clues to the development of tumor and malignancy in human. The results from this study may enrich the knowledge in chemotherapy and cancer treatments.

Keywords: ABC transporters gene family, multidrug resistance, site-directed mutagenesis, promoter, xenobiotics, transcription factor

INTRODUCTION

Tumor occurs very commonly in humans, some mammals and even in plants. Generally, tumor can be classified into three main types, namely benign, premalignant and malignant tumors. Azizah *et al.* (2019) reported that the mortality rate among the cancer (malignancy) patients is relatively high in Malaysia despite the vast availability of modern health facilities and medical chemotherapy treatments. This is probably due to the resistance of cancer cells to the chemotherapeutic agents over time.

The resistance to chemotherapeutic agents and some other anti-cancer drugs is driven by the ATP-binding cassette (ABC) transporters in multidrug resistance mechanism. Ferreira, Costa, and Reis-Henriques (2014) discovered the role of ABC proteins in multidrug resistance (MDR) for chemotherapeutic treatments. According to Annilo *et al.* (2006), all the ABC protein subfamilies (except for ABCH subfamily) found in zebrafish correspond to their respective human counterparts. For instance, the zebrafish *abcb4* gene is orthologous to that of the human *ABCB1* gene. Ergo, zebrafish *abcb4* gene is functionally similar to human *ABCB1* gene and they are important in cellular resistance to chemicals (Fischer *et al.*, 2013).

Previously, the *abcb4* gene of zebrafish and Sarawak rasbora (a close family member to zebrafish) has been functionally characterized by Fisher *et al.* (2013) as well as Lim *et al.* (2018a), respectively, and they had come to the same consensus that this gene has significant expressions in the intestinal tract of both species. In addition, the transcriptional analysis performed by Hamli (2019) as well as Lim and Chung (in press) on *abcb4* promoter of zebrafish showed that the zebrafish *abcb4* regulatory region is mainly controlled by SORY, HOMF, BRNF and HOXF. However, available knowledge and findings about zebrafish *abcb4* gene regulation is still

limited at current stage despite the fact that gene regulatory elements like the promoter and enhancer have been proven imperative in orchestrating the activation and deactivation of genes (Hernandez-Garcia & Finer, 2014; Lim, Chung, Chong, & Lee, 2018b; 2019a; 2019b; Liu & States, 2002; Mishra, Dhanda, Siwach, Aggarwal, & Jayaram, 2020; Wang, Cheng, Li, Wu, & Zhao, 2018). Therefore, this study is carried out with the aims to determine the specific transcription factor binding site (TFBS) within the promoter region of zebrafish *abcb4* gene and to conduct mutagenesis analysis on the promoter. Thus, it is hypothesized that zebrafish *abcb4* gene expression and regulation will be affected after mutagenesis.

MATERIAL & METHOD

Total DNA extraction

Fish maintenance, fish harvesting and total DNA extraction (using CTAB method as described by Chung (2018)) were conducted with acquiescence to the permission and guidelines drawn out by the Universiti Malaysia Sarawak Animal Ethics Committee (UNIMAS/TNC(PI)-04.01/06-09(17)). A healthy zebrafish was first euthanized by immersing it in ice-cold water and then the zebrafish was sliced finely on ice. Afterwards, the sliced zebrafish in conical tube was added with 9.5 ml of CTAB lysis buffer before incubation at 65ºC water bath for about 30 min. Next, 10 µl of proteinase K was added and the tube was incubated at 65ºC water bath for another 30 min. Throughout the incubation, the tube was shaken and vortexed intermittently to ensure all the minced zebrafish tissues dissolved completely. Upon the completion of incubation, the lysate was equally aliquoted into several 2 ml microcentrifuge tubes before the addition of an equal volume of Phenol:Chloroform:Isoamyl Alcohol (25:24:1) in fume hood. The tubes were then inverted gently to mix the PCI and lysate, followed by incubation at room temperature for 10 min to allow precipitation of proteins and nucleic acids.

After that, the lysate was centrifuged at 13,000 rpm for 10 min. The supernatant was equally transferred to several new microcentrifuge tubes and equal volume of isopropanol was added to each tube, respectively. The tubes were incubated at room temperature for 30 min to allow DNA precipitation, followed by centrifugation at 13,500 rpm for 10 min. Upon centrifugation, the supernatant was discharged gently, and the DNA pellet was washed with 1 ml of pre-chilled 70% ethanol and centrifuged at 12,500 rpm for 5 min. Then, the DNA pellet was air-dried for 30 min in fume hood. Lastly, the DNA pellet was dissolved in 20 µl of ultrapure water and kept in -20ºC until use.

Gradient polymerase chain reaction (PCR)

Gradient PCR was carried out, emulating that of Lim, Chung, and Hasnain (2020) with several modifications, to determine the optimum annealing temperature for the designed primer pair (forward primer: 5' ATG GTA CCT TTA TTT GAG TGA GTG GCC C 3' and reverse primer: 5' ATG AGC TCT GAA TGA AAG ATA CCT ACC GC 3', designed based on GenBank entry: NC_007127.7) via T100^{TM} Thermal Cycler (BIO-RAD, USA). To perform gradient PCR, PCR master mixture was first prepared as indicated in Table 1.

Table 1. Components of PCR master mixture for zebrafish *abcb4* gene promoter.

Components	Final concentration	Volume (1X)	Volume (4.5X)
Nuclease-free water (ddH_2O)	N/A	14.4 µl	64.8 µl
10X *EasyTaq* buffer (with Mg^{2+})	1X	2.0 µl	9.0 µl
2.5 mM of dNTPs	0.2 mM	1.6 µl	7.2 µl
10 µM of *abcb4* forward primer	0.2 µM	0.4 µl	1.8 µl
10 µM of *abcb4* reverse primer	0.2 µM	0.4 µl	1.8 µl
EasyTaq DNA polymerase	2.5 units	0.2 µl	0.9 µl
Genomic DNA of zebrafish (DNA template)	As required	1.0 µl	4.5 µl
Final volume	**-**	**20.0 µl**	**90.0 µl**

The prepared PCR master mixture was kept on ice to prevent the enzymes and dNTPs from degrading. Next, the PCR master mixture was aliquoted into four pre-labeled PCR tubes (20 µl each) before subjected to thermal cycling for 35 cycles. The thermal cycling conditions were initial denaturation at 95ºC for 3 min, followed by 35 cycles of denaturation at 95ºC for 30 sec, primers annealing between 59ºC and 65ºC for 30 sec as well as extension at 72ºC for 1 min 30 sec. The PCR products were then quality checked through agarose gel electrophoresis (AGE).

Cloning into pGL3.0 Vector

Cloning process (as performed by Jee et al. (2017)) was started with double RE digestion. Wherewith, *Kpn*I and *Sac*I restriction enzymes were used to cut both the zebrafish *abcb4* gene promoter and the pGL3.0 vector (Promega, USA). The restriction digestion mixtures were prepared and then incubated at 37ºC water bath for 16 hr. Upon incubation, the restriction enzymes were inactivated through the incubation at 80ºC water bath for 20 min. Followed by, the inactivated digestion mixtures were analyzed through AGE. Depending on the number of band yields, both the cut zebrafish *abcb4* gene promoter and pGL3.0 vector were subjected to either gel extraction or purification process.

The purified zebrafish *abcb4* gene promoter was then ligated into cut pGL3.0 vector by using 2X Rapid Ligation Buffer. The ligation reaction mixture was prepared by mixing 10 µl of 2X Rapid Ligation Buffer, 2 µl of pGL3.0 vector, 6 µl of purified zebrafish *abcb4* gene promoter and 2 µl of T4 DNA Ligase. Then, the ligation reaction mixture was incubated overnight at 4ºC to ensure maximum number of transformants. On the next day, the ligated pGL3.0 vector with zebrafish *abcb4* gene promoter was transformed into *E. coli* XLI-Blue strain. The transformants were then plated and transformation efficiency was calculated by using the formula shown below. The colonies grown were then screened and verified through colony PCR.

$$\text{Transformation efficiency (transformants per µg)} = \frac{\text{colonies per plate}}{\text{ng of plasmid DNA plated}} \text{ x 1000 ng/µg}$$

Analysis of DNA sequencing result

Upon dsDNA quantification, 15 µl of isolated plasmid DNA (pGL3.0 vector with zebrafish *abcb4* gene promoter) was sent for forward and reverse sequencing. The sequencing results were then confirmed by performing NCBI nucleotide BLAST (BLASTn). The outcomes (gaps, identities, score and coverage) were studied and recorded for data analysis. Subsequently, the sequencing results were compared and pairwise alignment was carried out. Then, the incorrect base calls were edited. Eventually, the consensus sequence of zebrafish *abcb4* gene promoter was generated and subjected to downstream analysis.

Transcription factor binding site analysis

Transcription factor binding site **(**TFBS) analysis was performed using MATCH tool. Firstly, the consensus sequence of zebrafish *abcb4* gene promoter was inputted into MATCH tool. Then, specific matrix and profile were selected. Wherewith, vertebrate was selected as the group of matrices and liver specific profile was set. From the MATCH outcomes, a specific TFBS was then chosen to be mutated. In this study, the TFBS for activator protein 1 (AP-1) was selected and subjected to the downstream mutagenesis analysis.

Mutagenic primer design

Mutagenic primers were designed based on the consensus sequence of zebrafish *abcb4* gene promoter. Since TFBS of AP-1 was chosen to be mutated in this study, thus the AP-1 TFBS located nearest to TATA-box was selected. Then, the mutagenic primers were designed by substituting three bases in the AP-1 TFBS sequence to another bases, thus creating mutation. Consequently, this mutation was expected to lead to the deletion of AP-1 TFBS in the specific region of zebrafish *abcb4* gene promoter. The mutagenic primers (forward and reverse primers) were then sent to Apical Scientific Sdn. Bhd. for primer synthesis.

Site-directed mutagenesis

Firstly, the plasmid template DNA (pGL3.0 vector with zebrafish *abcb4* gene promoter) was subjected to inverse PCR. Wherewith, the master mixture was prepared as depicted in Table 2.

Table 2. Components of inverse PCR master mixture for zebrafish *abcb4* gene promoter.

Components	Volume (1X)	Volume (3.5X)
ddH_2O	14.4 µl	50.4 µl
10X buffer for iPCR	2.0 µl	7.0 µl
2 mM dNTPs	2.0 µl	7.0 µl
Mutagenic forward primer for *abcb4* (10 µmol/µl)	0.4 µl	1.4 µl
Mutagenic reverse primer for *abcb4* (10 µmol/µl)	0.4 µl	1.4 µl
Plasmid template DNA (50 ng/µl)	0.4 µl	1.4 µl
KOD-Plus-DNA Polymerase	0.4 µl	1.4 µl
Total volume	**20.0 µl**	**70.0 µl**

The prepared master mixture was then aliquoted into three pre-labeled PCR tubes (20 µl each). Afterwards, the PCR tubes were subjected to thermal cycling for 7 cycles. The thermal cycling conditions were initial denaturation at 94ºC for 2 min, followed by 7 cycles of denaturation at 98ºC for 10 sec, primers annealing between 47.3ºC and 56.2ºC for 30 sec as well as extension at 68ºC for 7 min. Next, the PCR products were checked through AGE before subjected to *Dpn*I digestion.

For *Dpn*I digestion, 1 µl of *Dpn*I restriction enzyme (10 U/µl) was added to 20 µl of the PCR product. Then, the reaction mixture was mixed gently, spun down and incubated at 37ºC water bath for 1 hr. Then, the *Dpn*I-treated PCR product was subjected to self-ligation process. Wherewith, the ligation reaction mixture was prepared by mixing 2 µl of *Dpn*I-treated PCR product, 7 µl of ddH_2O, 5 µl of ligation high and 1 µl of T4 Polynucleotide Kinase. Then, the ligation reaction mixture was incubated at 16ºC for 1 hr. Next, the self-ligated PCR product was then transformed into *E. coli* XLI-Blue strains and the transformants were then plated. Lastly, the transformants (mutants) were analyzed through DNA sequencing and further verified through TFBS analysis.

RESULTS

Analysis of DNA Sequencing Results

The forward sequencing result showed 94% homology to the zebrafish DNA sequence from clone DKEY-24I24 in linkage group 16 (GenBank accession number: CR388365.10) (Supplementary Figure 1). The E-value obtained is 0.0, which indicates that the amount of alignments with the query sequence that would be expected to occur by chance in the database is zero (Supplementary Table 1). The identities obtained is 717/762 with 1% of gaps (14/762) found. On the other hand, the reverse sequencing result revealed 95% homology to zebrafish DNA sequence from clone DKEY-24I24 in linkage group 16 (Accession number: CR388365.10) (Supplementary Figure 2). The E-value obtained is 0.0 which indicates that the amount of alignments with the query sequence that would be expected to occur by chance in the database is zero. The identities obtained is 561/590 with approximately 0% of gaps (2/590) found (Supplementary Table 2).

TFBS Analysis

The MATCH outcomes revealed 155 transcription factor binding sites within zebrafish *abcb4* gene promoter sequence based on liver-specific profile. In addition, the frequency of sites per nucleotide in liver-specific profile depicted the value of 0.111351. Besides, there were 11 types of TFBS detected within the zebrafish *abcb4* gene promoter sequence under the liver-specific profile, namely HNF-3beta, C/EBPbeta, HNF-1, AP-1, TATA, CHOP-C/EBPalpha, GATA-3, NF-1, USF, CREB and GR (Figure 1). The distribution pattern of TFBS detected within zebrafish *abcb4* gene promoter region using liver-specific profile is shown in Figure 2.

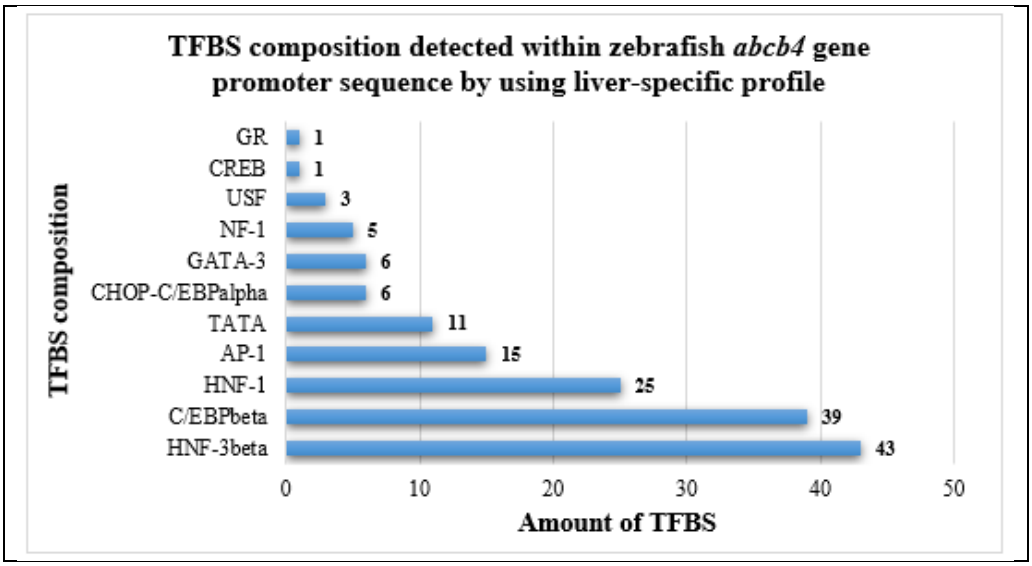

Figure 1. The amount of TFBS and TFBS composition detected within zebrafish *abcb4* gene promoter sequence by using liver-specific profile.

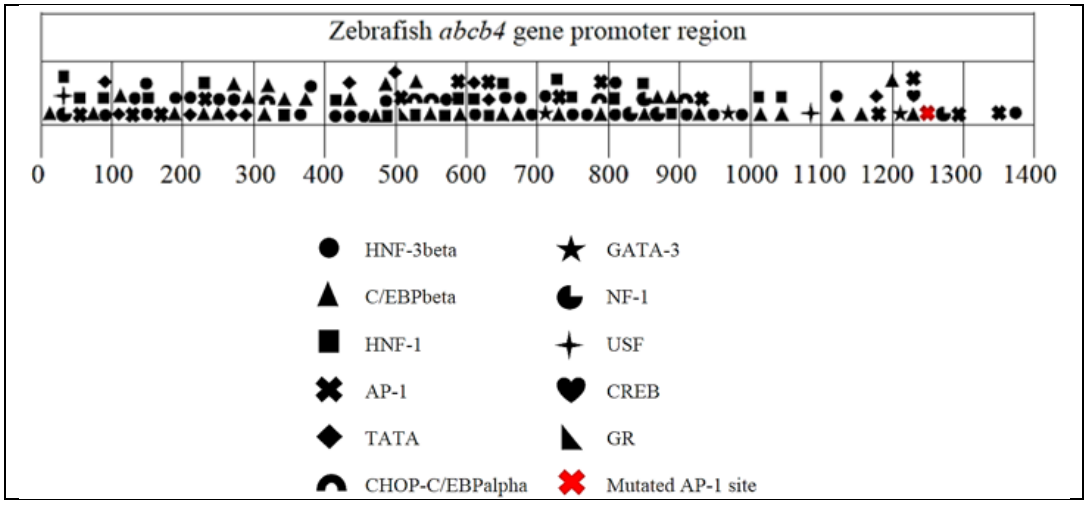

Figure 2. The TFBS distribution pattern per 100 bp interval. Stacking TFBS represents overlapping TFBS sites. Mutated AP-1 site was located at 1,255 bp.

Mutagenic primer designing

The mutagenic primers were designed by substituting three bases (AGT) in the AP-1 TFBS with another three bases (GGG), to remove the AP-1 TFBS, creating a mutation within the promoter. The parameters of the mutagenic primers designed for zebrafish *abcb4* gene promoter are shown below (Table 3).

Site-Directed Mutagenesis

Mutants were successfully generated via site-directed mutagenesis approach. The reverse sequencing result of mutated zebrafish *abcb4* gene promoter showed 98% homology to zebrafish DNA sequence from clone DKEY-24I24 in linkage group 16 (Accession number: CR388365.10) (Supplementary Figure 3 & Supplementary Table 3). Besides, the mutation site was created successfully and can be found in the correct region within zebrafish *abcb4* gene promoter (Figure 3).

Table 3. Parameters of the mutagenic primers designed for zebrafish *abcb4* gene promoter. The mutation induced site is indicated in red fond color.

Primer	Forward primer	Reverse primer
Sequence (5'-3')	GGG CAA GGC AGT ATA AAC GTG	TTA TGT TTC TAG GGA TTA CGT CAC
Length	21 mer	24 mer
Melting temperature (T_m)	56.3ºC	52.3ºC
GC content	52.4%	37.5%
Oligo amount	23.9 nmoles	25.3 nmoles

Figure 3. BLASTn analysis of the reverse sequencing result (partial sequence). Wherewith, the query sequence is the reverse-complement sequence of mutated zebrafish *abcb4* gene promoter that obtained from Apical Scientifc Sdn. Bhd. The sequence that framed in red colored box indicates the mutation site, at which the bases AGT had been substituted into bases GGG, thus creating mutation in the AP-1 TFBS.

In addition, the MATCH outcomes showed that AP-1 TFBS presents at 1,255 bp position within the consensus sequence of zebrafish *abcb4* gene promoter before mutagenesis (Figure 4). When the bases AGT within targeted AP-1 TFBS were substituted with bases GGG, the targeted AP-1 TFBS at 1,255 bp position was deleted (Figure 5), indicating the mutation was successful.

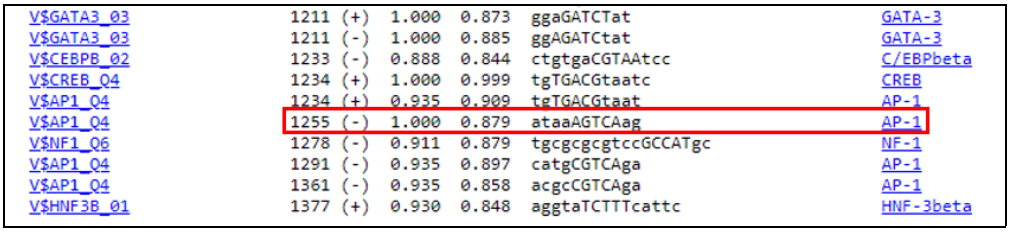

Figure 4. Part of TFBS list before mutation. The AP-1 TFBS presents at 1,255 bp within the consensus sequence of zebrafish *abcb4* gene promoter.

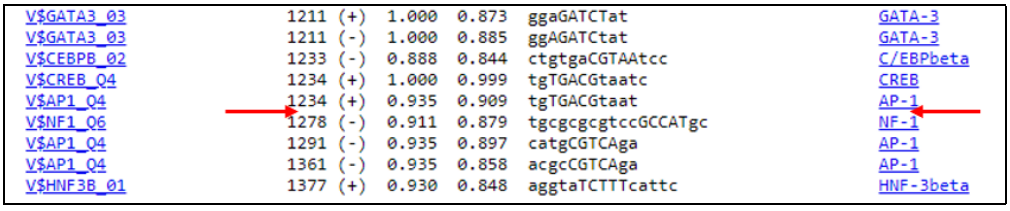

Figure 5. Part of TFBS list after mutation. The targeted AP-1 TFBS at 1,255 bp was deleted successfully and mutation was induced.

DISCUSSION

In this study, the potential TFBS within zebrafish *abcb4* gene promoter sequence was identified via MATCH tool. The human *ABCB1* gene is expressed on the apical surface of hepatocytes in liver. Both the zebrafish *abcb4* and human *ABCB1* genes are associated with liver disease, thus the search was specified to liver-specific profile (Abanda, Riches, & Collier, 2017; Zebrafish Information Network, 2019). According to Kel *et al.* (2003), liver-specific profile is designed to search for the potential binding sites within regulatory regions of liver-enriched genes. In addition, the most abundant TFBS found within the zebrafish *abcb4* gene promoter in the present study is the hepatocyte nuclear factor 3 beta (HNF-3beta) TFBS with a total of 43 binding sites found. This echoed the study by Yu, Guo, Jing, Dong, and Wei (2015) on HNF predominate expression in the liver and their role in regulating the hepatocytes differentiation and liver development.

Among the TFBS detected within zebrafish *abcb4* gene promoter region under liver-specific profile, only AP-1 TFBS located at 1,255 bp position was chosen to be mutated via site-directed mutagenesis approach. According to Gustems *et al.* (2014), AP-1 is a family of transcription factors that involved primarily in cell survival, proliferation and transformation, apoptosis as well as oncogenesis. Generally, AP-1 consists of a heterodimer between c-Fos and c-Jun that play a major role in transcriptional regulation of viral oncogene expression (Foppoli, Coccia, & Perluigi, 2014). Therefore, AP-1 TFBS was chosen to be mutated because AP-1 is closely linked to the proliferation and transformation of tumor cells (Foppoli *et al.*, 2014). In order to proliferate and transform, tumor cell population uses a protective mechanism known as the multidrug resistance (MDR) mechanism, to fight against numerous drugs (Stavrovskaya, 2000). The MDR mechanism is regulated by zebrafish *abcb4* gene and human *ABCB1* gene respectively via the efflux of the xenobiotic components, chemotherapeutic agents, chemicals and some other anti-cancer drugs out of the cells (Dermauw & Van Leeuwen, 2014; Fischer *et al.*, 2013; Liu *et al.*, 2016). Therefore, AP-1 TFBS mutation may provide insights on the elucidation of tumor development from benign to malignant stage.

Additionally, the study by Daschner, Ciolino, Plouzek, and Yeh (1999) had unearthed the close relationship between AP-1 and MDR mechanism in human cancer cells. The study revealed that when there is an elevation in the amount of c-Fos and c-Jun mRNA (AP-1 heterodimer) in cells, the cells are found to possess 12-fold, 65-fold or even 200-fold higher resistance towards the Adriamycin as compared to drug-sensitive MCF-7 (human breast cancer cells) wild type cells (Daschner *et al.*, 1999). This statement had been supported by Foppoli *et al.* (2014) as their studies showed that there was absence or very low level of AP-1 binding in normal cell as well as the premalignant lesions, but the AP-1 binding and transcriptional activity were found to be skyrocketed in malignant tissues. Ergo, by mutating AP-1 TFBS within the promoter and transfecting the mutant into cancer cell lines, the comprehension on the MDR phenomenon can be improved.

Mutation in TFBS can alter the conformation of binding site and disrupt the binding affinity of the TF, causing downstream transcriptional process to be hampered. Hence, the function and post-translational modification of proteins and DNA elements such as promoter region can be verified via this method (Chauhan, 2019; Hsieh & Vaisvila, 2013). The AP-1 TFBS mutation in the present study is the first imperative step in elucidating the transcriptional roles of the cis elements like AP-1 in orchestrating zebrafish *abcb4* gene promoter expression. This is relatively important because the transcriptional activation of zebrafish *abcb4* gene is closely associated with the MDR mechanism and cancer progression.

CONCLUSION

In conclusion, the objectives of this study had been achieved with the successful identification of specific TFBSs within zebrafish *abcb4* gene promoter as well as mutagenesis analysis. Using liver-specific profile in MATCH tool, 155 binding sites were found within the consensus sequence of zebrafish *abcb4* gene promoter and the TFBSs detected are HNF-3beta, C/EBPbeta, HNF-1, AP-1, TATA, CHOP-C/EBPalpha, GATA-3, NF-1, USF, CREB and GR. Mutation in AP-1 TFBS can therefore provide insights to tumor development up till malignant stage, which can be linked to the MDR mechanism that driven by zebrafish *abcb4* gene. It is recommended to do

functional characterization on the mutant via cancer cell line transfection and zebrafish embryo microinjection to further reveal the spatiotemporal expression patterns. Furthermore, mutation can be introduced to other TFBSs or a specific cluster of TFBS to unearth the functional cooperation of these TFs in the zebrafish *abcb4* gene promoter expression regulation.

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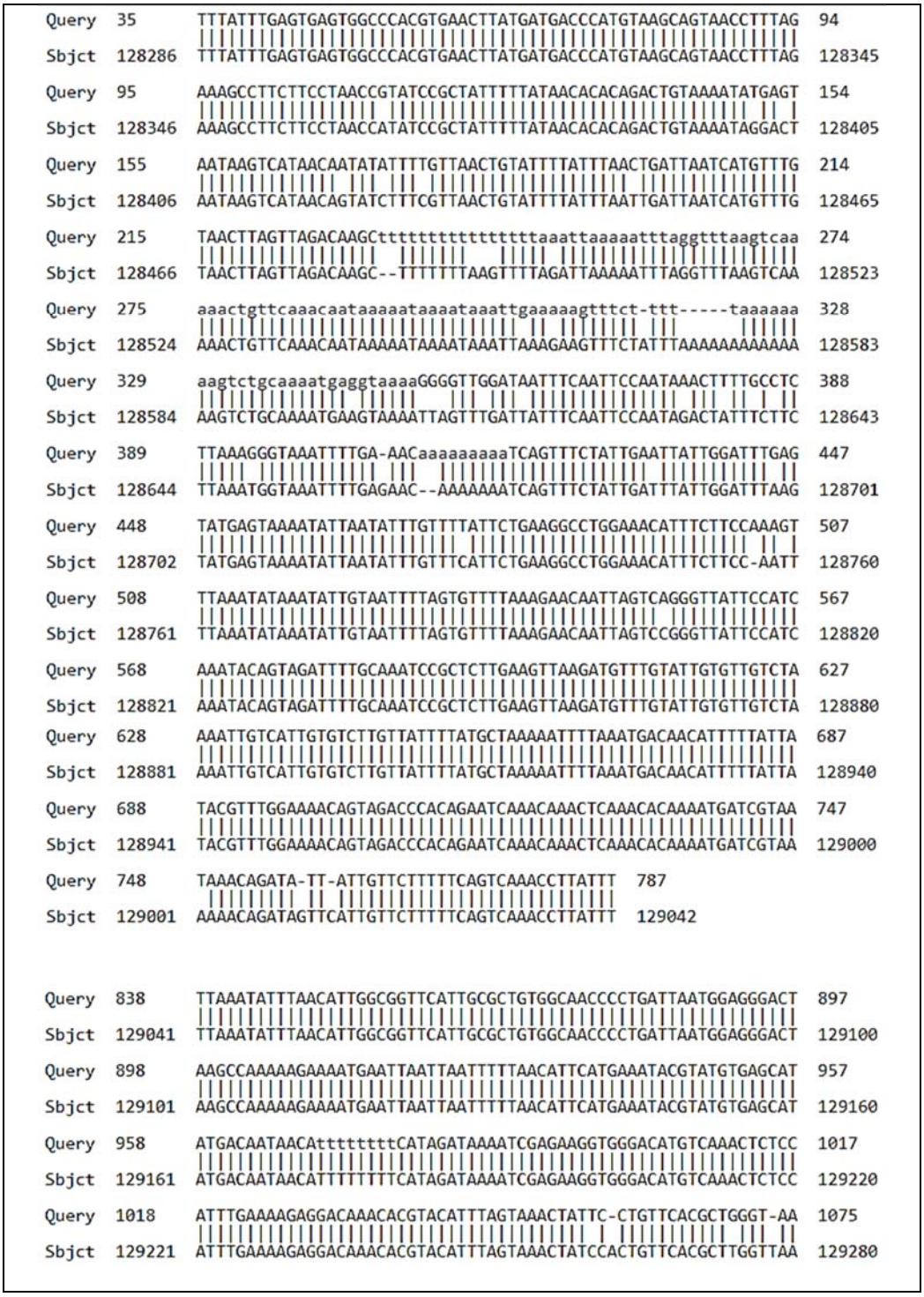
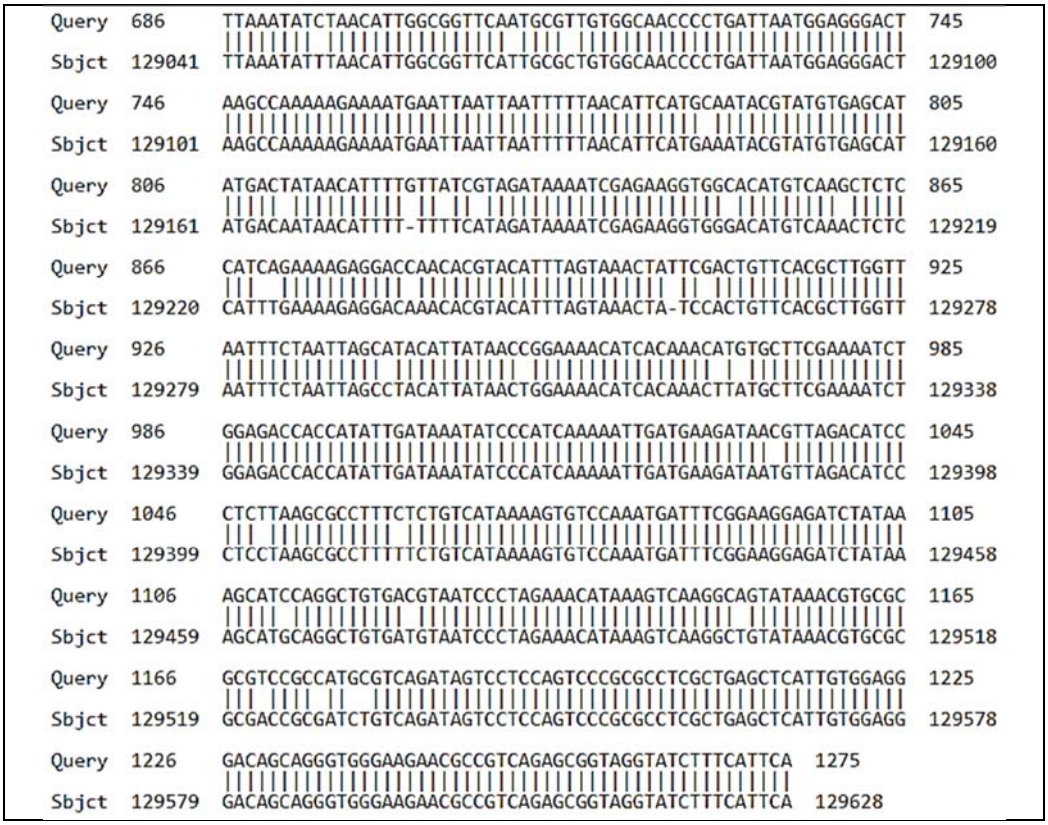
Supplementary Files



Supplementary Figure 1. BLASTn analysis of the forward sequencing result (zebrafish *abcb4* gene promoter). Wherewith, the query sequence is the sequence of zebrafish *abcb4* gene promoter obtained from First Base Laboratories Sdn. Bhd.

Supplementary Table 1. Summary of BLASTn analysis of the forward sequencing result (zebrafish *abcb4* gene promoter).

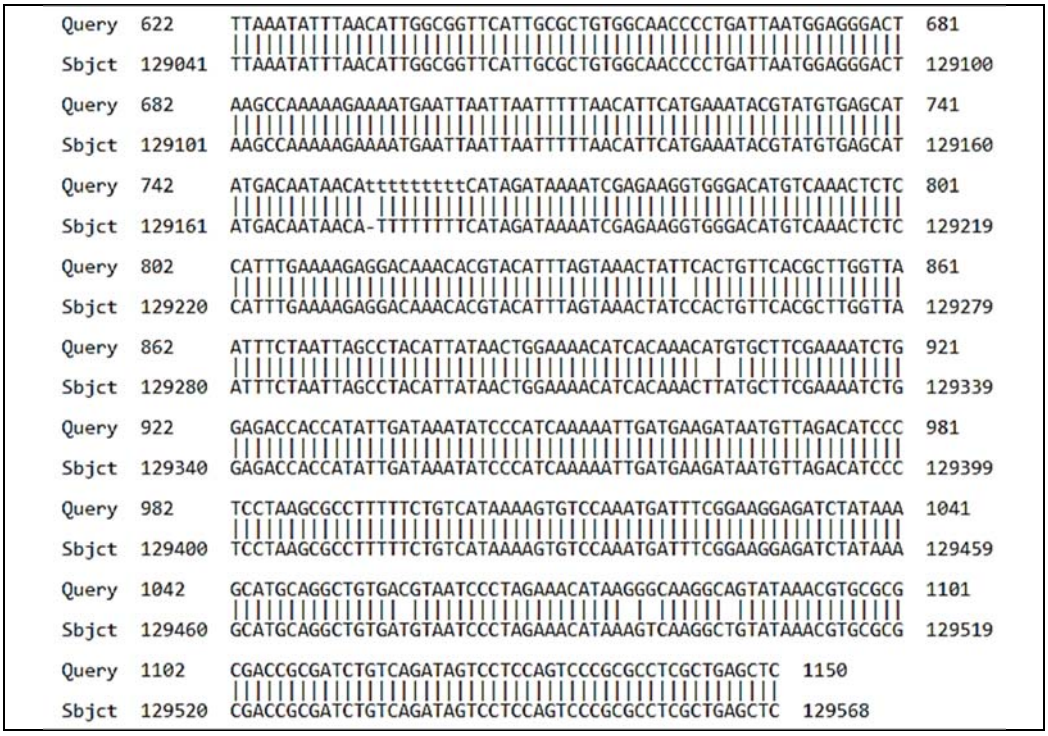
Gene name	Description of the highest score hit	Score (bits)	E-value	Identities	Gaps
Abcb4	Zebrafish DNA sequence from clone DKEY-24I24 in linkage group 16, complete sequence	1146 (620)	0.0	717/762 (94%)	14/762 (1%)



Supplementary Figure 2. BLASTn analysis of the reverse sequencing result (zebrafish *abcb4* gene promoter). Wherewith, the query sequence is the reverse-complement sequence of zebrafish *abcb4* gene promoter obtained from First Base Laboratories Sdn. Bhd.

Supplementary Table 2. Summary of BLASTn analysis of the reverse sequencing result (zebrafish *abcb4* gene promoter).

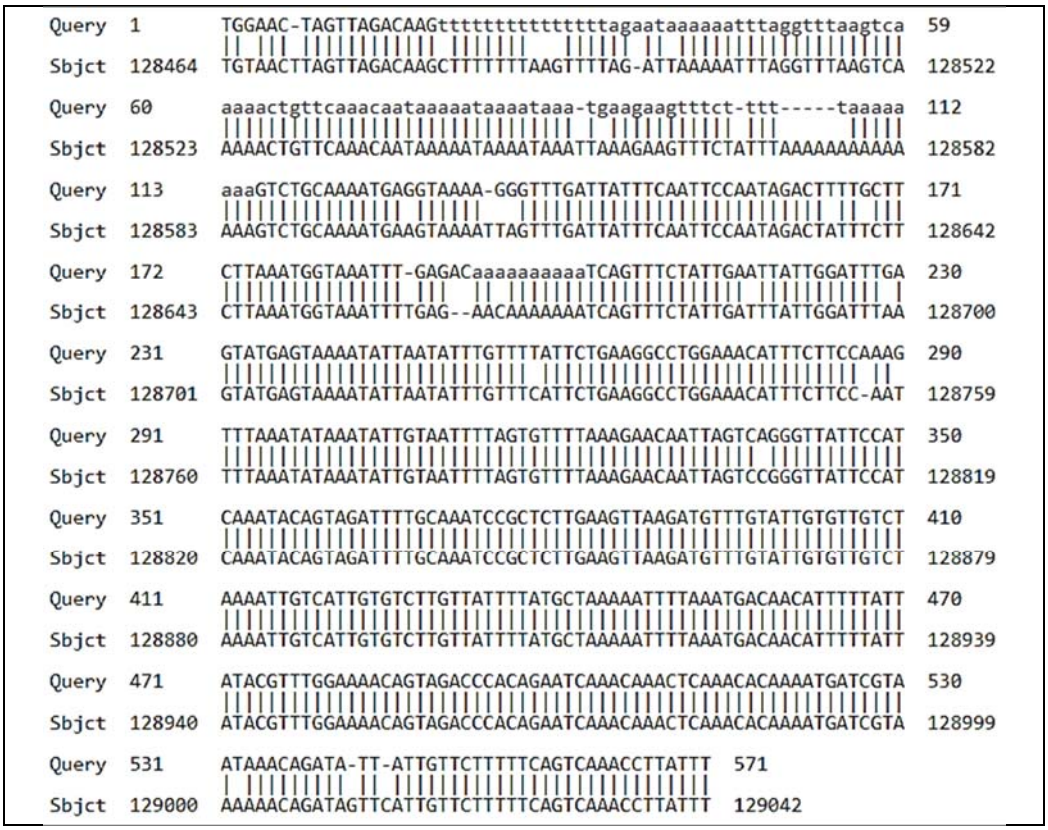
Gene name	Description of the highest score hit	Score (bits)	E-value	Identities	Gaps
Abcb4	Zebrafish DNA sequence from clone DKEY-24I24 in linkage group 16, complete sequence	928 (502)	0.0	561/590 (95%)	2/590 (0%)



Supplementary Figure 3. BLASTn analysis of the reverse sequencing result (first BLAST hits). Wherewith, the query sequence is the reverse-complement sequence of mutated zebrafish *abcb4* gene promoter that obtained from First Base Laboratories Sdn. Bhd. The sequence that framed in red color box indicates the mutation site, at which the bases AGT had been substituted into bases GGG, thus creating mutation in the AP-1 TFBS.

Supplementary Table 3. Summary of BLASTn analysis of the reverse sequencing result (first BLAST hits).

Gene name	Description of the highest score hit	Score (bits)	E-value	Identities	Gaps
Abcb4	Zebrafish DNA sequence from clone DKEY-24I24 in linkage group 16, complete sequence	931 (504)	0.0	521/529 (98%)	1/529 (0%)



Supplementary Figure 4. BLASTn analysis of the reverse sequencing result (second BLAST hits). Wherewith, the query sequence is the reverse-complement sequence of mutated zebrafish *abcb4* gene promoter that obtained from First Base Laboratories Sdn. Bhd.

Supplementary Table 4. Summary of BLASTn analysis of the reverse sequencing result (second BLAST hits).

Gene name	Description of the highest score hit	Score (bits)	E-value	Identities	Gaps
Abcb4	Zebrafish DNA sequence from clone DKEY-24I24 in linkage group 16, complete sequence	863 (467)	0.0	547/583 (94%)	16/583 (2%)

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Mutagenesis Analysis of *ABCG2* Gene Promoter of Zebrafish (*Danio Rerio)*

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ABSTRACT

Breast cancer is the commonest cancer among women worldwide and the probability of a woman dying from breast cancer is high (about 1 in 38 of total human population (2.6%)).The main factor for mortality is due to the resistance of this particular disease to chemotherapeutic agents. One of the most well-known proteins to be found to correlate significantly with breast cancer resistance to chemotherapeutic agent is the ATP-binding cassette super-family G member 2 (ABCG2). Knowledge on *ABCG2* gene regulation is still lacking in terms of how the increased cytotoxic levels are closely related to induce a hype in gene transcript levels and ultimately cause of the reduction in chemotherapeutic agents. The approach taken in this study is through mutational analysis of selected transcription factor governing the expression of *ABCG2*. In order to achieve this, a previously cloned *ABCG2* promoter which has been isolated (around 1500 bp in size) from *Danio rerio* and inserted into pGL3.0 plasmid, was subjected to site-directed mutagenesis. Selected transcription factor which is AP-1 was successfully mutated by deletion of 5'- TGACGCG -3' sequence at position 1113 bp from TSS+1 where it would bind in order to define their role in *ABCG2* physiological function. Sequencing result after site-directed mutagenesis shows high similarities about 98% with *ABCG2* gene of *Danio rerio*. Upon validation, it was found that the intended AP-1 binding site has been mutated. In future work, the mutated clone here will be subjected to transfection analysis where dual-luciferase assay will be conducted to verify the loss of activity from the *ABCG2* promoter upon mutation of the targeted AP-1 site. Hence, the mutagenesis analysis of *ABCG2* promoter are able to provide information on the involvement of AP-1 transcription factor in multidrug resistance mechanism of breast cancer and thus will be a potential target for chemotherapeutic agent.

Keywords: *Danio rerio*, *ABCG2* promoter, site-directed mutagenesis, transcription factor, xenobiotics

INTRODUCTION

About one in 20 women in the Malaysia suffers from breast cancer and the disease rate varied across the three main races, the Malays, the Chinese and the Indians (Yip, Bhoo, & Teo, 2014). ATP-binding cassette super-family G member 2 (*ABCG2*) gene expression showing correlation with grade of tumor advancement and high *ABCG2* gene expression level is associated with poor survival in early stage breast cancer patients (Maciejczyk *et al*., 2012). ABCG2 protein is well known as one of the ATP-binding cassette transporters (ABC transporters) which is capable to act as multidrug resistance because of its potential role in protecting the breast cancer stem cells (Mo & Zhang, 2012).

According to Hu *et al*. (2020), ABCG2 protein may produce resistance to chemotherapeutic agents. ABCG2 protein is responsible to control the movement of harmful and beneficial substrates such as flavonoids and phytoestrogens across the intestinal cells into the intestinal lumen. Therefore, inhibition of carcinogen substrate presence in living tissue will reduce the absorption of carcinogen substrates from the diet (Andersen *et al*., 2015). At the same time, ABCG2 function in transferring the chemotherapeutic drugs out of the cells and keeping the intracellular drug compound below the toxic level (Sukowati, 2012).

The functional characterization of *ABCG2* gene has been reported before on members of Danioninae like Sarawak rasbora and zebrafish (Kobayashi *et al*., 2008; Lim *et al*., 2018a). In addition, an *in vivo* spatiotemporal expression analysis has been conducted lately by Lim and Chung (in press) on *ABCG2* gene promoters in zebrafish

embryos. The research on the gene regulation of *ABCG2* is still considered scarce in spite of the highlights on the contribution of regulatory agents towards gene activation (Hernandez-Garcia & Finer, 2014; Lim, Chung, Chong, & Lee, 2018b; 2019a; 2019b; Liu & States, 2002; Mishra, Dhanda, Siwach, Aggarwal, & Jayaram, 2020; Wang, Cheng, Li, Wu, & Zhao, 2018). The detailed molecular mechanism of such gene expression still remains largely unknown especially how the increase in cytotoxic level may in turn induce a hype in gene transcript level which eventually leads to the lowering of chemotherapeutic agent. This research focuses on the potential transcription factor candidate in *ABCG2* gene regulation which provides complex feedback regulation and allows different physiological response under various circumstances. Previously, trans-factors regulating ABC genes such as Sp1, Sp3, p53 and AP-1 were identified. Hence it is postulated that site directed mutagenesis will help to identify critical transcription factors and determine their role in regulating *ABCG2* by introducing specific nucleotide changes.

MATERIALS & METHOD

DNA extraction, PCR and cloning

The upkeep of fish and fish tissue yielding were performed with compliance to the approval and regulations established by the Universiti Malaysia Sarawak Animal Ethics Committee (UNIMAS/TNC(PI)-04.01/06-09(17)). Total DNA extraction from whole body of an adult zebrafish was done following the protocols formulated by Chung (2018). Gradient PCR targeting the *ABCG2* gene promoter was conducted as described by Lim, Chung, and Hasnain (2020) with adjustment on the extension time to 1.5 min. The cloning procedures were mirrored from that of Jee *et al*. (2017). The plasmid used to house the promoter gene insert is the pGL3.0 (Promega, USA). Sequence verification was done via sequencing and bioinformatic query against NCBI BLAST.

Transcription factor binding site (TFBS) analysis

The specific *ABCG2* sequence was used to look into the transcription factor binding site (TFBS) analysis using the MATCH tool (Kel *et al*., 2003). The TFBS composition was identified through the MATCH tool. Both aspects of TFBS abundance and total TFBS frequency were examined. Four groups of profiles such as immune cell-specific profile, cell cycle-specific profile, muscle-specific profile and liver-specific profile being provided in MATCH tool.

Site-directed mutagenesis

Mutagenesis experiments were performed using the QuickChange^{TM} II Site-Directed Mutagenesis kit (Stratagene, USA). Prior to the mutagenesis reaction, two complementary oligonucleotides containing the desired mutation flanked by unmodified nucleotide sequences were synthesized. Inverse PCR was conducted by preparing PCR primers and template plasmid around 10 pmol/µl and 50 ng/µl respectively at first. Subsequently PCR reaction mixture with total volume 20 µL in each tube was prepared which containing 14.4 µL of PCR grade water, 2 µL of 10x Buffer for iPCR, 2 µL of 2mM dNTPs, 0.4 of µL forward primer (5'-CGT GCT TTT ACG AAA CTC GTT CCC G-3') (10 pmol/ µL), 0.4 µL of reverse primer (5'- CAC GTG TTA CGA GCT TAG AAA TGT C-3') (10 pmol/ µL), 0.4 µL of Plasmid Template DNA (50 ng/ µL) and 0.4 µL of KOD –Plus- DNA Polymerase. Next, the PCR tubes were subjected to thermal cycling for 7 cycles. Around 0.8 to 1 µL of *Dpn*I restriction enzymes was added into 20 µL PCR reaction and mixed gently by pipetting before it was incubated at 37°C for 1 hr to digest the template plasmid. Next, PCR product was self-ligated by preparing the ligation reaction mixture consisting of 2 µl of *Dpn*I- treated PCR product, 7 µl of PCR grade water, 5 µl of Ligation High and 1 µl of T4 Polynucleotide Kinase in a new sterile microcentrifuge tube. Each reaction mixture was centrifuged and incubated at 16°C for 1 hr before transformation into XLI-Blue *E. coli* and plating. DNA sequencing was conducted to analyze and verify transformants (mutants).

RESULTS

Gradient PCR was conducted to identify the best annealing temperature for the primer designed, *ABCG2*F 5'-ATG GTA CCG CAA GTC ACA CGT TTT TAC CTT CT-3' and *ABCG2*R 5'- ATG AGC TCT CGA GTC TAT GAT CAA AA AGC GT-3'. The PCR product was yielded at optimum annealing temperature of 61.4˚C. A single PCR amplicon band, which is about 1,500 bp in size (Figure 1) and close to the expected size, was observed on 1% agarose gel following PCR purification.

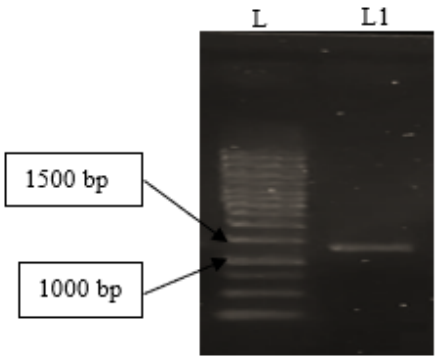

Figure 1. Agarose gel electrophoresis was conducted using 1% agarose gel and showed a band after PCR purification. First lane from the left (Lane L) was loaded with 1 kb DNA ladder (Promega, USA) while the band in the second lane (L1) represents PCR amplicon produced at 61.4 ˚C annealing temperature.

Study and analysis of TFBS were conducted using MATCH program. Based on bar chart in Figure 2, the frequency of sites per nucleotide across four profiles (liver-specific profile, immune cell-specific profile, muscle-specific profile and cell cycle-specific profile) depicts that majority of TFBS per nucleotide were located in liver-specific profile, which accounted for 0.0913 in frequencies and comprised of TFBS composition such as AP-1 (Figure 3). Muscle-specific profile showed the least number of sites per nucleotide, which was only 0.0187. Overall, immune cell-specific profile had more composition of TFBS than other types of profiles, these TFBSs were AP-1, GATA-3, TATA and NF-AT. On the other hand, the highest amount of TFBS across the four profiles was HNF-3beta.

The 1196/1215 identities (98% similarities) were obtained after blasting the mutated zebrafish *ABCG2* gene promoter (Supplementary Figure 1) against NCBI database. The 0.0 E-value is a good indication that the expected occurrences by chance of this alignment with the query sequence in the database is zero. About 0% gap indicates the absence of any frameshift mutations.

Furthermore, MATCH program showed that after site-directed mutagenesis the AP-1 is located at a different position than previous unmutated sequence. Based on Figure 5, position 1113 bp of the forward strand does not depict any presence of TFBS after targeted AP-1 TFBS (with base TGACGCG) was deleted, indicating mutation was successful.

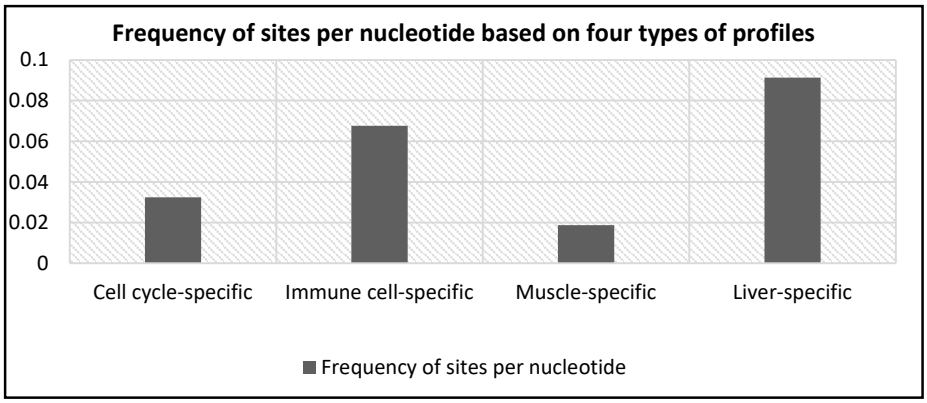

Figure 2. The expected number of TFBS compositions found in 1.5kb promoter sequence across four types of profiles estimated based on standard TRANSFAC profiles via public MATCH program.

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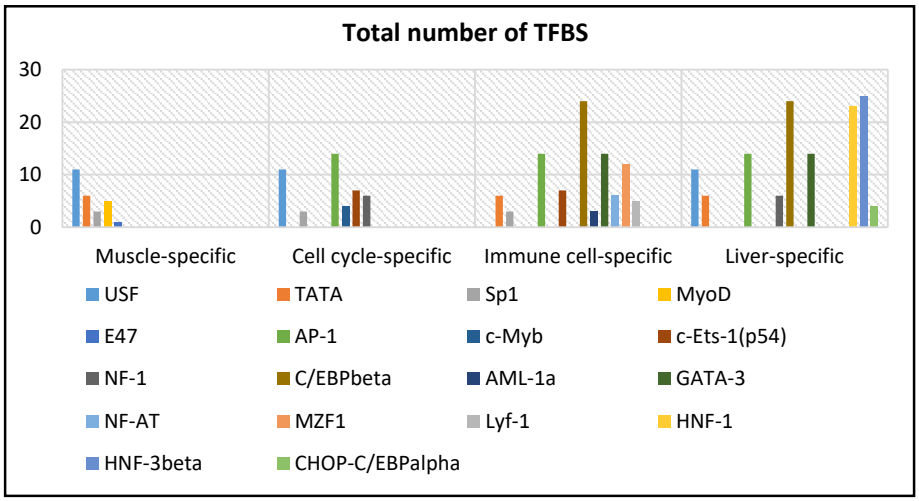


Figure 3. The expected number of TFBS compositions found within *ABCG2* gene promoter of zebrafish across four types of profiles.

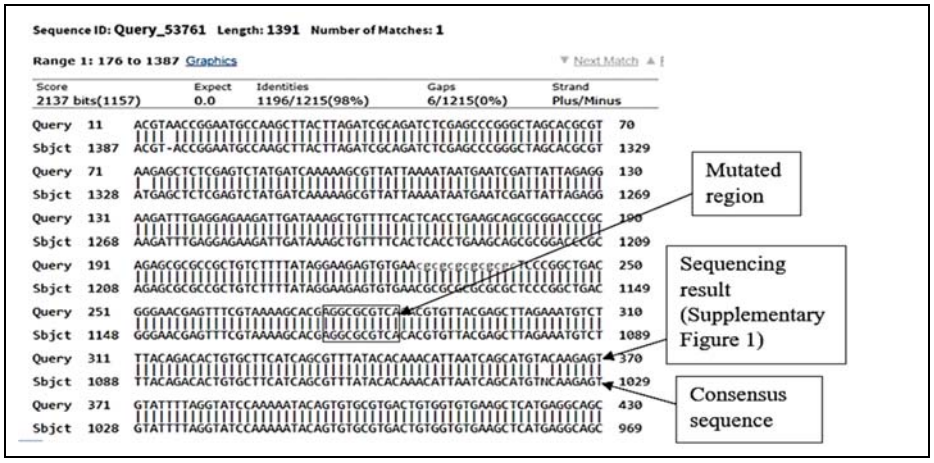
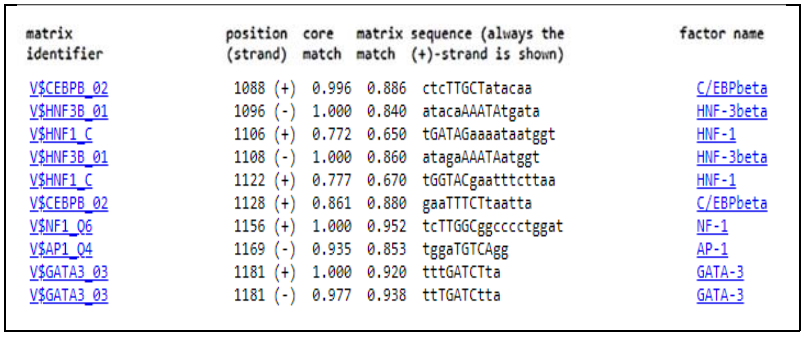


Figure 4. BLAST pairwise alignment results showing the reverse sequences of mutated zebrafish *ABCG2* gene promoter as query and the *Danio rerio* chromosome 23 (GenBank accession number: LR812085.1) as the closest match.



matrix identifier	position (strand)	core match	matrix match	matrix sequence (always the (+)-strand is shown)	factor name
V$CEBPB_02	1088 (+)	0.996	0.886	ctcTTGCTatacaa	C/EBPbeta
V$HNF3B_01	1096 (-)	1.000	0.840	atacaAAATAtgata	HNF-3beta
V$HNF1_C	1106 (+)	0.772	0.650	tGATAGaaaataatggt	HNF-1
V$HNF3B_01	1108 (-)	1.000	0.860	atagaAAATAatggt	HNF-3beta
V$HNF1_C	1122 (+)	0.777	0.670	tGGTACgaatttcttaa	HNF-1
V$CEBPB_02	1128 (+)	0.861	0.880	gaaTTTCTtaatta	C/EBPbeta
V$NF1_Q6	1156 (+)	1.000	0.952	tcTTGGCggcccctggat	NF-1
V$AP1_Q4	1169 (-)	0.935	0.853	tggaTGTCAgg	AP-1
V$GATA3_03	1181 (+)	1.000	0.920	tttGATCTta	GATA-3
V$GATA3_03	1181 (-)	0.977	0.938	ttTGATCtta	GATA-3

Figure 5. Part of the TFBS list showing the deletion of targeted bases. The targeted AP-1 TFBS is missing from the position 1113 bp (forward strand), indicating the successful mutation.

DISCUSSION

In this study, 5'- TGACGCG -3' was chosen as the site to be mutated which is at expected position (forward strand) from 1113 bp to 1122 bp of the *ABCG2* gene. Based on the MATCH program, activating protein-1 (AP-1) TFBS is located at this deleted region. The primers were designed for the amplification of mutated *ABCG2* gene and deletion was the type of mutation selected. The constitution of AP-1 comprises multiple proteins (Jun, Fos and ATF) involved in cell proliferation (Karin, Liu, & Zandi, 1997). AP-1 acts to receive extracellular signals and participates in induce proliferation and differentiation of cells. This transcription factor influences breast cancer cell growth with the involvement of modulating cyclin D1 and restrains the activation of E2F (Shen *et al*., 2007). Tam67 (a dominant form of c-Jun and part of Jun family members) makes up the structure of the AP-1 transcription factor and it is capable of hindering the development of breast cancer cells by restricting the activity of AP-1 (Gazon, Barbeau, Mesnard, & Peloponese, 2018; Lu *et al*., 2005).

Another essential component of AP-1 is the Fos family which comprises Fosb and c-Fos. c-Fos is found to be associated in a dual way of causing diseases. High expression of this protein induces proliferation of osteoblasts and malignant tumours of bone occurrences while its removal resulted in serious effects on bone resilience and strength (Schinke & Karsenty, 2008). Breast cancer is not the only cancer studied linked to the transcription factor AP-1. AP-1 is also a protein responsible for regulating gene transcription associated with the cause of cervical cancer. However, curcumin, an antioxidative agent, has been described in previous study to have the ability to modulate the human papillomaviruses (HPVs) such as HPV18 (Prusty & Das, 2005).

Verification on the mutated sequence has been conducted using BLAST and high similarities (97%) with *Danio rerio*'s linkage group 23 were detected at 0% gap. Subsequently, further verification on mutated amplicon has been conducted by aligning the reverse sequences of mutated zebrafish *ABCG2* gene promoter with *Danio rerio* chromosome 23 (Accession number: LR812085.1) via BLAST. Comparison between consensus sequence (non-mutated sequence) and new sequencing result (mutated sequence) gives high similarities at around 98% with E-value of 0.0. Previously, the non-mutated promoter region of *ABCG2* possesses the binding site for transcription factor AP-1 which is located at 1113 bp from the TSS+1 of the gene. However, after inserting a new sequence (mutated sequence), results reveal no presence of AP-1 binding site at position 1113 bp from the TSS+1 of the gene. That means the sequence has been successfully mutated and can be used for further expression analysis and functional studies. It is expected that the deleted AP-1 TFBS will cause significant reduction in zebrafish *ABCG2* promoter activity as it has been proven by various literature that AP-1plays vital roles in both enhancer and promoter activity (Grossman *et al*., 2017; Kerppola & Curran, 1993; Lim *et al*., 2019b).

CONCLUSION

One of the TFBSs, AP-1, was found in a 1.5kb zebrafish *ABCG2* promoter sequence through the MATCH program and was successfully mutated using the QuickChange™ II Site-Directed Mutagenesis kit (Stratagene, USA). This will aid in further research on multidrug resistance mechanism of breast cancer which thus be part of target for chemotherapeutic agent in the future.

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>1st_BASE_3853341_NABILA_*ABCG2*_GLprimer2

AAAAAGGTTCACGTAACCGGAATGCCAAGCTTACTTAGATCGCAGATCTCGAG
CCCGGGCTAGCACGCGTAAGAGCTCTCGAGTCTATGATCAAAAAGCGTTATTA
AAATAATGAATCGATTATTAGAGGAAGATTTGAGGAGAAGATTGATAAAGCTG
TTTTCACTCACCTGAAGCAGCGCGGACCCGCAGAGCGCGCCGCTGTCTTTTATA
GGAAGAGTGTGAACGCGCGCGCGCGCTCCCGGCTGACGGGAACGAGTTTCGTA
AAAGCACGAGGCGCGTCACACGTGTTACGAGCTTAGAAATGTCTTTACAGACA
CTGTGCTTCATCAGCGTTTATACACAAACATTAATCAGCATGTACAAGAGTGTA
TTTTAGGTATCCAAAAATACAGTGTGCGTGACTGTGGTGTGAAGCTCATGAGG
CAGCATCAACGCAACATCTTTGGCGTGATTATGCTTTAAAGTCACTTCAGTACT
ATGAAGATATCAAACTTGAGAATTTACCGAATAACACTGCATTAGCCGATTAT
CATCAACATTAATATGCAGCCTGTTAAATTAATAGTGATAGCCATAATTTAAAT
AAAAGTTGAAAACTAGCCAACACTGTGAAAAAGTCATTGCCCTTCATTTCTGA
GATGAATCAAATTAATGGTATGAGTCTGTTGAACTTATGTTAACCTGACTTAAA
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GAGGCCCTATATAAGCACCTCCAGCCATGGAGCCCAAGTGCTGAAATCCACCC
TTTCTACAGTTATTTAATAAGTATTTATTTTGCTGCTTTTTTAAATATCACTAAA
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TCTTAAAGTTTATTTACAACTAAAAACAATATATTTTTTTAGTAAATGTGACTG
CCGGACTGCTTCCTGATTTGACGAGTGGATATTTTAGTTTATAATATCATTATT
AAACTACATTATTGACTCTTGCTATACAAAATATGATAGAAAATAATGGTGGT
ACGAATTTCTTAATTATACTTCTTGAATTTTCTTGGCGGCCCCTGGATGTCAGG
ATTTGATCTTATTTTTTANGCGTTATTGTTGTTTAAATTTTCAA

Supplementary Figure 1. The sequencing result of mutated *ABCG2* gene promoter from *Danio rerio* was analyzed. The red font colour indicates repeating A nucleotide at the beginning of the sequence. The one highlighted with yellow colour refers to the mutated region while sequences highlighted in blue and purple are forward and reverse primer respectively which are used to amplify DNA sequence. The black font sequence demonstrates the partial fragment of *ABCG2* gene promoter amplified by PCR.

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Hospital Inpatient Tracking System Using RFID Technology

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ABSTRACT

Hospital Inpatient Tracking System using RFID technology is a web application developed for the medical personnel (doctors and nurses) to track the movements of the inpatients in the accident and emergency department of government hospitals. RFID reader fixed in each of the rooms will detect the patient who is wearing the registered tag when enter and leave from the room. It is designed to solve the problems of long queues, overcrowding, delayed treatments, and insufficient beds for patients. Tracking process is taken to track all of the registered patient. At the same time, duration of patient process in each of the room will be recorded and calculated to get the range of processing time in each of the room. It can be used as reference and solving the bottlenecks that faced by hospitals. All the medical personnel need to register and approved by system administrator before accessible to the system.

Keywords: Patient tracking, RFID technology, web application

INTRODUCTION

The Accident and Emergency Department (A & E) in general hospital provides care to patients who arrive following an accident or with an emergency medical condition without prior appointment. All patients will be triaged and given priority status by determining according to the condition of the patient. Patients belonging to the non-priority status category will be requested to register at the registration counter first. Then, the patients will be seen by the doctor following the visit number. The patients will be categorized into three zones that are green, yellow and red zone. Green zone states that the patient which is an outpatient and can be discharged directly after treatment. Yellow zone states that the patient is an inpatient who needs to be observed and may need to be admitted. Red zone states that the patient which is an inpatient with serious condition and needs to be admitted. After consultation, the patient will be admitted, observed or discharged. The inpatient in the yellow and red zone will be admitted to the wards and will undergo treatment and medical checkup processes for example X-Ray, Blood Test and Physiotherapy. Finally, the inpatient either will be discharged from the hospital, transferred to other hospital or transferred to the mortuary for deceased cases. This is the current scenario for the movement of patients from admission to A & E until the patient is being discharged from the hospital.

The current scenario for the A&E of government hospitals, where A&E is having problems of long queue, overcrowding, delayed and not enough bed for patients (Eller, 2018). Next, the medical personnel, which are doctors and nurses tracking their patients' movements using phone call or oral asking among the others. This tracking process is currently done manually in the hospital. A lot of time will be wasted and maybe will missed out the patients if tracking the patients' movements manually. Then, the security of the patients in the hospital cannot be ensured because the medical personnel cannot track the location of patients by 24 hours.

The objectives of the project were

i. To design the Hospital Inpatient Tracking System (HITS) Using RFID Technology.
ii. To develop the layout of HITS as a web application.
iii. To test the proposed HITS through the simulation cases.

Related work

Several existing systems, which is related to the proposed application are discussed and compared. The first existing system is Mobile RFID Kids Tracking System – Al-Ali, Aloul, Aji, Al-Zarouni and Fakhro (2018) proposed a mobile tracking system using RFID technology. This tracking system is designed for the kids. The objective of their project was to track the lost kids in a large open area. Movements of the kids in an open area, such as a park or mall can be tracked using RFID technology. The tag readers are distributed around the open area. The kids wear the RFID tags can communicate between the tag reader by antenna and the signals are sent to the web server via wireless LANs. Location of the kids will be displayed in the system. Route taken by the child by plotting the last detected position can be shown and the parents are able to connect with their kids.

The second existing system is an application using RFID technology in Patient Management System – Mapa and Saha (2015) proposed an application using RFID technology in Patient Management System. The objective of their project was to minimize the time serving a patient by identifying the patient, type of service required, history of treatment, waiting time and accessing personal information. Each of the patients will be given a passive RFID tag with personal information during registration in the hospital. Data is collected from the time the patient who enters into a processing area until being discharged. The range of processing time and the chart for each patient can be simulated from the data collected to conclude the processes of each department.

The third existing system is Indoor Positioning System using Ultrasonic Technology – Al Kahf, Mian and Lim (2016) proposed a project for Indoor Tracking System using Ultrasonic technology. The objective of their project was to track the location of an elderly mother who is stay alone in the house. Band will wear by the user on the wrist. The band in one of the rooms will listen to the ultrasonic pulses. Once the ultrasound pulse is captured, the band will send it to the Hub to compute the band's position. Table 1 below shows the comparison between the three systems states above and the proposed application.

TOOLS AND TECHNOLOGY USED

Several tools and technologies were used in the proposed application.

Laravel

Laravel (https://www.tutorialspoint.com/laravel/laravel_overview.htm.) is an open-source tool for PHP framework. This was used for the development of the proposed application. It helps in creating a web application which can be designed in a more structured and pragmatic. It has a set of features, which can help increase the speed in developing the web application. For example, the features include modularity, testability, routing, configuration management, query builder and ORM, schema builder, template engine, email, authentication, Redis, queues, event and command bus. Furthermore, a website built in Laravel is secure and prevents web attacks. Composer is a tool consisting of all the dependencies and libraries which are needed to install first before the installation of Laravel. With the help of this framework, the proposed application can be done in a more scalable way and can save the time in designing the web application

XAMPP

XAMPP (Mikoluk, 2013) is an open-source software that was used for the development of this proposed application. It is used to create a local web server or local host for testing purposes. The components to set up a web server are all included in XAMPP. They are server application (Apache), database (MySQL), MariaDB and scripting language (PHP). The transitioning from a local test server to the live server is easy because XAMPP has the same components with the actual web server. Furthermore, XAMPP can function across all platforms on the Linux, Mac and Windows.

Bootstrap

Bootstrap is an open-source tool for CSS framework that will be used to design the interface for this proposed application. It contains HTML, CSS, and JS based design template for the forms, buttons, and others. Bootstrap was chosen to be used in the development of the interface for this proposed application because it can speed up the building of a responsive web application.

Table 1. Comparison between the existing system and proposed application

Function and Features	Mobile RFID Kids Tracking System	Application using RFID Technology in Patient Management System	Indoor Positioning System Using Ultrasonic Technology	Proposed System
Indoor tracking the locations of people	Yes	Yes	Yes	Yes
Display the location tracked in the system	Yes	Yes	Yes	Yes
Plot the last detected position	Yes	No	No	No
Record the time spent for each process	No	Yes	No	Yes
Simulate the range of processing time	No	Yes	No	Yes
Download range of processing time report	No	No	No	Yes
Display the discharged list in system	No	No	No	Yes
Exceeded waiting time alert for the patient due to different type of room	No	No	No	Yes
Search engine	No	Yes	No	Yes
Control the Hub trigger a single cluster of devices only	No	No	Yes	No
Type of device	RFID active tag with fixed RFID reader	RFID passive tag with fixed RFID reader	Ultrasonic-based band and slaves	RFID passive tag with fixed RFID reader
Type of technology	RFID technology	RFID technology	Ultrasonic technology	RFID technology

RFID Technology

Radio-Frequency Identification (RFID) was used in this proposed application for tracking the real time locations of patients. RFID is a technology that uses radio waves to identify people or objects from a distance automatically. It consists of readers and tags. The RFID tag is a microchip which is connected to the antenna, acts as a transducer which sends the signal to the reader (Jia, Feng, Fan & Lei, 2012). The active RFID reader then communicates with the tag to capture the data. It can capture the data with high reading speed. When in longer read range, fast scanning and flexible data carrying capability is required.

METHODOLOGY

The methodology used for this project was the Rapid Application Development (RAD) cycle, going through the process of requirements analysis and design, prototype cycles and testing.

The requirements for this proposed application were gathered and analyzed to produce a high-quality application, which fulfill the requirements needed. Then, the design for the proposed application is carried out based on the requirements needed. There was system architecture design, module design, database design and user interface design. All of them were ready to continue for producing a systematic application with an idea.

Requirements

Functional Requirements are listed as below:

a) Admin can login directly into the system with the given staff id and password.
b) Admin need to validate the user after the registration process.
c) Admin can manage users' accounts with delete, search, and view.
d) Admin can manage the reader section that needed to be tracked with add, edit, delete, search, and view.
e) Admin can manage the exceeded waiting time alert for the patient according to different reader section.
f) Admin can view the range of processing time tracking details in each reader section.
g) User need to register and login to the system.
h) User can manage patients' details with add, edit, delete, search and view.
i) User can check the location of patient.
j) User can check total patients list, total inpatients list, total staff list and the discharged patients list.
k) User can get the exceeded waiting time alert in the system due to the patient who are waiting over the maximum waiting time in the room.
l) User can check the tag whether it is existing.
m) User can view the duration for the patient stay in each of the room.
n) User can view the chart for the tracking data.
o) User can generate and download different type of according to the tracking data.
p) User can view and update the profile.

Non-Functional Requirements are listed as below:

a) User need wait for the registration confirmation by admin before access into the system.
b) User allowed to change the login password if forgot the password.
c) Only the basic information of patient allowed to show in the system to ensure the privacy of patient.
d) New discharged patient must be highly visible in the discharged list.

System architecture design

System architecture design is an overview system design for the proposed application with conceptual representation of the components and subcomponents. System architecture diagram for this proposed application is shown in the Figure 1.

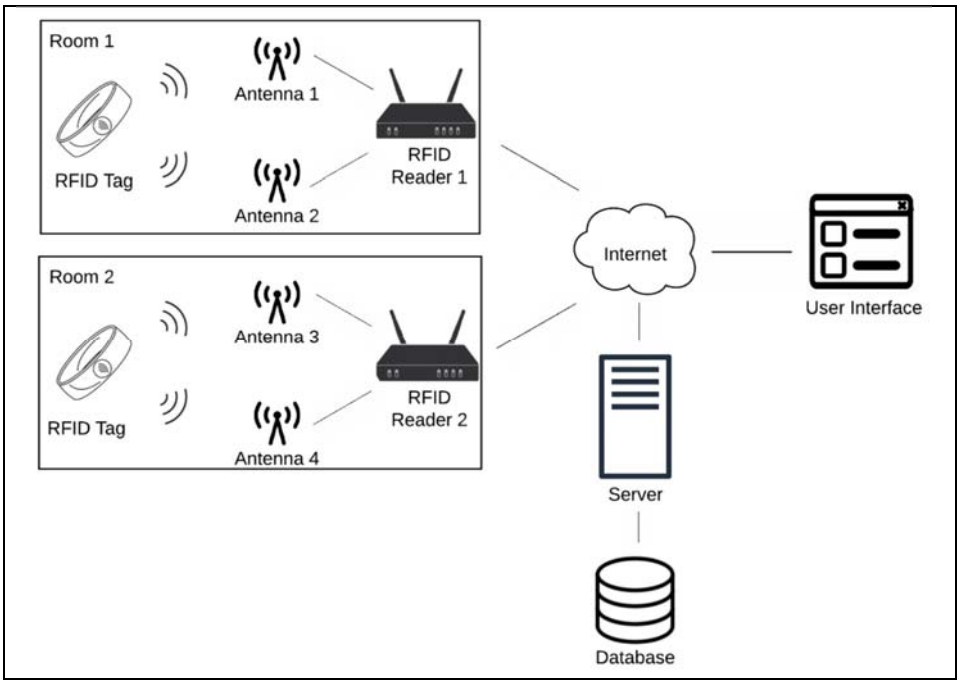

Figure 1. System Architecture Diagram in HITS

Module Design

Context diagram is shown in Figure 2. The proposed application in this project is HITS. The inputs and outputs flow with the external entities are required in the context diagram. The medical personnel need to send the registration and approval request to the HITS and wait for the approval from the system administrator who is successfully login. The details of medical personnel will be shown to the system administrator. After successfully register and login, the medical personnel can register the patient who will be tracked through managing the patient's details. Then, the system administrator needs to update the reader section details in HITS. The RFID tracker will send the tracker information to HITS. Finally, patient's tracking details list and the range of processing time details will be shown to the medical personnel and admin in HITS.

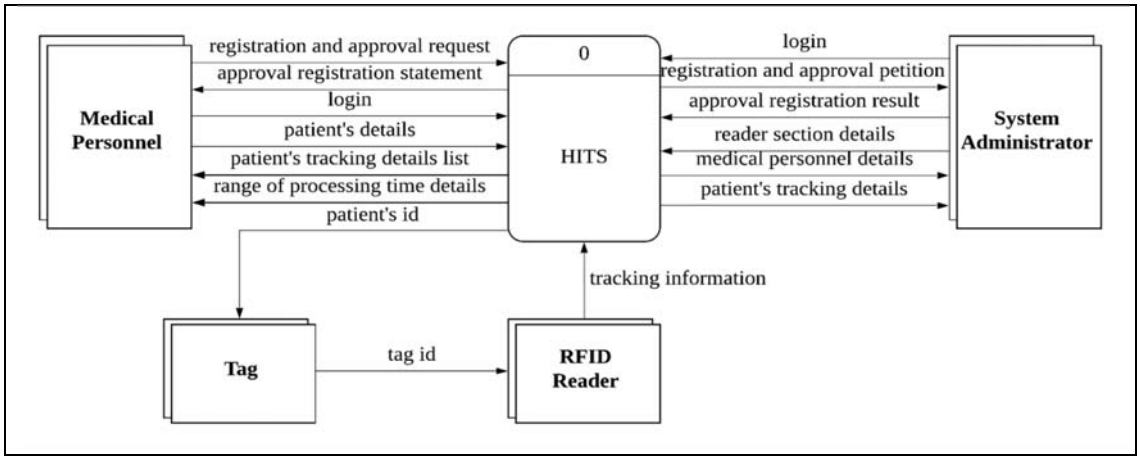

Figure 2. Context Diagram in HITS

Figure 3 shows the Level 0 data flow diagram in HITS. System administrator can access the system by providing the username and password with the validation of user record. The medical personnel are required to register and wait for the approval from system administrator before accessing the system. All of the data will be stored in the user record. After successful approval, they can manage the patient tracking. The data will be updated and stored in the patient record. System administrator can manage the reader section details and store in the reader record. Then, the patient and reader section details with the tag id from tag will be retrieved and send the information to the RFID reader which is detected with the tag id. The tracking details stored will be displayed to the medical personnel and admin. It is then used for generating the chart of range of processing time.

Database design

Figure 4 shows an Entity Relationship diagram for the HITS. Entity relationship diagram is used to design the relational databases for this proposed application. It is a type of flowchart that demonstrate the relativity between entities. There are six tables in the database. They are users, patients, tags, readers, tracks and history table. User can manage the patients and readers. Each of the patient can only put on one tag. Then, the tags and readers details will be including in the tracking table after detected by RFID reader. The patient discharged will be deleted from tracks table and stored in history table.

User Interface Design

Figure 5, 6 and 7 show the user interface design of main page for system administrator and medical personnel.

IMPLEMENTATION AND TESTING

The implementation process was done based on the requirement analysis and design with the development tools and technology.

Then, the testing process was taken to ensure the requirements and objectives of this proposed application can be achieved. Developer site testing is a test case to determine whether each of the functional requirement is working as expected. Each of the test case includes ID, test description, step details, expected result and actual result. The test cases on login page, registration page, email notification, new user request, manage reader section, manage user, manage patient, check exist tag, tracking, dashboard, generate report and user profile are tested for functionality. All of test cases were successfully tested and showed the actual results as expected with all the status pass for this proposed application. The test cases are shown in Table 2 to Table 13.

CONCLUSION AND FUTURE WORK

The proposed application, HITS was successfully designed, developed and tested, which fulfill all the requirements. However, this project still has several weaknesses due to the developer's experience, technical skills and knowledge, lack of resources and software limitation. The weaknesses and limitations of this web application can be improved in the future to increase the quality of this web application. This project can consists the long distances detection RFID technology with reader, antenna and passive tags. Passive RFID inlay is suggested for patient to wear. These are the parts of the improvement can be made for this proposed application.

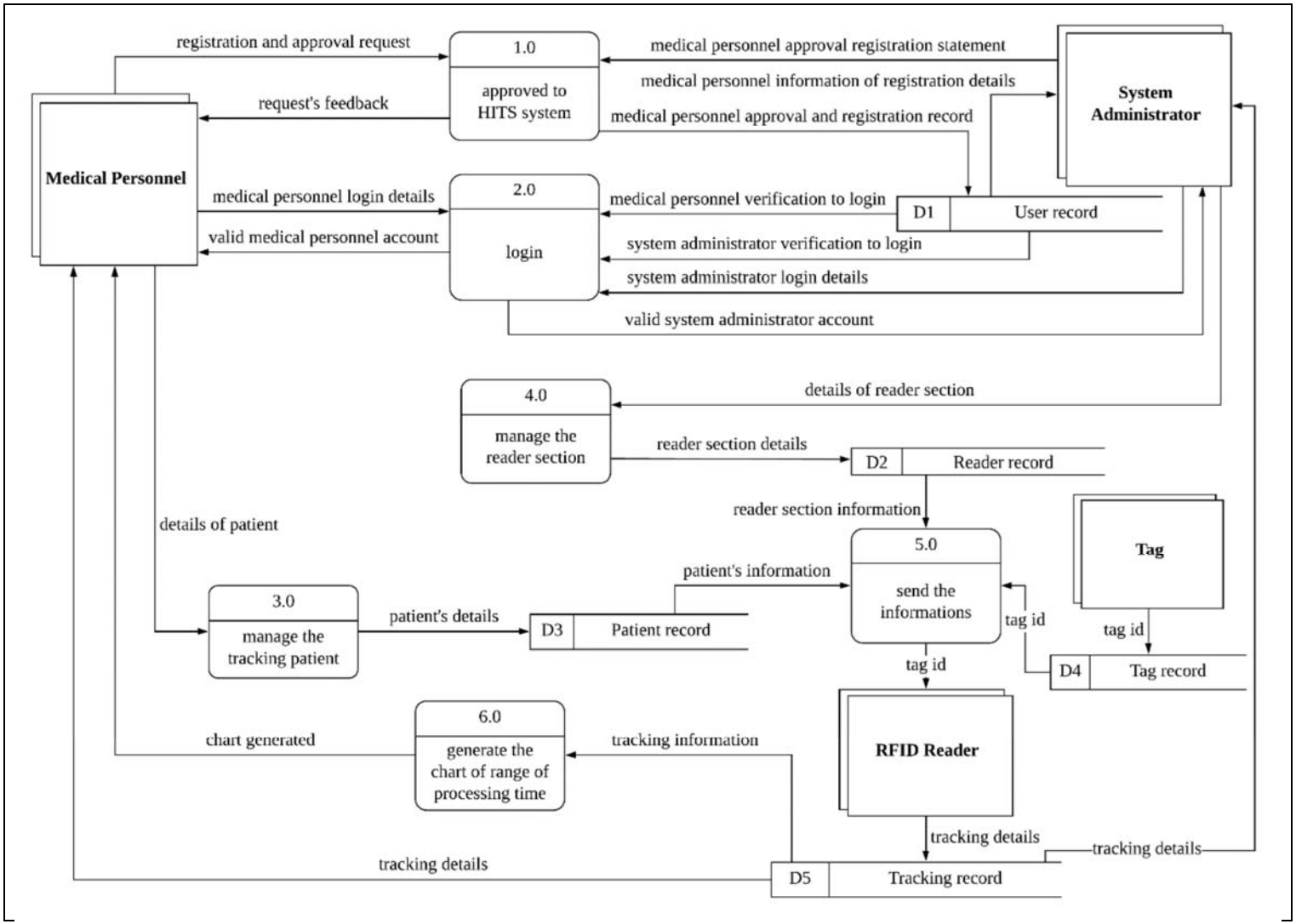

Figure 3. Level 0 Data Flow Diagram in HITS

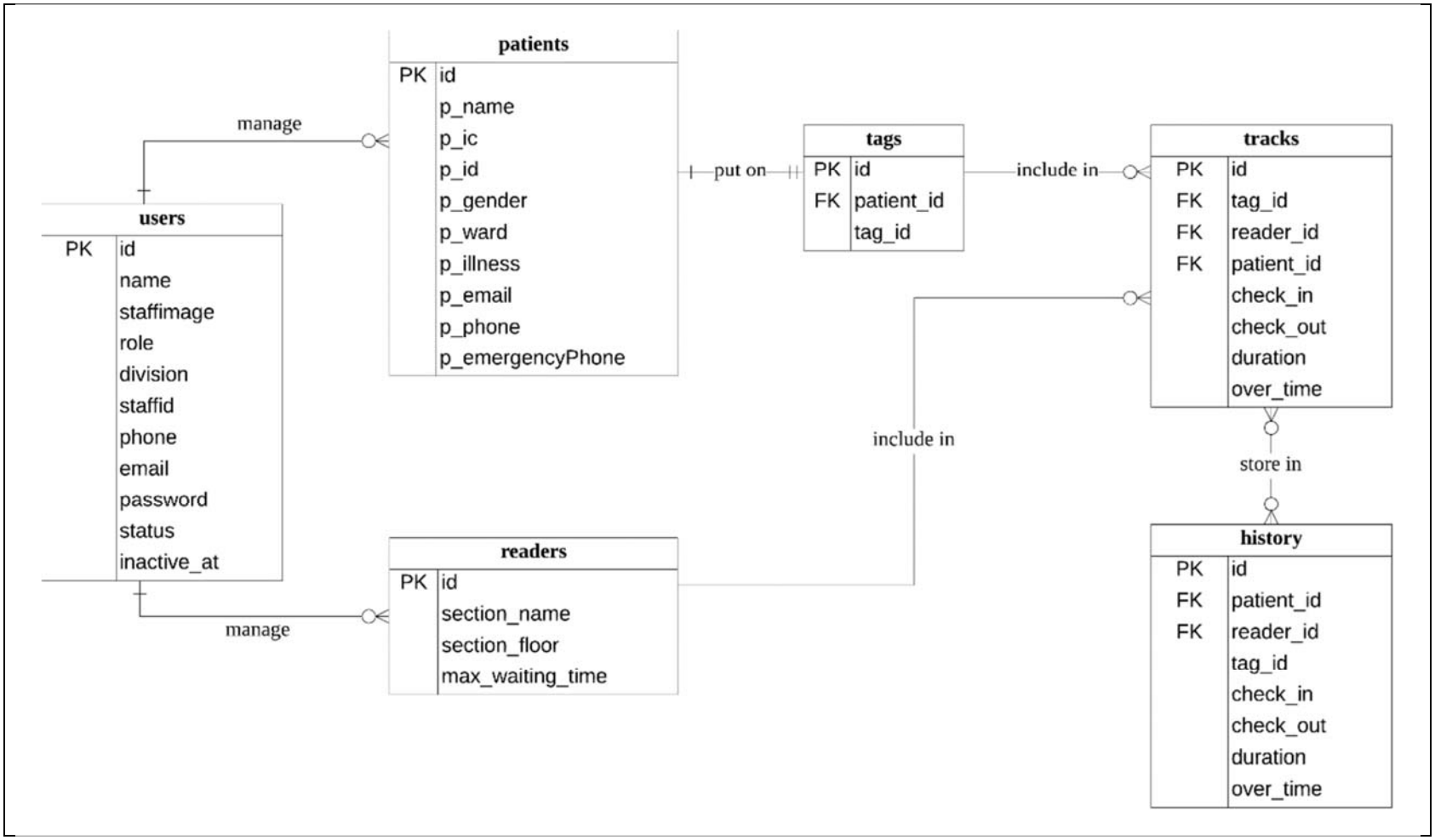

Figure 4. Entity Relationship Diagram

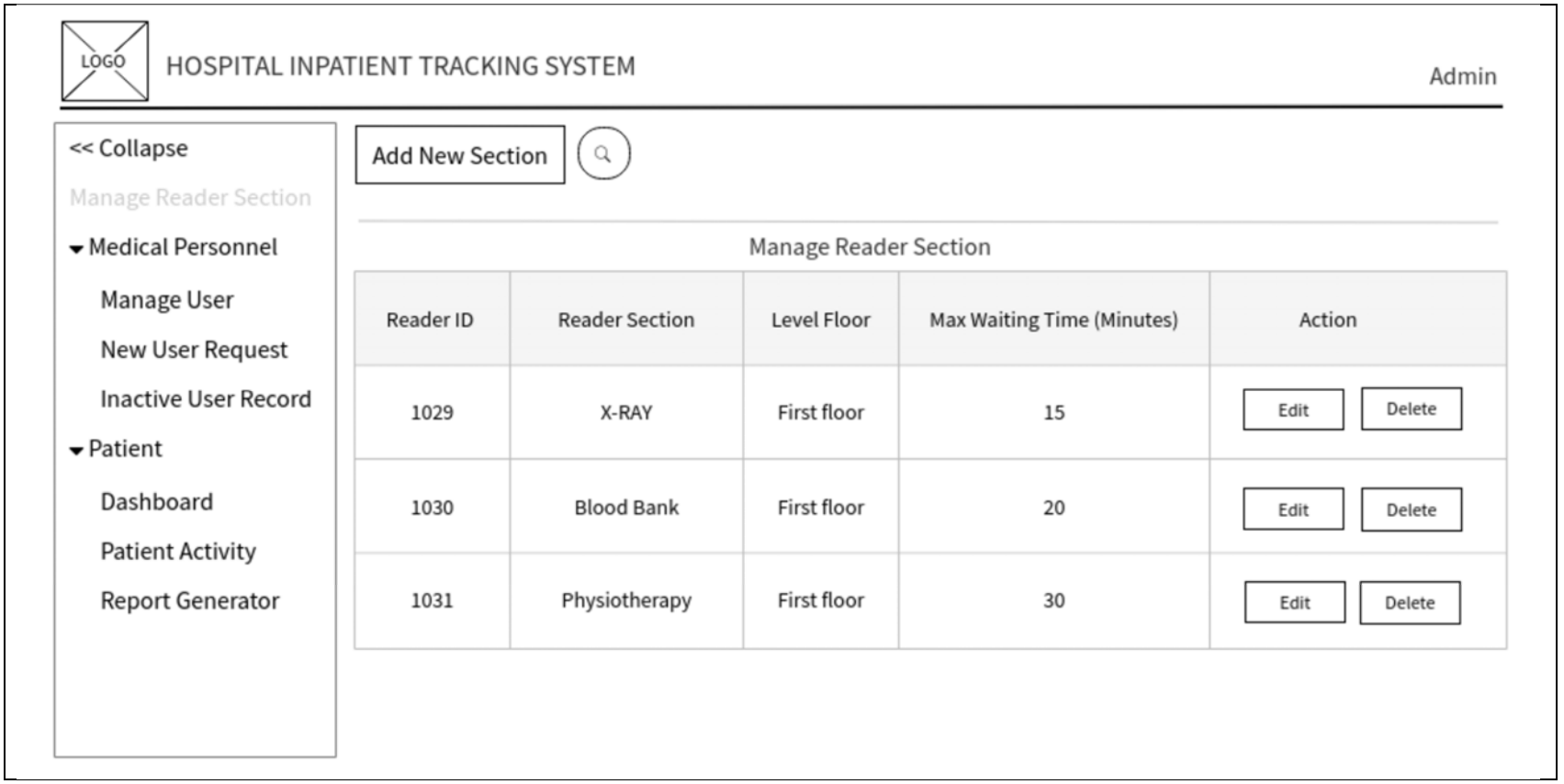

Figure 5. User Interface Design of System Administrator (Manage Reader Section)

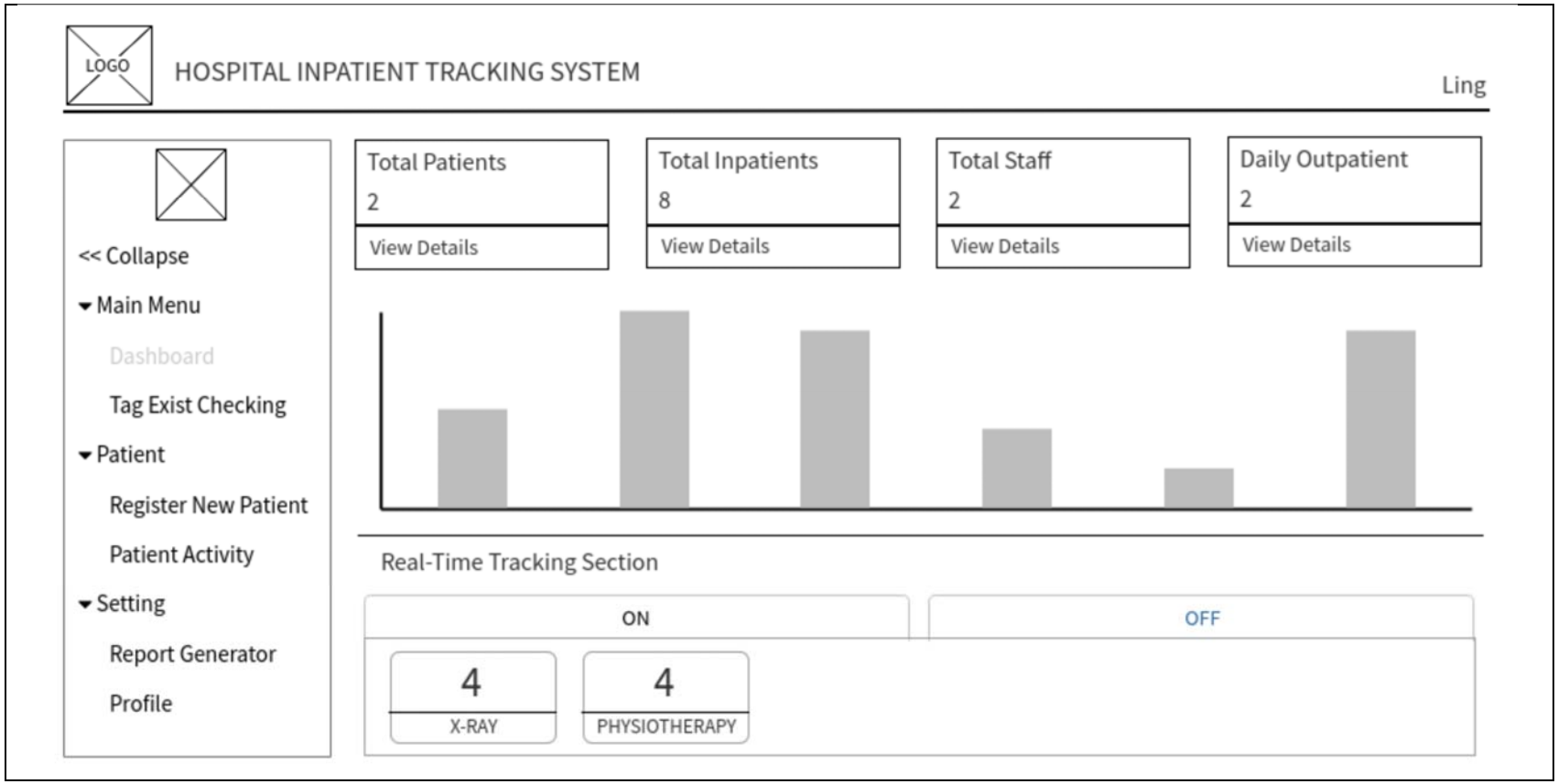

Figure 6. User Interface Design of Medical Personnel (Dashboard)

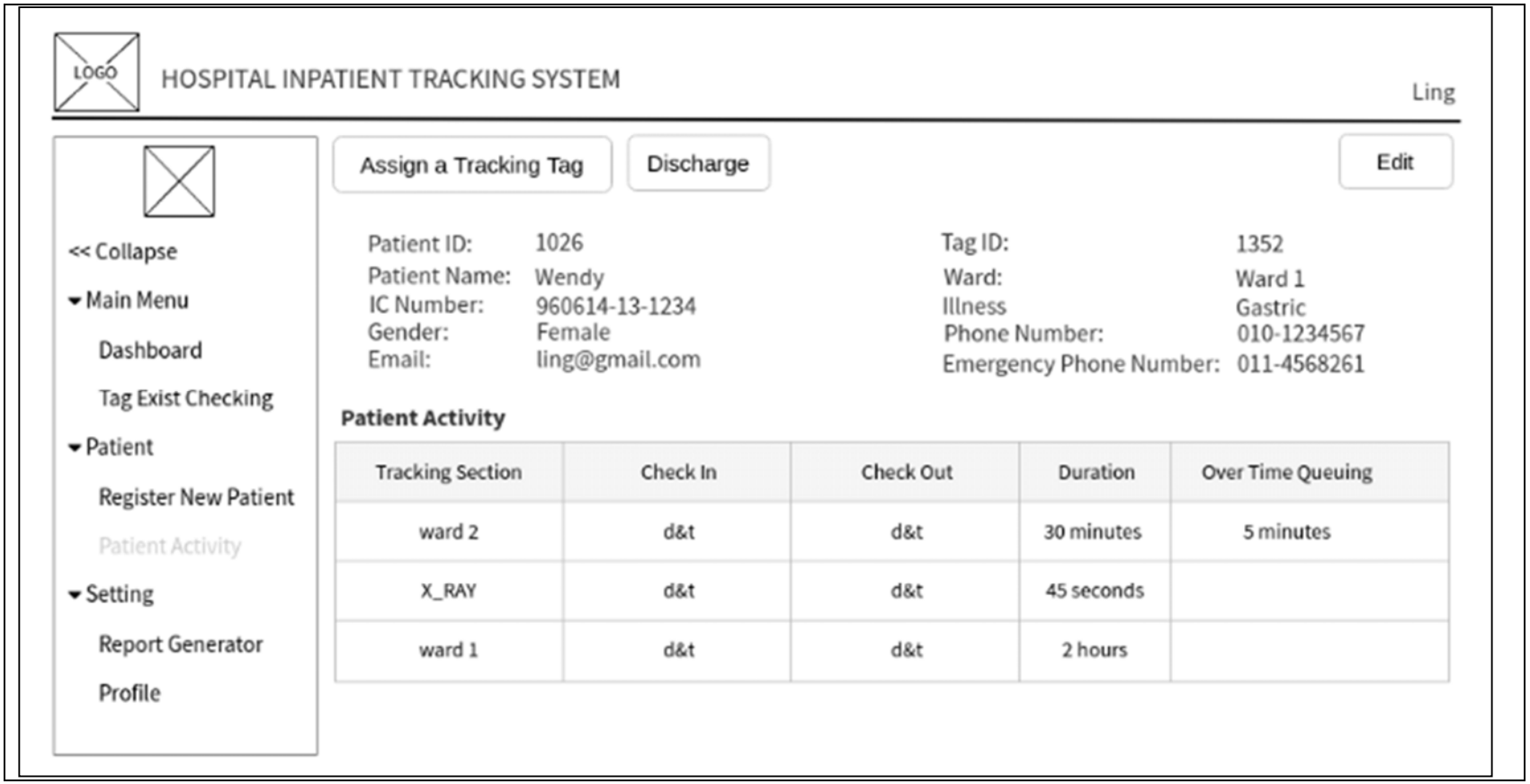

Figure 7. User Interface Design of Medical Personnel (Patient Activity)

Table 2. Test case on login page.

Test Case:	TC01			
Test Description:	User can login to the application			
#	Step Details	Expected Results	Actual Results	Status
1	Enter staff id and password	Credential can be entered	As Expected	Pass
2	Click login	User is logged in	As Expected	Pass

Table 3. Test case on registration page.

Test Case:	TC02			
Test Description:	User can register to the application			
#	Step Details	Expected Results	Actual Results	Status
1	Register user's account	User's validated details are added to the database	As Expected	Pass
2	Reset registration form	User registration form is cleared	As Expected	Pass
3	Waiting approval	Registered user proceeds to waiting approval page	As Expected	Pass

Table 4. Test case on email notification.

Test Case:	TC03			
Test Description:	User and admin can receive email notification			
#	Step Details	Expected Results	Actual Results	Status
1	User sends email notification after registration	Admin received email notification of new user request		
2	Admin sends email notification after approve user	User received email notification of approving result	As Expected	Pass
3	Admin sends email notification after reject user	User received email notification of rejected result	As Expected	Pass

Table 5. Test case on new user request.

Test Case:	TC04			
Test Description:	Admin can manage new user request			
#	Step Details	Expected Results	Actual Results	Status
1	Click approve	New user is approved and can be logged in	As Expected	Pass
2	Click reject	New user is rejected and cannot be log in	As Expected	Pass

Table 6. Test case on manage reader section.

Test Case:	TC05			
Test Description:	Admin can manage reader section			
#	Step Details	Expected Results	Actual Results	Status
1	Add new reader section	New reader section is added to database	As Expected	Pass
2	Edit reader's detail	Reader's detail is edited and updated to database	As Expected	Pass
3	Delete reader section	Reader section is deleted to database	As Expected	Pass
4	Search reader section's detail in table	Reader section's detail is searched based on the table	As Expected	Pass

Table 7. Test case on manage user.

Test Case:	TC06			
Test Description:	Admin can manage user			
#	Step Details	Expected Results	Actual Results	Status
1	View user's detail	User's detail is viewed by admin	As Expected	Pass
2	Search user's detail in table	User's detail is searched based on the table	As Expected	Pass
3	Deactivate user's account	User access is revoked	As Expected	Pass
4	Activate user's account	User account is activated and able to login again	As Expected	Pass

Table 8. Test case on manage patient.

Test Case:	TC07			
Test Description:	User can manage patient			
#	Step Details	Expected Results	Actual Results	Status
1	Add patient's detail	Patient's detail is added to database	As Expected	Pass
2	View patient's detail	Selected patient's detail is viewed by user	As Expected	Pass
3	Search patient's detail in table	Patient's detail is searched based on the table	As Expected	Pass
4	Edit patient's detail	Patient's detail is edited and updated to database	As Expected	Pass
5	Assign a tracking tag	Patient is assigned with a tracking tag and added to database	As Expected	Pass
6	Edit tracking tag	Tracking tag is edited and updated to database	As Expected	Pass
7	Discharge patient	Patient is discharged from tracking	As Expected	Pass

Table 9. Test case on check exist tag.

Test Case:	TC08			
Test Description:	User can check the tag whether is existing			
#	Step Details	Expected Results	Actual Results	Status
1	Scan the tag to check	Tag is scanned as requested to check	As Expected	Pass
2	Show the checked tag with patient's detail	Patient's detail is checked from database and displayed	As Expected	Pass

Table 10. Test case on tracking.

Test Case	TC09			
Test Description	User can track the patient			
#	Step Details	Expected Results	Actual Results	Status
1	Scan the tracking tag of assigned patient with RFID reader	The tracking tag ID is read by RFID reader and request as input in the hidden text box of HITS will be inserted to the database	As Expected	Pass
2	Differentiate the reader section when patient is scanned	The different reader section is detected when the patient is scanned with different laptop	As Expected	Pass

Table 11. Test case on dashboard.

Test Case:	TC010			
Test Description:	User and admin can view overall details in dashboard			
#	Step Details	Expected Results	Actual Results	Status
1	View total patients list, total inpatients list, total staff list and the discharged patients list.	Patient and staff details are viewed	As Expected	Pass
2	Get exceeded waiting time alert in each reader section	Different type of color alert in each reader section is viewed	As Expected	Pass
3	View the chart with tracking data	Chart with tracking data is viewed	As Expected	Pass

Table 12. Test Case on Generate Report

Test Case	TC011			
Test Description	User and admin can generate and download report			
#	Step Details	Expected Results	Actual Results	Status
1	Generate different type of chart with tracking data as report	Different type of chart with tracking data is generated	As Expected	Pass
2	Download the chart	Chart is downloaded	As Expected	Pass

Table 13. Test Case on User Profile

Test Case:	TC012			
Test Description:	User can update own user profile			
#	Step Details	Expected Results	Actual Results	Status
1	View user profile	User's detail is viewed	As Expected	Pass
2	Edit the user profile	User profile is edited and updated to database	As Expected	Pass
3	Change password	Password is changed and updated to database	As Expected	Pass

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Youth Apathy: A Class Struggle for Student Political Hegemony in Malaysia

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ABSTRACT

On the 10th December 2018, an unprecedented historic event took place in the lower courthouse of the Malaysia Parliament. After years of repressive and regressive stance on student activism, members of parliament voted unanimously to amend the Universities and University Colleges Act 1975, which finally allows student political participation on campus. However, claims of youth apathy and the portrayal of youth in mass media as "unprepared and inexperienced political actors" pose a detrimental dilemma on the participation front. Intrinsic experiences of the youth community, especially from within the confines of universities have been misunderstood, and in fact, very much alienated. Therefore, the impact of the amendment amongst students is assessed in this research. Through exploring the experiences of youth who are caught up between state autonomy and civil liberties, this study employs qualitative research methods through asynchronous in-depth interviews in understanding youth's freedom of expression. The findings are analyzed thematically to extract emergent themes from interviews derived from participants' experiences with bureaucratic structures of the university environment and secondary data on the existing models of polity within the campus. Results show that structural barriers empowered by the existing ideological control provide both perceived positive and negative experiences to the participants. The majority of participants were alienated from the mechanisms of existing democratic institutions and discourses whereas subaltern voices of the youth prevail outside the confines of state-oriented spaces. This study has implications on the Overton Window practices of policymakers in providing true autonomy to students.

Keywords: Ideological control, Malaysia, political hegemony, student unions, youth apathy

INTRODUCTION

One ought to remember that participation in student politics is not only about enacting one's university citizenship (Klemenčič & Bergan, 2015 as cited in Klemenčič & Park, 2018), but in addition to developing propensities of engaged citizenship within democratic societies. The concept of student politics refers to the activities related to the power relations between students and other social actors in and out of the higher education systems; more explicitly, it pertains to the relationships between the students and the university authorities, as well as the interactions between students and state officials (Klemenčič & Park, 2018). The systematic juxtaposition of civil societies in reflection of the state is encapsulated in the existence of social movements. In particular, the youth as a working-class mobilizing a class consciousness, which reflects the progress of labor union movements. The increasing prevalence of segregation under the general umbrella of the youth therein lies the fundamental crisis in which, actors caught in the gap between state autonomy and civil liberties often go to war. The term "youth" and "students" are used interchangeably when they are not always related. Portrayed and represented mostly by university students rather than the urban poor or alternative communities by the media and policy makers, youth apathy often connotes to the issues of employment-ability and political succession. The change in dynamics, which accord privileges to students to engage in the political scene, especially as an institutionalized interest group would transform the landscape of society, thus generating a collective consciousness within a class of citizens. A complimentary, interconnected, and interdependent cosmic duality, which keeps the political structure of a nation accountable with its organic checks and balances, certainly enlivens the health of the political system, one's very right to exercise what is known as

political will. Be that as it may, the reality of such images is not as utopian as it was thought out to be, theoretically. Political cleavages with the intersectionality of social dimensions created new discursive opportunities and therefore restless dissents among the dynamic framework of society.

As Altbach (1989) emphasizes, student movements do not emerge from a vacuum, but are influenced by a social-economical-political environment generally and by governments (and sometimes academic) policies concerning student activism. For 40 years, any form of student activism or dissidents on the Malaysian front line has been curbed using sanctions or legislation from the government through the educational institution, which has severely influenced youth apathy towards politics. Weiss and Aspinall (2012) highlighted that, "as students' political mobilization ramped up, so did the government's efforts to keep activism in check". This was specially stipulated through the Universities and University Colleges Act (UUCA) [Akta Universiti dan Kolej Universiti (AUKU)] 1971 in Malaysia. The counter-response was to create policies that forcibly hinder any participation of student activism within university grounds. As a consequence, the previous government apparatus has kept Malaysian students from achieving political enlightenment that was enshrined back in the sixties, which garnered independence from colonial powers. Throughout the four decades of political suppression using the legislation, student activism was reined in using sanctions and threats. In such instances after the UUCA 1971 was enforced, students were confronted with police brutality and tear gas, which resulted in "more than twelve (12) students injured and one thousand one hundred and twenty-eight (1,128) students arrested" (Karim & Hamid, 1984). This occurrence led to more protests by students and later gave an excuse for the government to take over the university administration, effective immediately. With the upheaval in campus administration, all student-led organizations were suspended and dissolved while university lecturers who had supported the struggles of the students and peasants were apprehended and terminated without further notice (Karim & Hamid, 1984). Hence, further mitigating the participation of students in politics, which are often deemed radical and dismissed. Due to the structural barrier that was imposed in the seventies, such as "the corporatization of public universities; the National Council of Higher Education Act 1996, which put in place a single governing body to steer the direction of higher education development", student activism was curbed to a minimum (Ministry of Education, 2015). The drastic decline in youth participation in politics also meant the lack of representation in parliament. Because of this long-term repression, youth representation in the parliament is almost nonexistent and stresses a deep sense of alienation among young generations (Altbach, 1989). Therefore, any decision-making process that pertains to matters regarding the youth lacks the support in numbers and the link in terms of the generational gap.

But on the 10th December 2018, an unprecedented historic event took place in the lower house of the Parliament of Malaysia. After years of the repressive and regressive stance on student political apathy, members of parliament voted unanimously to amend the UUCA 1975 that finally allows student political participation on campus (Abdul Rashid, 2019). This political invigoration was inspired by a series of events after Pakatan Harapan, a coalition of four (4) parties ousted the six (6) decade long of the Barisan Nasional regime. The promulgation produced opportunities for students to mobilize momentum. Universiti Malaya (UM) students revived orientation week convoy, marched in protest and featured controversial activist Fahmi Reza to give a lecture on the history of student activism (Yap, 2019). The envisaged spirit of political freedom also mobilized the first establishment of an official student union (SU) in International Islamic University Malaysia (IIUM), which created rippled effects on the public window of discourse regarding the rise of the student movement in Malaysia (Mustafa, 2019). As SU do not exist independently from labor unions in Malaysia, this unprecedented move of amendment signified strong support in legitimizing the progress of representation, collective power, pride in work and fair treatment in the workplace (Crane, 2014). This constitutes the consolidated presence of students as political actors that can lobby interests on a broader platform and influence the fabric of society enough to leave a lasting social transformation. The change in dynamics, which accord privileges to students to engage in the political scene, especially as an institutionalized interest group would transform the landscape of society, thus generating a collective consciousness within a class of citizens. Nevertheless, are the university grounds ready for such pressure?

This research does not essentialize nor undermine the necessity of the education system. Rather, it critiques the power dynamics within the industry itself. With the critical analysis founded on ideological control, the analysis, deconstruction and interpretation of student movements through the critical lens of Gramsci's Marxism delineates that the power dynamics of students within the public arena of discourse is highly multifaceted and controlled (Gramsci & Hoare, 1971). Student political awareness is the key element of this study and where youth apathy is its contrast: Are they conscious enough of their own personal activism? The youth who is riddled with a myriad of political, economic, social and environmental issues are the stakeholders in this study; particularly, the students who are set to inherit these dilemmas as a nation. One of the arguments is that the welfare of the youth is rarely represented as the perspectives of the youths are often marginalized and sidelined due to the glaring issue of unemployment (Dass, 2018). The stress and uncertainties in facing modern challenges aggravate the living conditions of the youth such as precarious working conditions, inadequate income, paid internship, and affordable housing. Social inequality as overly presented under the guise of racism, sexism, heterosexism, classism, or ethnocentrism is the nexus to such precarious living conditions. When it is speared with youthful idealism and optimism, students are able to coalesce and shed light on these issues.

This leads us to the next question of SU. There seems to be a paradoxical paradigm at play. The conferred privileges by the previous student bodies of officials such as Majlis Perwakilan Pelajar (MPP) and student leadership clubs are dubious when the dominant mindset of society at large pertains to the notion of partisanship. Are SU independent and autonomous entities that can be a reliable opposing force of accountability? A subsequent issue is, on which sides do the SU choose to adhere to? The fallacy of 'either/or' binarism depicted in the pro-government or pro-opposition positions will be critiqued. In the past, "students' engagement with pro-government groups or component parties of the ruling coalition attracted less opprobrium" (Weiss & Aspinall, 2012). Why are they (the government) suddenly empowering the voting power of the youth? Is there a beneficial gain that they can capitalize on? Will they galvanize the SU's political connections for their self-interest? This study zeroes in on the recent amendment of UUCA, which finally allowed students to participate in politics within campus grounds. How students collectively reacted towards the announcement and reconcile a class conscience to be deemed as powerful political actors, influence policies, and social narratives within the fabric of society is further scrutinized. Despite that, the trade-offs of having a powerful mechanism that provides space for the social movement to be co-opted or hijacked by extremist views that could be detrimental to the already unstable status quo. Since the student movement revitalization is still in its infant stage, it is a delicate time frame where the grapple for power comes with the formation of SU constitutions. Whoever holds the highest and dominant position within the hierarchy gets to shape the SU accordingly and that will set a precedence to other SU throughout Malaysia. As such, the notion of students being affiliated with an educational institution already provides grounds for suspicion where the imposing process of guidance that leads to indoctrination is still liable. Furthermore, third party individuals or groups, which are politically incentivized will seek the gullibility of students in order to further one's own selfish interest. The tangible harm of this mechanism allows violent and radical outcomes that may destroy institutions or cause greater inequality due to an oversight of consequences. For these reasons, there needs to be guided questions for this research to anchor its analysis. In the analytical framework, these three sets of interconnected questions guide the analysis.

1. *What causes student or youth apathy in politics?*
   Why are the youth apathetic towards politics? On the individual level, is it because of the restrictive laws that force one to conform where one's free political will is taken away or is it just pure debilitating ignorance?

This study is conducted with a focus solely on the youth's participation in the national political scene whereby the discourse of youth apathy is to question the legitimacy of youth's freedom of political dissent. Investigations into the role of emotions, students' sense of inclusion, as well as the emergence of different forms of collective identity and its impact on students' short-term and long-term political behaviour would be a valuable

addition to the existing scholarship. This study is designed to update existing literature regarding Malaysian student movements that was once generalized to be connoted with ethno-religious cleavages.

2. *How far is the extent of student-youth, freedom of expression?*
   As a civil society, what acts are out there to confine or limit the actions of students who protest? How are SUs developing their mechanism and ideology? How does it promote youth participation that is deemed inclusive? Is there some form of hierarchy or bureaucracy barrier that facilitates inequality or used to control the power of SUs? Who or which group influences the narrative in the SU? Are there nuanced demographic inequalities that exist in societies mirrored in SU?

The investigation into the mechanisms and politics that are being formed in student-civil societies within Malaysia's new context, explores the latest characteristics found in the formulation of SUs that would eventually determine the agenda of the movement itself or whether the amendment of UUCA is tokenistic instead. Through the perception garnered by the youth, the significance of SUs and its impact is studied. This can be seen through their values and norms practiced as its foundation as it acknowledges the importance of equity, accountability, transparency, and inclusiveness within the principles of its constitution.

3. *Do students collectively have a class conscience to be deemed as powerful political actors to influence policies and social narratives within the fabric of society?*
   On the national platform, where is the student movement in Malaysia heading towards?

The third objective analyzes, deconstructs and re-interprets student movements through the lens of Marxism that delineates the power dynamics of students within the public arena of discourse. The specific purpose of this study and the research questions it attempts to answer is the direction of the student movement within Malaysia. With the critical analysis founded on ideological control, the general pervasive pattern of student apathy is identified and questioned.

METHODS

Participants

Currently, there are 20 public universities in Malaysia where issues of power or status are discussed within the implementation of the SU on each campus. The justification for public universities instead of private sectors is seen in the foci of the Ministry of Higher Education (MOHE)'s policies in implementing SUs, which IIUM's SU is the piloting project, precedence for all other models of its kind (Mustafa, 2019). The study population, which is of central interest to the subject matter of the study, involves youths who are students in higher tertiary education ranging from age 17 to 30. The range is further narrowed through the roles, knowledge or behaviour towards different groups and their ability to shed light on different aspects of the research. In this case, 20 organizations of the SU taskforce/MPP are contacted. The voices of institutionalized authorities are the subsets of the central population, which will be included rather distinctly. The difference between SU task force and Majlis Perwakilan Pelajar members is in the nuance of legitimacy. SU taskforce are comprised of students who are external members assembled randomly and voluntarily who either is or isn't a part of the Majlis Perwakilan Pelajar. Whereas Majlis Perwakilan Pelajar are students who participated in student campaigns and elections in order to be voted in as some representatives. On the other hand, there are additional groups or sub-populations such as activists, student body leaders and club members that are included because their views and experiences would bring contrasting or complementary insights to the inquiry. This defines the supplementary parent population.

Procedure

The research activity covered a six (6) month period, from February 24, 2020, to July 24, 2020. Based on the qualitative nature of the study, the research is employed through a parallel case study framework, which is defined

in Mohajan's (2018) work on case study especially the parallel studies; the cases are all happening and being studied concurrently. An additional period of three weeks as the framing of the spatial continuum was initiated to allow an appropriate adjustment for data collection as well as the process of triangulating the data collected from the participants. This extensive time frame is also justified due to the nature of this heuristic study, which requires one to fully grasp the nuances in different sets of worldviews propagated by numerous participants from all walks of life. The random snowballing technique of collecting the sample population of 1-2 students per university is reasonably large as the nature of the population is quite heterogeneous. Since the number of criteria is small and its requirement for diversity is obligated, the sample size of 20 participants is perfectly sufficient. This has a significant impact on the number of cases that were covered where triangulation of data occurs through virtual ethnography of respondents social account such as Facebook, Twitter, Instagram, Tumblr, Reddit etc. along with official online channels of universities.

Analysis

This research implements the method of content analysis and analytic induction of a grand narrative. It involves consolidating, reducing, and interpreting what people have said and what the researcher has seen and read (Abdullah, 2019). In a thematic fashion, general patterns would be derived from the first set of data. This specific approach applied in "critical analysis of a qualitative research" whose "goal is to critique and challenge, to transform and empower" (Abdullah, 2019). The factors in human behaviour in youth apathy is identified and codified. Findings for each specific research question and objectives are categorized and ranked on the basis of its relevance and significance. Content analysis of both written and oral interviews along with secondary data mined based on critical research is carried out through the subcategories of several themes constructed from direct quotations from interviews, documents, observations and official reports. Through triangulation from primary respondents' social media platforms (such as Facebook, Twitter, Instagram, Reddit and Tumblr), these sources were confirmed and validated. Mostly qualitative, this research deems it more appropriate than a quantitative as a more nuanced and empirically grounded rethinking of existing paradigm on youth and politics in developing a perspective that both pays closer attention to the systemic barriers to young people's political agency, as well as explores their potential for affecting real social change without leading to a version of the 'youth as powerless' discourse (Rhenigans & Hollands, 2013). Therefore, this research spends a significant amount of effort in digging deeper into individual cases rather than a large collective.

RESULTS AND DISCUSSION

Objective 1 - What causes student/youth apathy?

The first research question prompted the initial assumptions of youth debilitating ignorance in the case of political action. It is with the intention of this guiding principle to investigate the factors in contributing to its apathy. In spite of that, the results revealed a different conception of which the youth aren't apathetic to political systems, but rather active in levels of participation. The revelation is filtered out in several layers of analysis. One including the method of triangulation as proposed in the methodology segment earlier.

Through the first layer of analysis, several key phrases/elements are found in each of the participant's interview:

Compartmentalizing and essentializing youth

In the 'Public Opinion Survey: Youth Perception on the Economy, Leadership and Current Issues' from the period of 28 June – 1 July 2019, of the 604 youths in Malaysia conducted by independent research firm Merdeka Centre and WATAN, 70% said they were not interested in politics, while 75% found politics confusing (International Republican Institute's Center for Insights in Survey Research, 2019). However, the quantitative data does not explain the intrinsic issues, which pertain to the youth.

All participants in this research claimed to be active socially online but in the same breath they also claimed their expression of political interests is marginal at best. As this majority pattern of response was premised upon the highly contextualized definition of 'politics', the perception of traditional advocacy is met with high expectations of vigorous protest/riots/petitions. Therefore, in their opinion, their contributions are 'comparatively pale' to the experiences of vocal activists. Furthermore, when the participants are asked whether they would consider themselves to be politically invested/active online with politics/just participating for socials, the question is met with several responses which tend toward a negative affirmation, with a slight exemption.

Most of the answers fell within the spectrum of:

- *"very busy with studies"*
- *"complacency with personal preoccupation/self-development"*
- *"just a by-stander"*

Only a small subset (4 out of 13) would contradict and attest to be somewhat politically active such as one of the participants, find himself to be, in his own words,

> *"more politically expressive and critical when it comes to nonverbal means of displaying them. Not only that I'm more politically transparent online but also more engaging. Mostly on Twitter because there seems to be a lot of like-minded people there compared to FB and Insta. Most of my political concerns and engagement are supplied by Twitter, although I do go to other platforms such as Reddit and news outlets for further reading and fact checking." (personal communication, June 1, 2020).*

What does this mean then? Do students partake in politics without claiming the exclusive actions of activism? Further investigation through data triangulation and clarification later shows that most of their online platforms do contain evidence of participating in politics rather actively. This misalignment of self-identification is due to their definitions of 'politics', which were specifically narrowed either into protest activism, physical advocacy or running for candidacy and joining student body executive councils. While some do attest to wider definitions such as social justice keyboard warriors or online advocacy, yet they do not assume the label/role. This brings up the question in the power dynamics of 'representation'. How identity plays a vital role in assuming roles and responsibilities, but also susceptible to the forces of ideological control by the ruling class. Narrative-wise, the awareness of student-youths in the political environment is arguably an important role in addressing problems to youth apathy. Despite that, its voice of representation is oftentimes distorted or seen as inferior and static. The youth's narrative, which was subsumed and translated within the dominant international framework undergoes countless bureaucratic vetting before it reaches the prestigious platform within the Parliament of Malaysia. This dogmatic exercise exacerbates the structural violence upon the connoted narratives in these communities. Therefore, the angle of which the youth could be perceived as a substantial use in the national discourse of youth apathy should be dissected, analyzed and articulated further. Premised upon the heterogeneity of the youth paradox, arguments for and against the importance of student activism in addressing the problems relating to youth apathy would be discussed thoroughly with regard to the ambiguous concept of 'ageism'.

Power disparity and ageism

In the '2012 Survey of Malaysian Youth Opinion' poll by the Asia Foundation, 71% of the youths reported to perceive themselves as less empowered to act, saying they can't make a difference in solving problems within their communities (The Asian Foundation, 2012). In light of this statement, participants were asked whether they engage well or just do the basic minimum requirement and wish to avoid all problems or engagement with their university (academicians, staff or bureaucracy). When asked whether they have a problem with bureaucracy or student politics, what do they think of their peers and how do they deal with issues on university campuses? Most of the participants either believe politics were for 'adults' to regulate or not within their capacity by the rationale with due respect to the

chain of command. As a result, a combination of both the SOPs and procedure required for students to express their concerns and difficulties can be very discouraging and oftentimes were dealt in a very slow manner. Many would just wait and let someone else to actually voice and highlight the problems, which they would go to the MPP first and subsequently the University administration.

Most of the key phrases were:

- "*would not mind doing or following their rules if it is not against my principles"*
- *"depending on severity of issue and the situation but I trust that there are better people who are managing it"*
- *"don't want to get myself involved in such a thing and get criticism from everyone"*
- *"most of us are critics to the system but there's no obvious change being done"*

On the other spectrum, two (2) participants, expressed their dilemma in the interview,

- *"don't want to be confrontational, not confident"*
- *"afraid of repercussions and hate conflict"*

when asked why they would not relate to the concept of student politics (personal communication, May 11, 2020), therefore opting for opportunistic/utilitarian approach, when needed to further personal interest. This type of non-confrontational method has led youth-students to resort to numerous ways to adapt in order to survive within a bureaucratic setting and against the backdrop of an authoritative institution.

The general sentiment surrounding these responses according to Gramsci highlight the perpetual dialectical and maieutic relationship established with common sense in order to transform it (and enable it to transform itself) so that a "new common sense" will prevail (Gramsci & Hoare, 1971; Liguori, 2009). Essentially, dominion over the masses were not just within the acts of political/economic violence and coercion, but also through subtle ideological expressions. The values or norms such as the liberty of decisions only subject to the state being the common sense of all, are part of the bourgeoisie (capitalist-state) developed and indoctrinated hegemonic culture. People in the working-class (the student-youths) identified their own good with the good of the bourgeoisie, and helped to maintain the status quo (through labor/resources whether it be intellectual or physical), rather than revolt. Instead of equalizing the importance of social roles, the seeming portrayal of internalized youth subordination and political powerlessness exhibited by the participants, in actuality, demonstrates the essence of ageism, the supremacy of hierarchy. The structural forms of the political and ideological superstructure such as the intellectual and moral leadership of the University management sector and MPP are indeterminate to Gramsci's theory of "historical bloc" (as cited in Ramos, 1982). This bloc becomes the foundational basis of consent to the hierarchy, and at the same time, it embodies a machine, which produces and perpetuates the hegemony of the ruling class. The network generated through social relations in alliances and compromises both maintain and fracture relations of the economic base. However, this struggle should not be concluded indefinitely from an essentialist framework where social organization of fractured class consciousness is the only mechanism at play. Subsumed by mainstream media or government and ultimate blind respect to the chain of command through political avoidance is actively constructed through various university policies and practices, as well as through the watchful eye of those who hold the power to intervene in youth organizing when it becomes perceived as dangerous and out-of-bounds of proper youth behaviour. Encouraged to avoid politics and define politics narrowly, the result of perpetual struggle of student activism against a system that rewards subordination and inferior complexes are saturated with negative perceptions in mainstream media or the basis of policy makers' range in public window of discourse. But of course, with the recent UUCA amendment, are the youths perceived to have more support or leeway to enact change from the ground up?

Discrimination within the internal narrative or discourse between students

In a survey of Malaysian Youth Opinion of their perceived influence on the government, only 41% of youth today said they could influence how the government works (The Asia Foundation, 2012). Nine (9) out of 13 participants (70%) stated that they were uninterested in 'playing any student representative role, such as the MPP, Clubs or Councils members', and preferred to 'just be a bystander'. Engagement with university level administrative executives such as staff, bureaucracy and MPPs are met with minimal contact in reasons for doing the basic requirement and wish to avoid all problems or engagement with them. There is a small percentile of participants within the subset who would complain of the abuse of authority in online platforms but are then met with resistance. Whereas the other 30% of the participants would claim to 'maintain civil and cordial relationships with their university administration in respect to their club/student body organization-related works'. Why is there a large size of participants eluding contact or maintaining a distance from their representative student-bodies? Why are they not receptive towards the engagements coming from MPPs and even some who has so far claimed to surpass the MPP directly in order to deal with their higher authorities to solve an issue. The individualized and asocial theme of the responses are further researched and the clarification showed that there was another angle of measuring the political discussions amongst student-youths, through official channels of "University Confessions" on Facebook where students anonymously post their dissatisfactions online, as highlighted by Ms. Tiffany Pung in one of her interviews (personal communication, May 31, 2020). Empirical data found online are collected from these sources, which add to the collective sentiment of youth dissatisfaction with internal university politics, administrative policies and bureaucracy production. However, the complacency was the compounding tone of most participants. One of the participants who emphasized the priority of self-improvement and was preoccupied with personal agendas rationalized that there were experts who are manning the executive roles even though they were doubtful of it. When questioned further, the participant found that the notion of students partaking in politics detrimental, as pointed out by a USM student (who stressed her wish to remain anonymous),

> "*from my perspective, student politics cause a lot of distractions to students and it deters their attention from their main goal which is their education. This is because students tend to get caught up in all the political turmoil and be consumed by it i.e. skipping classes to go and participate in their friend's political campaign."* (personal communication, May 25, 2020).

This sentiment was largely supported by 90% of the participants. This inherent normalization of reductive responsibility is seen as a complex interplay between class consciousness of the subaltern and state as delineated by Gramsci (Gramsci & Hoare, 1971). The common sense characterized "(a) as the prevailing and often implicit 'conception of the world' of a social or regional group; and (b) as something that is the opposite of a developed and coherent worldview" (Liguori, 2009) seems to be vastly intertwined with the agenda of the capitalist-state. Which is to say the cultural hegemonic influence of the ruling class over the working class is deeply infiltrated to the point where some of the youths are readily handing over their autonomy in regards to assume the responsibility of providing an available labor resource to the national agenda. Despite that, this does not answer the reason as to why the youth would rather conform instead of critiquing the 'natural common sense' or revolting against the status quo. Hence, this leads to the subsequent element.

When the participants are asked, 'do they relate to the youth/student movement', or 'they have a problem with bureaucracy or student politics that ties into their relationship to the movement, most of the participants (80%) in this research responded with keen awareness of the internal student politics going on in their campuses. However, they do not relate nor define themselves collectively to the student movement in Malaysia. Some would even go as far to say that it is absent.

The key reasoning/phrases collected are:

- *"social movements are very based on connections/some are group oriented where if you know someone only you will get a position, one must know the back doors to get in anyway...no credit for talent"*
- *"students getting serious about politics create more segregated groupings"*
- *"don't want to get into trouble as their supporters will attack us"*
- *"student election is filled with unnecessary drama and distractions"*
- *"prefer to be in clubs/societies that's inclusive of all races rather than one singular race."*
- *"university is the only place that should be kept clean from any 'politics'.*
- *"people who are in politics are because of ego, they do not care about the welfare of students"*

While there are quite a number of students who claim that they are political, much of the discourse tends to incline towards partisan arguments between Malaysian political parties and rarely the larger socio-political landscape of the governing system and structure. They are aware of the general discursive debate about 'why this political party is better than the other' or 'why this person is the better politician' but negating the space to instead highlight crucial matters of ideologies, policies and welfare. This type of political discourse is much reflected in the campus where the social organization of students is confined and reduced to only party vs party narrative. They are predominantly partisanship based instead of critiquing the rules of the system itself. Hence, the political climate for student activism is stifled and limited within these variations.

Despite that, when the analysis of responses is compared with the response analysis recorded by other researchers in other seven countries such as the 'Youth Participation in Democratic Life' Survey (2011-2012), it is found that the interpretation of these elements misconstrued the concept of participation (Cammaerts, Bruter, Banaji, Harrison, & Anstead, 2014). Level of participation does not only consist of voting as political behaviour, but also within one's capability of affecting change through the sharing of information on social media websites (such as Facebook, Twitter & Instagram), joining the online political discourse (on Reddit/Tumblr) and etcetera.

When assessing young people's attitudes towards democratic life in the UK, France, Spain, Austria, Finland, and Hungary, data suggests that young people are willing to engage politically but are "turned off by the focus and nature of existing mainstream political discourse and practice, which many believe excludes them and ignores their needs and interests. Contrary to the assumptions of the disaffected and apathetic citizen approach, there is a strong desire amongst many young Europeans to participate in democratic life, but this desire is not met by existing democratic institutions" and discourses (Cammaerts, Bruter, Banaji, Harrison, & Anstead, 2014). This fundamental misconception is reflected within the interview session of this research where student-youths are exhibiting lack of enthusiasm towards the discussion of traditional polity. The case in which the systemic barriers empowered by ideological control exist within the status quo of traditional polity. Ergo, the two final key elements filtered from the data to summarize youth's alienation into traditional politics are:

I. Cultural hegemony

The findings of this research were supported by the existence of evidence in authoritative and bureaucratic regimes within the university grounds, which exercises a political, intellectual, and moral role of leadership. The success of the authoritative regime in shutting down dissent through mechanisms and policies that are being formed in the new student-civil societies are seen in the SUs within Malaysia's new context where they are still heavily monitored and suppressed. Consequences such as active and subtle reproaches dissuade students while slow and discouraging university's standard operating procedures restricts the empowerment of student-youth freedom of expression.

II. Lack resources for political engagement
The suppression and relatively low amount of alternative outlet of expression are key to confirming the lack of political resources. There are sufficient forums and events to be somewhat politically engaging for students to go and join but it is still very much controlled and mostly are organized by the faculty themselves, not the students.

The youth are not simply apathetic, rather alienated. There is not a simple benign conclusion as to why but the next best question critiques the structures within university grounds. This entreats the question of what mechanisms are in place, which supports this existing ideological control?

Objective 2 - How far is the extent of student-youth freedom of expression?
Rheingans and Hollands (2013) argued for a more nuanced and empirically grounded rethinking of existing youth and political paradigms in developing a perspective that both pays closer attention to the systemic barriers to the young people's political agency, as well as their potential for affecting real social change without once more leading to a version of the 'youth as powerless' discourse. The governance structure which allows for more youth to be emboldened with a proper political thinking than just simply talking about whose political viewpoints are better.

As a civil society, what acts are out there to confine or limit the actions of students who protest? How are SUs developing their mechanism and ideology? How does it promote youth participation that is deemed inclusive? Is there some form of hierarchy or bureaucracy barrier that facilitates inequality or used to control the power of SUs? Who or which group influences the narrative in the SU? Are there nuanced demographic inequalities that exist in societies mirrored in SUs?

The mechanism proposed by SU lobbyists such as Dr Zaid bin Omar from the Ministry of Higher Education's representative and speaker on lobbying SU constructions across Malaysia is reflected in Figure 1:

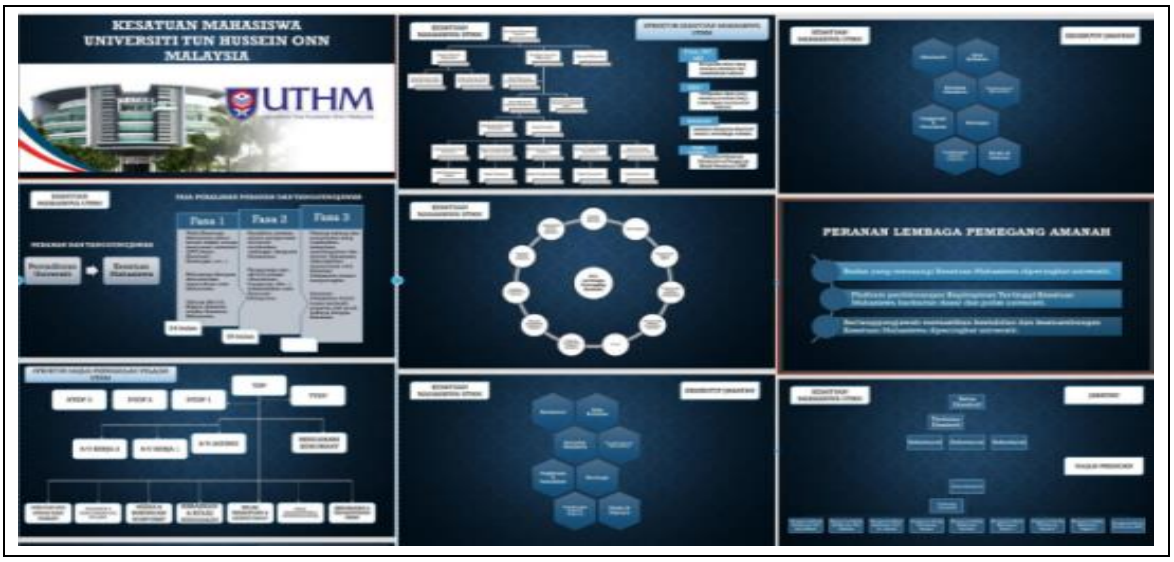

Figure 1. Model and framework recommendations by the Ministry of Education. Source: UTHM Student Union Facebook Page, 2020

In political theory, meaningful participation is defined as a sharing of power. In the framework of Gramsci's hegemonic culture, predominance by consent is cemented by a condition in which a fundamental class exercises a political, intellectual, and moral role of leadership by a common worldview over another class (Gramsci & Hoare, 1971). This conception of ideology and revolution was often combined with a reductionist interpretation of ideology, which argued that ideologies necessarily had a class character, so that there was an ideology of the capitalist class and an ideology of the working class, both ideologies antagonistic, defined, and mutually exclusive in their totality. Therefore, exacerbating the emphasis on the role of state institutions' superstructural and infrastructural foundations of class power as a backdrop against contemporary news and government reports.

For 40 years, any form of student activism or dissent on the Malaysian frontline has been curbed using sanctions or legislations from governments through the educational institution, which has severely influenced youth apathy towards politics. On December 2018, the Dewan Rakyat passed amendments to the UUCA, and other related laws, thus allowing university students to participate in political activities (Kow, 2018). The new amendments were gazetted into law effective March 15, 2019. The structures of power relations erected by the state to maintain subordination and control lies within the leadership of the student representative council. In Malaysia's university environment, this is observed through the roles in which student societies play such as MPP, Jawatankuasa Sekretariat Universiti and SUs. The latest characteristics discovered in the proposed formulation of SUs should be acknowledged as that would eventually determine the agenda of the student-youth movement itself. However, the establishment's progress through the perception garnered by the current national political structure is unpredictable. The significance of SUs and its impact has to be studied continuously. This can be seen through their values and norms whether it acknowledges the importance of equity, accountability, transparency, and inclusiveness within the principles of its constitution. In this research, the key elements mined from a comparative analysis between the mechanism proposed by SU lobbyists and the mechanism within the MPP's current administrative system showed contrasting evidence. The contradictions are summarized below:

> *"The SU is not a body that performs the tasks differently as a whole, they are just rightfully acclaimed with the true autonomy they deserve. The MPP would still hold onto both the administrative or bureaucratic demands of students. The proposed model of SU propagated by KPM absorbs the MPP bodies within the new structure. Take the example of Universiti Malaya and Universiti Kebangsaan Malaysia, although there are other universities who have changed the name of the student body entity. These university student bodies' have changed the name of their MPP to Kesatuan Mahasiswa even though the functions they execute are still the same as before. Part of the response from the administrative side, as quoted from a representative of an MPP in UMT, delineates that there are other universities who have changed the name of the student body entity to rebrand themselves"* (personal communication, March 23, 2020).

The unpredictable shift in policy implementation due to the change of government cabinets halted the internal politics of task force members in constituting the SU currently where there are dynamics of power plays between students who are representative of MPP and of those minority voices against the restrictive model. According to the alternative-activist group, the preoccupation with bureaucracy as proposed by the representatives of MPP negates the ability for students to discuss on an inclusive platform.

> *"Implying on the UUCA; as long as it is around the students will never have the autonomy that is rightfully theirs. The Ministry's ideal version of SU is within the limitations and restrictions of the law however the law implemented must be amended leaning towards students' autonomy and academic freedom. When the participants were asked regarding the UUCA amendment, their response was that the amendment is perceived as tokenistic and through the perception garnered by the youths, the significance of SUs and its impact is marginal"* (personal communications, March 20, 2020).

Nevertheless, the available platforms or structural mechanisms in the status quo, which supposedly allow students to voice their concerns are marginal at best. As supported by another MPP from University Malaysia Perlis said, that the SU task force committee received a low rate of participants and are represented by the same members in his university's MPP, which he himself admitted and as quoted, "To be frank, I don't know why I am even involved with task force" (personal communication, March 4, 2020). Currently, there are some task-force committees whose construction of SUs is manipulated for the convenience of meeting the universities' requirement, which defeats the purpose of establishing SUs in the first place.

For now, until the removal of the Section 15(2)(b) of UUCA, the amendment is tokenistic (Act A1433, Universities and University Colleges (Amendment) Act 2012). Hence, the extent of the student-youth, freedom of expression is limited to university education. The findings exhibited that the shift of power fundamentally does not provide meaningful participation. The youth/students need to rely on alternative platforms outside the regulation of the state to exit limiting existing discourse.

Objective 3 - Do students collectively have a class conscience?

Ideological control through subtle instruments of oppression can be identified by questioning about who has the power, how is power negotiated, what structures (policy) in society reinforce (increase/strengthen) the current distribution of power and, so on. It is also assumed that people unconsciously accept things the way they are, and in doing so, reinforce the status quo (current state). Others may act in seemingly self-destructive or counterproductive ways of resisting (resistant to change and development) the status quo.

Comparative analysis of the current existing structures within MPPs around Malaysia through observation method and content analysis of their official records posted online suggests an elaboration of the dialectical relationship between the base and the superstructure (Ramos, 1982). Hence, the structural analysis of the roles and its civic practices on university grounds are conducted.

The roles of MPP

Ideological control of the capitalist state through its infrastructure is seen in the subtle instruments of oppression and social organization of MPP. The elements which portray Gramsci's Praxis of hegemonic influences are through forms of symbolic production, collective practices and rituals (Gramsci as cited in Ramos, 1982). In this case, representative emblems, slogans and specifically tailored uniformed suits in social structures reflects a separation of class as reflected within the MPP's current hierarchal administrative system (Figure 2):

This is further exacerbated with the constant reproduction of posts on Facebook, Twitter and Telegram. The exclusive community where its membership into elite groups enables privileges (i.e. connections), encourages people to accept the supremacy of its hierarchy and to conform to the power relations identified as the leader and the led, reflecting segregation by ethnicity and gender. Most of the members within the MPP are predominantly Malays with a disproportionate ratio of men to women. This reflects the ruling class's prerogative in maintaining an established hierarchy according to ethnicity and gender. The geographical distribution between the East and West Peninsular of Malaysia emphasizes the distinction where the East is ethnically more diverse than the West. Furthermore, concentrations of support in financial, facilities and recognition allocation shown through congratulatory and appreciation posts. This legitimizes their position as consolidated by the university administration, the mass media and government. The MPP becomes a tool for the ruling class (i.e. the capitalist state) to perpetuate propaganda by socially stratifying the students into a classist/ageist society. In addition, most decisions made behind closed doors negate the ability for student-youths of subaltern classes to partake in the decision-making process. This severely affects the youth's agency in aspiring for state power. The youth must strive to attain hegemony in civil society by making its challenge against the dominant class while conforming itself to the interests and aspirations of other subaltern classes (Ramos, 1982). The SUs' developing mechanism and ideology are hijacked by MPP's or other powerful student body representatives who influence the narrative of the SU in the

making. Hence, this is the success of the authoritative regime in shutting down dissent subtly by manipulating the structural mechanism within the environment.

Therefore, directing its attention into the tradition of civic practices within university grounds, the ruling class can intellectually dominate the other social classes by imposing a worldview that ideologically justifies the social, political, and economic status quo of the society as if it were a natural and normal, inevitable, and perpetual state of affairs that always has been so.

Figure 2. Examples of MPP organization charts. Source: MPP Facebook Pages, 2020

The civic practices within university grounds

The mechanisms and politics that are being formed in student-civil societies such as SUs within Malaysia's new context are heavily monitored and suppressed. Data from triangulation of accessible channels conducted through virtual ethnography shows that there is only a handful methods to influence policies; either having connections to elected officials of MPP/future SU members, approaching the administrative staff or directly meeting the higher chain of command. Even then, these channels are not easily accessible physically. Due to limited alternative outlet/platform to engage in political discourse or to air grievances, the attention shifts to the online platform. Through several intervals of time, this research has conducted multiple attempts in reaching out to these channels as they represent one of the primary method/tools of contact and interaction from officials and the general student population. However, it is met with slow responses and is a problem-solution mismatch as most of these channels either do not respond at all or delayed communication for weeks.

These consequences disincentivize students while slow and discouraging university's standard operating procedures restricts the empowerment of student-youth freedom of expression. Despite that, there are often misinterpretations of activism, which connotes bi-partisanship and violent protests (personal communications, May 25, 2020), hence, negating any sort of narrowly defined 'political' involvement in campus. The lack of political platform/outlet due to fear of the UUCA repercussions mitigates the membership of youth/students into politics.

With the critical analysis founded on ideological control, the analysis, deconstruction, and interpretation of student movements through the critical lens of Gramsci's Marxism delineates that the power dynamics of students within the public arena of discourse are highly multifaceted and controlled (Gramsci as cited in Ramos, 1982). The

specific purpose of this study and the research questions it attempts to answer reveals the layers of the struggles and levels of participation intrinsically fought by the youth. Whether the youth's contribution is debilitating or an exaltation to the movement in general, is not the goal of this research. Rather, it is the interpretation and the adapted evolution of the movement itself in the eyes of the youth. Outside the confines of the state institution, students collectively have a class conscience to be deemed as powerful political actors to influence policies and social narratives within the fabric of society. This is seen through diverse online participations such as forums, debate platforms and social chat rooms on Facebook, Twitter, Instagram, Reddit and Tumblr.

CONCLUSION

Nevertheless, the research on these communities negates the misconception of apathy, the youths are rather alienated. Student-youths are exhibiting a lack of enthusiasm towards the discussion within the confines of traditional polity; the case in which the systemic barriers empowered by ideological control exist within the status quo of the traditional polity. Not only that, but this study also updates existing literature regarding Malaysian student movements that were once generalized to be connotative of ethnoreligious cleavages with another intersectionality of age-power dynamics (Weiss, 2005). This research does not essentialize nor simply undermine the necessity of the education system, rather it critiques the power dynamics within the industry itself. Klemenčič and Bergan's (2015) stance of the organizational model of student participation would be an important explanatory factor for the policy influence strategy. However, the importance of this element, which was missing, is a (strong) causality between the model and the influence strategy. The missing links which are cultural factors such as the governance style used (interactive or non-interactive) and personal factors (both student representative and the policymaker) influence the strategy employed became the pillars of this in-depth research. The framing of the policy in execution is lost in translation. Therefore, negating the full positive impact of the initial intended outcomes. This research reveals that the social proxies of students are saturated with prerogatives characterized by the capitalistic interest which are state-sanctioned idealism. Citing Sartre's experience of "death consciousness", the reflexive free will in learning is restricted by the inability to question, critique and challenge or stray away from the conventional, narrow, limited path that the system has set upon youths (Howells, 1992). With the critical analysis founded on ideological control, the analysis, deconstruction, and interpretation of student movements through the critical lens of Gramsci's Marxism delineates that the power dynamics of students within the public arena of discourse are highly multifaceted and controlled (Gramsci as cited in Ramos, 1982). The specific purpose of this study and the research questions it attempts to answer in the direction of the student movement within Malaysia and its capability to form a class consciousness reveals the layers of the struggles and levels of participation intrinsically fought by the youth.

Contribution and Recommendation of Study

This research informs that in any given hegemonic system undergoing an organic crisis, a subaltern but fundamental class aspiring for state power in that system must strive to attain hegemony in civil society by making its challenge against the dominant class while conforming itself to the interests and aspirations of other subaltern classes (Ramos, 1982). The level of consciousness needs to keep up with the current globalized digital capitalistic world that allows the student-youth to shine in their unique and dynamic way. The set of practices, normally governed by overtly or tacitly accepted rules and of a ritual or symbolic nature, which seek to inculcate certain values and norms of behaviour by repetition through traditional means of politics hampers the dissenting voices (Hobsbawm & Ranger, 1983). Therefore, it is imperative that the student-youth community can still have a voice outside the confines of universities or state-oriented platforms.

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Impak Industri Pelancongan Terhadap Penduduk Kampung Tellian Tengah, Mukah, Sarawak: Satu Kajian Awal

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ABSTRAK

Industri pelancongan merupakan salah salah satu aktiviti ekonomi yang mampu memberi pelbagai impak, baik yang positif mahupun yang negatif, kepada penduduk setempat. Makalah ini membentangkan hasil awalan kajian yang telah dijalankan terhadap impak industri pelancongan masyarakat Melanau di Lamin Dana kepada penduduk setempat yang tinggal di Kampung Tellian Tengah, Mukah. Pengumpulan data untuk kajian ini menggunakan kaedah pemerhatian dan temubual yang telah dijalankan di kalangan penduduk Kampung Tellian Tengah. Data kajian dianalisis secara kualitatif untuk mengenalpasti impak-impak hasil daripada aktiviti pelancongan di Lamin Dana. Hasil analisis awal mendapati impak yang telah dialami oleh penduduk setempat adalah dalam aspek ekonomi, budaya dan kehidupan, serta infrastruktur dan persekitaran.

Kata kunci: Impak industri pelancongan, Melanau, Mukah, pelancongan, Sarawak

ABSTRACT

Tourism is an economic activity that can contributes various impacts (both positive and negative) to local communities. This article presents the preliminary result of a research that was conducted in order to study the impacts of tourism at Lamin Dana on the lives of the local residents at Kampung Tellian Tengah, Mukah. The data for this study was collected using direct observation and interviews, which were conducted among the local residents of Kampung Tellian Tengah. The data were analysed qualitatively in order to identify the impacts from tourism activities at Lamin Dana. The preliminary results show that the impacts experienced by the local residents are in the aspects of economy, culture and life, and infrastructure and environment.

Keywords: Impacts of tourism, Melanau, Mukah, Sarawak, tourism

PENGENALAN

Pelancongan adalah salah satu industri ekonomi yang utama dan ternyata pesat membangun di negara Malaysia pada hari ini (Hitchcock & King, 2003). Hal ini juga dilihat berlaku di negeri Sarawak yang mempunyai pelbagai etnik dan budaya yang menjadi tarikan kepada para pelancong tahun demi tahun. Walau bagaimanapun, kajian-kajian lepas telah menunjukkan bahawa industri pelancongan di serata dunia telah membawa kepada pelbagai impak kepada masyarakat setempat (Hassan & Siddique, 2016). Kajian-kajian terdahulu telah membincangkan impak-impak industri pelancongan ini dari pelbagai sudut. Contohnya, impak kepada pembangunan infrastruktur sesuatu kawasan (Nayomi & Gnanapala, 2015), impak kepada ekonomi tempatan (Mochechela, 2010; Samad, Shukor & Mohd. Salleh, 2013), impak kepada kehidupan sosial dan budaya masyarakat setempat (Enemuo & Oduntan 2012; Jaafar, Paijo, Mohamad & Ismail, 2016; Mochechela, 2010; Spanou, 2007; Zaidan, 2016; Zhuang, Yao & LI, 2019), dan impak kepada alam sekitar (Andereck, Valentine, Knopt & Vogt, 2005; Brunt & Courtney, 1999; Mason, 2008; Mohd. Salleh, Shukor & Mohd. Idris, 2017; Sunlu, 2003). Menyedari hal ini, satu kajian telah dijalankan untuk melihat sama ada aktiviti pelancongan turut mendatangkan kesan kepada masyarakat setempat di Sarawak. Dalam makalah ini, fokus diberikan kepada Lamin Dana yang merupakan sebuah tempat pelancongan yang terletak di Kampung Tellian Tengah, Mukah, Sarawak, yang memaparkan budaya masyarakat Melanau sebagai tarikan pelancong. Seterusnya, tujuan kajian

ini adalah untuk mengkaji impak-impak pembangunan pelancongan di Lamin Dana ini kepada penduduk Kampung Tellian Tengah di Mukah, Sarawak.

DATA DAN METODOLOGI

Kajian ini dijalankan di Kampung Tellian Tengah, satu perkampungan masyarakat Melanau di Mukah, Sarawak. Kampung Tellian Tengah juga merupakan lokasi di mana terletaknya sebuah pembangunan pelancongan budaya masyarakat Melanau yang dikenali sebagai Lamin Dana. Nama Lamin Dana sendiri bermaksud 'rumah lama' dalam bahasa Melanau, dan bangunannya dibina dalam bentuk rumah tradisional Melanau yang tinggi. Kini Lamin Dana, yang mula beroperasi sekitar tahun 2000, merupakan sebuah tarikan pelancong di kawasan Mukah. Ia merupakan satu pusat kebudayaan yang mempamerkan pelbagai aspek warisan, sejarah dan budaya suku Melanau tradisional, dan juga menawarkan latihan pembuatan seni dan kraf tradisional. Selain daripada itu, Lamin Dana juga menawarkan tempat penginapan untuk pelawat, makanan tradisi masyarakat Melanau, dan aktiviti-aktiviti lawatan untuk melihat kawasan persekitaran.

Pengumpulan data di lapangan dijalankan di lokasi kajian dari 17 Januari 2020 sehingga 20 Januari 2020. Data kajian diperolehi melalui pemerhatian dan temubual. Temubual yang dijalankan adalah berbentuk separa struktur (*semi-structured*). Disebabkan oleh tempoh kajian yang terhad, temubual yang dijalankan hanya melibatkan 12 orang responden. Responden-responden ini dipilih menggunakan kaedah *snowball sampling*, iaitu satu kaedah persampelan bukan rawak, di mana pengkaji mendapatkan responden-responden hasil daripada cadangan daripada responden yang terdahulu. Responden-responden utama dalam kajian ini merupakan Ketua Kampung Tellian Tengah (Encik Boneventure Juana Lupieh) dan pengurus Lamin Dana (Puan Andrea Binti James). Manakala, 10 orang responden lagi terdiri daripada penduduk kampung yang berlatarbelakangkan pekerjaan yang berbeza seperti suri rumah (4 orang), pesara kerajaan (2 orang), peniaga kedai makan (2 orang), petani (1 orang), dan pemandu kenderaan awam (1 orang). Daripada 12 orang responden, 7 orang merupakan lelaki, manakala 5 orang adalah wanita. Kesemua responden, seperti kebanyakan penduduk Kampung Tellian Tengah, beragama Kristian.

DAPATAN KAJIAN

Kajian ini mendapati beberapa impak yang diterima oleh penduduk setempat hasil daripada industri pelancongan di Lamin Dana. Impak yang paling utama adalah impak kepada ekonomi tempatan. Selain daripada itu, terdapat juga impak kepada budaya dan kehidupan sosial, serta impak kepada infrastruktur dan persekitaran.

Impak kepada ekonomi

Hasil kajian mendapati impak ekonomi utama yang diperolehi akibat daripada industri pelancongan di Lamin Dana ialah industri pelancongan ini telah memberikan peluang pekerjaan kepada penduduk setempat. Antara peluang pekerjaan yang telah wujud akibat daripada aktiviti pelancongan di Lamin Dana adalah penduduk dapat bekerja sebagai pekerja separuh masa (*part-time*) di Lamin Dana, contohnya sebagai penari tarian tradisional kaum Melanau, sebagai ahli pengurusan protokol majlis yang dianjurkan oleh pihak Lamin Dana dan sebagai pekerja tambahan untuk menguruskan pelancong sekiranya Lamin Dana menerima pelancong yang ramai. Selain itu, aktiviti pelancongan di Lamin Dana juga telah mewujudkan pekerjaan sebagai pemandu bot yang membawa pelancong yang ingin melihat suasana kampung dengan menggunakan jalan sungai (Gambar 1), pembuat kuih tradisional kaum Melanau, pembuat anyaman kraftangan (Gambar 2), dan yang terbaru, pembuat kain Batik Linut (Gambar 3). Golongan suri rumah juga tidak terkecuali dalam mendapat impak yang positif ini. Ini adalah kerana golongan yang bekerja sambilan untuk membuat kuih tradisional dan hasil kraftangan adalah terdiri daripada golongan suri rumah.

Gambar 1. Salah seorang penduduk kampung yang bekerja sebagai pemandu bot pelancong.

Gambar 2. Barangan kraftangan yang dihasilkan oleh penduduk kampung dijual di Lamin Dana.

Gambar 3. Batik Linut yang dihasilkan oleh penduduk kampung.

Disebabkan Lamin Dana terkenal sebagai satu tarikan, ia juga pernah dijadikan lokasi penggambaran filem. Ini juga telah memberikan satu punca pekerjaan sambilan kepada penduduk tempatan yang pernah diambil sebagai pelakon tambahan.

Terdapat juga produk ekonomi baru yang diwujudkan oleh penduduk setempat dengan kerjasama pihak pengurusan Lamin Dana. Salah satu contoh adalah kain Batik Linut. Menurut Jamaluddin (2019), memandangkan produk ekonomi utama masyarakat Melanau secara tradisinya adalah sagu, maka sagu juga telah digunakan dalam penghasilan sejenis kain batik yang diberi nama Batik Linut, yang seterusnya telah menjadi produk tradisional yang baru dan unik kepada pelancong yang datang ke Lamin Dana.

Produk ekonomi penduduk setempat juga telah dapat dipasarkan dengan lebih meluas melalui bantuan industri pelancongan di Lamin Dana. Produk ekonomi penduduk setempat semakin dikenali ramai dengan adanya pelancong yang sering datang ke Lamin Dana. Pelancong yang berkunjung ke Lamin Dana ini dikatakan telah mencadangkan kepada orang luar untuk membeli produk ekonomi yang telah dihasilkan oleh penduduk setempat. Misalnya, kuih kering yang merupakan kuih tradisional penduduk setempat pernah ditempah oleh orang luar untuk dijual ke tempat-tempat yang lain. Hal ini demikian kerana kuih kering yang dijual di kampung tersebut hanya berharga RM1.00 sebungkus sekiranya dibeli secara borong. Penawaran harga yang murah ini telah berjaya memasarkan produk ekonomi penduduk kampung secara meluas. Di samping itu, produk ekonomi baharu penduduk kampung iaitu kain Batik Linut juga telah dipasarkan dengan lebih meluas dengan bantuan pemasaran oleh pihak Lamin Dana. Sebagai contohnya, pihak pengurusan Lamin Dana telah menyertai Festival Kraf Tekstil Borneo 2019 yang bertemakan ‘Jalinan Inspirasi Kehidupan Borneo’, yang telah diadakan di Kota Kinabalu, Sabah (Mohd. Said, 2019). Ia bertujuan untuk memberi peluang terutamanya kepada usahawan kraf tekstil dari Sabah dan Sarawak untuk mempromosikan produk

mereka. Jadi, walaupun festival kraf tersebut diadakan di Sabah, penglibatan pihak Lamin Dana menunjukkan bahawa mereka telah memanfaatkan peluang yang ada ini untuk memperkenalkan dan seterusnya memasarkan produk baharu seperti kain Batik Linut kepada masyarakat luar.

Impak kepada budaya dan kehidupan

Hasil daripada industri pelancongan di Lamin Dana, budaya masyarakat Melanau telah diberikan pendedahan sehingga ke peringkat antarabangsa. Hal ini dapat dibuktikan melalui kedatangan pelancong-pelancong dari luar negara yang berkunjung ke Lamin Dana pada setiap tahun. Kebanyakannya adalah pelancong dari Eropah yang datang secara berkumpulan bagi merasai kehidupan masyarakat Melanau di Lamin Dana. Pelancong yang kerap datang ke Lamin Dana adalah pelancong yang datang dari Jerman, Belanda, Itali, China, dan Singapura. Kebiasaannya pelancong-pelancong asing ini akan mengambil pakej pelancongan yang telah disediakan oleh pihak Lamin Dana dan mereka kebiasaannya akan bermalam di tempat penginapan yang disediakan di Lamin Dana.

Selain itu, industri pelancongan di Lamin Dana juga telah dilihat mampu menggalakkan pengekalan warisan budaya masyarakat Melanau. Hasil daripada kajian lapangan yang dijalankan menunjukkan bahawa aktiviti pelancongan di Lamin Dana mampu mendorong penduduk setempat untuk mengekalkan budaya yang diwarisi mereka dari generasi terdahulu. Memandangkan Lamin Dana merupakan suatu tempat pelancongan yang memaparkan budaya tradisional masyarakat Melanau, maka ini telah mendorong sesetengah penduduk setempat untuk sentiasa mengamalkan dan seterusnya mengekalkan amalan budaya yang diwarisi daripada nenek moyang mereka. Seperti yang telah dinyatakan oleh salah seorang responden:

> *Kalau dilihat sekarang ini, memang Lamin Dana ini telah berjayalah dalam mengekalkan budaya nenek moyang kami dulu-dulu. Anak-anak yang tidak tahu sangat dengan budaya dulu-dulu ini boleh tahu sebab adanya Lamin Dana ini.* (Responden 7)

Impak kepada infrastruktur dan persekitaran

Industri pelancongan di Lamin Dana juga telah memberikan impak kepada pembangunan infrastruktur yang terdapat di Kampung Tellian Tengah di mana telah sering berlaku penambahbaikan untuk kemudahan pelancong. Misalnya, kerajaan telah menyumbangkan dana bagi penambahbaikan laluan masuk ke Lamin Dana. Di samping memberi kemudahan infrastruktur kepada pelancong yang datang ke Lamin Dana, penduduk setempat yang tinggal berdekatan dengan kawasan pelancongan tersebut juga telah mendapat kebaikan daripada penambahbaikan infrastruktur yang dilakukan ini (Gambar 4). Perkara ini telah disokong oleh salah seorang responden yang ditemubual:

> *Ada baiknya juga kalau pelancong guna jalan depan rumah kami ni untuk pergi ke Lamin Dana. Kalau berlaku kerosakan, ada yang akan baiki dan semakin lama orang atasan tengok jalan tersebut tidak sesuai untuk kegunaan pelancong yang nak menuju ke Lamin Dana, dia orang pun simen lah jalan yang di hadapan tu. Kami juga dapat kebaikan daripada situ.* (Responden 7)

Namun demikian, terdapat isu dari segi penyelenggaraan infrastruktur. Misalnya, terdapat jambatan kayu yang merupakan laluan pelancong ke Lamin Dana Jalan yang kini mengalami kerosakan dan kurang selamat untuk penggunaan harian penduduk tempatan (Gambar 5). Isu kerosakan jambatan ini dikaitkan dengan jumlah pelancong yang ramai yang datang ke Lamin Dana.

Gambar 4. Laluan masuk ke Lamin Dana yang telah mendapat penambahbaikan untuk kemudahan pelancong

Gambar 5. Keadaan jambatan menuju ke Lamin Dana

Terdapat juga isu pencemaran alam sekitar yang telah timbul daripada aktiviti pelancongan di Lamin Dana. Misalnya, terdapat masalah pembuangan sampah oleh pelawat yang tidak terkawal walaupun kawasan tersebut kebersihannya dijaga oleh pihak pengurusan pelancongan. Perkara ini disokong oleh salah seorang responden yang menyatakan:

> *Ada juga pelancong yang buang sampah suka hati di sini tapi kami maafkan sajalah sebab kami faham mungkin mereka tidak jumpa tong sampah untuk buang sampah. Ada jugalah yang buang dalam sungai tu.* (Responden 3)

Perkara ini turut disokong oleh pengurus Lamin Dana sendiri yang telah mengaitkan masalah pencemaran sampah kepada sikap dan mentaliti pengunjung tempatan:

> *Ada juga lah masalah buang sampah sedikit di sini tapi biasanya saya tengok yang banyak buang sampah ni memang orang-orang kita lah, pelancong tempatan biasanya. Kalau pelancong luar ni memang dia orang sangat menghormati tempat sini.* (Responden 2)

Dapatan kajian juga mendapati aktiviti pelancongan di Lamin Dana telah memberikan kesukaran kepada penduduk setempat untuk meletakkan kenderaan mereka. Hal ini kerana Lamin Dana tidak menyediakan tempat untuk meletakkan kenderaan kepada pelancong yang datang sehinggakan pelancong yang datang ini meletakkan kenderaan mereka sesuka hati di tempat kediaman penduduk setempat.

KESIMPULAN

Hasil awalan daripada kajian ini telah menunjukkan pelbagai impak yang telah dialami oleh penduduk Kampung Tellian Tengah, Mukah hasil daripada pembangunan pelancongan di Lamin Dana. Dapatan awal kajian menunjukkan bahawa impak utama industri pelancongan kepada masyarakat Kampung Tellian Tengah adalah impak yang positif di mana pelancongan telah memberikan peluang pekerjaan dan seterusnya sumber pendapatan kepada penduduk tempatan. Hal ini serupa dengan dapatan yang pernah dilaporkan oleh penulis-penulis lain yang pernah menjalankan kajian di kalangan masyarakat Kandalama di Sri Lanka (Nayomi & Ganapala, 2015), di kalangan komuniti Batek di Kuala Tahan, Pahang (Man, Zahari & Omar, 2009), dan di kalangan masyarakat di Pulau Langkawi (Samad *et al.*, 2013). Selain itu, pembuatan produk baharu dan pemasaran produk tempatan yang lebih meluas juga merupakan impak positif industri pelancongan di Lamin Dana. Tambahan lagi, budaya masyarakat Melanau juga semakin dikenali di peringkat antarabangsa, manakala di peringkat tempatan, telah terjadinya pengekalan warisan budaya. Namun yang demikian, aktiviti pelancongan juga mampu untuk memberi impak yang negatif. Misalnya, Zaidan (2016) mendapati bahawa pelancongan di Dubai telah menyebabkan peningkatan kos barangan dan perkhidmatan, yang seterusnya telah membebankan penduduk tempatan, serta telah meningkatkan kadar jenayah. Di Kampung Tellian Tengah,

antara impak negatif industri pelancongan adalah dari segi isu penyelenggaraan infrastruktur dan isu pencemaran alam sekitar.

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Social Change and Identity – Education and the Socio-Political Awareness of Sarawak Malays Before 1963

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ABSTRACT

Education emancipates a society, and this is also true in Sarawak for where it has an important role in maintaining the core values of Sarawak Malay identity politics. Education, and how it is related to the political consciousness of the Sarawak Malay, shall be the main subject of this research. The purpose of this study is to analyse the role and importance of education in maintaining the core values in Sarawak Malays identity politics. This study was conducted through library research and other secondary sources as it tries to explore the elements of education and the social and political change of the Sarawak Malays. Education not only provided the access to social mobility and socio-political awareness of the Sarawak Malays, but it also enhanced the politics of identity of Sarawak Malays through the inculcation of values based on Islam and the local context of Malayness (*Kemelayuaan*).

Keywords: Education, Malay, political awareness, Sarawak, social change

INTRODUCTION

In the past two decades, Francis Fukuyama gloriously declared the end of history with the victory of liberal democracy. However, the victories of liberal democracy order at stake with the rise of identity politics. Identity politics can be described as the people adopting political positions that are based on their ethnicity, race, sexuality or religion (Heath & Richards, 2018). This view differs from the notions of 'New Politics', which focuses on justices and equality in terms of socioeconomics conditions, participatory politics and transition from consociation to deliberative democracy.

However, development in politics has caused the crisis on the meaning of identity, when the idea of identity that was built around self-esteem, based on the historical experiences and social contexts, were undervalued by the liberal democratic ideas, thus reduced them to social identification that is based on economic status and material (The Economist, 2018). The feeling of a sense of belonging according to the nation-state's boundary has pushed their resentment and fought for recognition of their undervalued identity.

Politics of identity were in fact a very recent subject of study as it comes into view during the period of 1980s and 1990s in the discourse of cultural politics. Despite being not widely discussed, politics of identity as a phenomenon was prevalent during the post-colonial period, when many of the colonies of Great Britain seek independence after World War 2 (WW2). This was also true in post-WW2 Sarawak.

In the aftermath of the war, the last Rajah of Sarawak, Charles Vyner Brooke decided to cede to the British Empire as a colony of Britain in 1946. The cession of Sarawak to the British Empire was done for several reasons. Firstly, the internal dispute between the Brooke's family on the ascension to the throne (Said, 1975) and secondly, the estranged relationship between Britain and Sarawak. Sarawak was not formally a colony of Britain as it was

governed by the Brooke family (Ho, 2001). The third factor was the declining socioeconomic of Sarawak that worsened by WW2 (Yaacob, 2014).

The nationalist response was to be expected as the decision to cede Sarawak to Britain conflicted with the 1941 constitution that promised self-governance by the natives. Many anti-cession movements were initiated to show rejection of the cession move by the Brooke's government. *Persatuan Kebangsaan Melayu Sarawak* (PKMS) was one of the main anti-cession movements in Kuching. PKMS mobilised many of its members to protest the cession of Sarawak.

The various issues that are plaguing the Sarawak Malay community had ignited the torch of nationalism among the Sarawak Malays. Experience of colonization by the Brooke Dynasty and the passive attitude of the Malay elites have caused resentment among the commoners. These issues were later brought up by the later generation of educated Malays to voice and fight for their rights and interest in the state.

Identity politics and ethnicity

Identity politics can be defined as a tendency for a group of people of a religious belief, ethnicity or social background to form exclusive political alliances, moving away from the traditional broad-based party politics. Its political activity and theory are based on the injustice that is faced by members of certain social groups. They want to claim the distinctiveness of their groups and challenge the dominant characterization that oppressed them (Heyes, 2020).

Fukuyama (2019) relates identity with dignity. The dignity that is trampled on only invites resentment of related groups. The humiliation of related groups motivates them to demand recognition or reinstitute their dignities carries more emotional values than the pursuit of economy.

Identity such as ethnicity can be one of the potent forces for political mobilization as the people are asserting their belongingness to the states to claim the material resources and political positions. In the discourses of identity politics, it is always asserted that identity politics was used by the weak and minority ethnics of a certain polity or community in asserting their rights. However, the role of identity politics in the preservation of political power by the ethnic of the majority is always left out of examination.

Three perspectives can be taken in analysing the views and role of ethnicity in identity politics. First, the way ethnicity is conceptualized by scholars and commoners. The ethnic characterisation can be referred to any, or a combination of the geographic region the ethnic origins, their language and dialect, culture, economic or social positions. Secondly, the special place that certain ethnicity has in the formation of the modern nation-states. Etienne Balibar (1991), as cited in Leach, Brown, & Worden, 2008) argued that modern nations were a result of different people coming together to be part of a fictional identity that identifies them as a group. Third, the subjectivity of the reality of the ethnic's identification and the benefits (Leach *et al*., 2008). The idea of identity continues to resonate with the people as it provides the sense of self-esteem, social status, supplies existential security and knowledge and granting social protection.

The core identity of the Sarawak Malays

Malayness is considered a core identity for the Sarawak Malays. Hence, what determines or constitutes Malayness (*Kemelayuan*)? On what basis did the Sarawak Malays assert their identity and their history in Sarawak? There were several theories that arise in discussing the origins, identity, and the ideas of Malayness of Sarawak Malays.

James Brooke defines the Sarawak Malays as "*all coastal, sea-faring Moslems in the archipelago*" (Babcock, 1974 as cited in Amir, 2015). Prominent Sarawak historian Datu Dr. Sanib Said (2010) suggests two

opinions on the origins of the Sarawak Malays: either they were originated from the other part of the Malay Archipelago or they are a derivation from the natives of Sarawak itself.

The first opinion suggests the origins of the Sarawak Malays come from the descendant of the Sumatera princes and nobles that come to Sarawak. Local literature such as *Hikayat Datu Merpati* and *Syair Tarsilah Abang Gudam* suggest the Malays of Kuching were descendants of Datu Merpati while the Malays of Saribas were descendants of Abang Gudam.

The second opinion suggests that the Malays of Sarawak were originated from the Islamised natives of Sarawak itself. This phenomenon of '*masuk Melayu*' or entering Malayness was common among the Iban, Bidayuh, Melanau and other minority groups since the 15th century. Not only they professed Islam, but their sociocultural practices also changed as a result of the accommodation, acculturation, assimilation, and amalgamation processes.

Due to the complex origins of the Sarawak Malays, one might suggest that it was Islam that unified the meaning to become Malay in Sarawak. Islamization of the local community during the reign of the Brunei Sultanate at the northern part has shown many of the Muslim '*rakyat'* (citizens) were in fact converts from local Dayak groups (Brown, 1973 & Leake, 1990, as cited in Milner, 2011). Leigh (1974) also mentioned that the Melanaus and Kayans were also grouped into Malays because of Islam. Three-quarters of the Melanaus became Muslim by 1960 and described themselves as 'Malay'. This shows how important is Islam in defining the Malays. Tom Harrisson (1970) also commented that the non-Malays would be surprised to learn that the present Malay population was derived from the local Sarawak natives.

Sarawak Malays in politics – from Brooke's rule to the British colony

The Sarawak Malays maintain their political dominance in a state where they were not the majority. Despite coming second after the Iban in terms of population, the Sarawak Malays have maintained their political dominance over Sarawak for decades before the cession of Sarawak to the British. This dominance was challenged several times and threatened by the split between the Sarawak Malays - especially during the Cession of Sarawak to Britain in 1946, and during the inclusion of Sarawak into the Federation of Malaysia in 1963.

Even though historically Sarawak was a state or '*kerajaan'* in the sense of Malay concept of polity under the Brunei Sultanate, the Sarawak Malays lost their political rights and control over their territory due to the adoption of European-style administration during the rule of Brooke's Dynasty (Said, 2010). Their influence further eroded as administration of the states was gradually replaced by the European administrator, and the traditional Malay leaders among the *Perabangan* were reduced to mere figurehead and functions only for ceremonial purposes. They eventually lost the decision-making power in the newly established Council Negeri after the secession of Sarawak to Britain in 1946.

During the post-cession period, Sarawak Malays experienced economic, social, and political decline. The Malay leaders among the *Perabangan* aristocrats were ineffective and failed to respond to the issues which have become the prelude to the rise of a new Malays intelligentsia. This is evident during the anti-cession movement when the leaders were among the Malay intelligentsia while the pro-cession was among the aristocrat Malays. During the first Malay split in 1946 due to the cession controversy, we see the transition of political leadership from the traditionally-inherited legitimacy to charismatic-educated legitimacy. The Malays no longer see the traditional leaders as the protector of their rights and see the educated intelligentsia as their new protector. This has brought upon multiple political organisations from both sides such as *Persatuan Melayu* Sarawak (later, *Persatuan Kebangsaan Melayu* Sarawak), *Persatuan Melayu Sibu* (PMS) and *Barisan Pemuda* Sarawak that sided with the Anti-Cession movement, while Young Malay Association (YMA) on the Pro-Cession side. The Cession

Controversy also has brought further resistance from the Malays such as the *Rukun 13* group that planned the assassination of Duncan George Stewart, the second governor of colonial Sarawak.

The transfer of power from the Brooke Dynasty to the colonial government was an eclipse of the Sarawak Malay political power and influence. The Malay community was already divided due to the differing opinion on the cession of Sarawak to Britain. At the heat of the Anti-Cession movement, in April 1947, 338 public servants, with 76 of them teachers, resigned from the administration (Ooi, 2001). This response was due to the Circular No. 9 issued by the colonial government that demanded absolute loyalty from the civil servant. The circular also warned any public servant not to get involved in the Anti-Cession movement otherwise any public servant will face immediate dismissal (Sanib, 2010).

The modernisation of administration during the rule of the Colonial Office was responsible for the erosion of the political power of Sarawak Malay, especially the Malay Aristocrats. In the new administration of the colonial government, the British imported European expatriates to accommodate the needs for qualified officers. The position in the Senior Service was mostly consisted of the expatriates, while the Native Officers were only assigned to help with the duty of the District Officers (Yaacob, 2014). At the municipal/local council level, the Sarawak Malay political power further trimmed down as not many of the Malays were elected to the local council. As a matter of fact, during the first local government election for Kuching Municipal Council, only six of the Malays candidates won while there are 21 Chinese candidates won.

Yaacob (2014) argued that even though the British proposed to have more ethnic composition in the government, the three-tier system introduced by the colonial office only made the results more racially divided. The people of different ethnicities tend to vote for their respective ethnic groups. This gave the edges for the ethnic group with the biggest populace such as the Chinese and Iban compared to the Malays.

Taking lessons from the past, the Malay leaders learned to compromise to maintain the unity among the Malay-Muslim community to avoid splits that will further compromise the Malays rights as one the indigenous people of Sarawak and the interest of the Muslim in the state.

Political and social change through education

Philosophically speaking, Albert Einstein (as cited in Ujang, 2011) defined education as "…*what remains after one has forgotten what one learned at school"*. Meanwhile, a local Malaysian scholar, Syed Muhammad Naquib al-Attas (1980) viewed education as "*…recognition and acknowledgement of the proper places of things in the existence*".

Education does not only function to transmit knowledge and values. It also can be a major factor in political, social, and economic change. Education is perceived as the instrumental elements in bringing social change into society. Since the time of antiquity, Plato and Aristotle affirmed and recognised the place that education has in political development: "*What you want in the State, you must put into the School*".

Dewey (1922), recognising the role of education as an important institution in improving the social condition mentioned that, "as society became more enlightened it realised that it was responsible not to transmit and conserve the whole of its existing achievement but to strive for a better future society".

Education is a necessary element in bringing change within society. Education is also important as it reminds the people of their origin, history and thought that their civilisation is built upon, which characterises identity politics. Furthermore, being knowledgeable is important as it helps the people to discern truth from falsehood as it provides the people with the tools to make a rational decision and to act towards change.

METHODOLOGY AND SOURCE

This research tried to explore the importance of education that helps in establishing the political identity of the Sarawak Malays. Therefore, this study was exploratory in nature as it seeks to investigate and further clarify the concepts that are involved in the phenomena being studied.

This research covered the Sarawak Malay community between the period of 1946 to 1963. The approach was done through qualitative method and data collection was done through library research and other secondary sources to take account of the records and opinion of the past.

MAIN THEMES AND DISCUSSION

The data collected and analysed from primary and secondary sources point to a number of themes that affect the important role of education in Malay Identity politics during the period. The themes are Brooke's policies, formal education and political awareness, and are discussed further in this section.

The Brooke's views on education of the Malays

Education can be a means to achieve status in society. This was true in the sense where to become educated means to have more options in choosing a career. During the Brooke Dynasty, joining the '*perentah'* or the administration meant social mobility. This has brought demand for more government schools to be open for the locals.

The Brooke's saw the Malay aristocrats as a group of people that have the nature to administer the people of Sarawak (Ooi, 2001). For that reason, James Brooke maintained and adopted the traditional ruling class to help him in his administration. However, the Rajahs did not favour the Malays to be more educated. Ooi (2001) also mentioned that the Brooke Rajahs envisioned the Malays to maintain their 'traditional' way of life and want them to be educated with practical education such as agriculture and health education. James Brooke argued that the western education will 'corrupt' the mind of the natives while Charles and Charles Vyner Brooke both thought the Malays had to be encouraged to become farmers after finishing their primary education.

However, one might argue that what the Brookes feared the most was the political implication resulting from the emancipation of natives through education. Charles Brooke (1866) correlated education as the main factor for a revolution to arise. If the natives were educated, they can be fearsome opponents and bring disaster against the colonial rule (Ooi, 2001).

Early Sarawak Malays response towards formal education

To secure the support from the Malay traditional leaders, James Brooke promised that he will not interfere with Islamic affairs and Malay customs. However, despite being the biggest benefactor of the Brooke's policies, the benefits were not evenly distributed among the Sarawak Malay community. The responses were divided among the elites, the middle class, and the commoners.

According to Leach (as cited in Osman, 1990), the Malay groups that benefited the most during Brooke Dynasty rule was the *Perabangan* elites, the *Tuanku* and the middle class that come from the Malay and English educated, which also known as *'orang kerani'* (the clerk men). For them, being educated implied being able to get a job with the Brooke's administration. Ooi (2001) mentioned that being appointed into the position of Native Officer or Head of Village during the Brooke's administration signified power and prestige. Being appointed into that position also meant being closer to the White Rajah. Those that were appointed into that position have the basic education in the Malay language and so that they able to exercise their official task.

The middle class correlated education with social mobility. Being educated in an English medium school and getting the English education certification enabled them to apply for positions in the Brooke's administration. In contrast to the *Perabangan* and the *Tuanku* elites, just having 'Abang' and 'Tuanku' in their names was enough to secure the opportunity to work with the government due to their privilege as part of the aristocratic class within the Malay society. However, the middle class and the commoners have to struggle to secure the positions (Ooi, 2001).

As for the Malays of the lower class, they considered education as unimportant. The parents among the farmers and the fishermen considered the time spent at school by their children were a loss of free labour for them (Ooi, 2001). They questioned the need for being educated when in the end, the graduates who were unable to find work went back to the village and become farmers like their parents (Harrisson, 1970).

Education and Social Mobility

The lenient policies since the time of James Brooke had given them the illusion of peace and made them perceived that Sarawak was not a colony or was being oppressed by the Brooke Dynasty. According to Osman (1990), the Malays generally were given privileges and have special places within the Brooke administration, even though it was monopolised by the *Perabangan* and *Tuanku* elites.

Education, besides functioning to transmit knowledge and values, can be used to initiate social change. In the context of Sarawak Malays, it can be seen from two perspectives. First, is to move upward in the economic and social ladder; and second, is to initiate change in the society.

Education can improve the economic status of the individual and initiate social change within the society. During the Brooke's rule, those serving as white-collar workers promised status and a better life. The only way for a commoner to achieve this is through education. The middle-class Malay considered education as important because of its usefulness in social mobility, compared to the elites such as the *Perabangan*, as they have already secured positions in the administration based on their birth right (Ooi, 2001). However, for the middle class, they can only achieve it through merits, which come from education. It is through education that, the students from lower-income group can climb up the social ladder, increase their social mobility and be a part of a higher economic class.

The development of Malay education since the Brooke Dynasty until before the Japanese Occupation has made the Malays involved more in education. The opening of Malay schools and higher education institutions implied that education was no longer exclusive among the elites as more Malay commoners became capable and had opportunity to study in the government-sponsored schools and institutes. Somehow, the Malays have regained their consciousness that they have been deprived of political and economic position in Sarawak especially during the 1941-1945 Japanese Occupation. This consciousness is most apparent among the non-*Perabangan* Malays.

Education as an agent of social change and political awareness

Osman (1990) noted how education was changing the attitude and mentality of the Malay in the later decades, especially during the Cession of Sarawak in 1946 where the education received by early generation of Sarawak Malays has contributed to the rise of the Malay intelligentsia. This rise came from the educated and professional Malays such as teachers and government officers who were mostly graduates from the Malay and English medium school.

These educated Sarawak Malays also initiated publication to spread awareness among the peoples of Sarawak such as the publication of Fajar Sarawak, the first Malay newspaper in Sarawak with the motto:

> "*Fajar telah menyinsing, bangunlah wahai anak bangsaku*". [The dawn has come, rise my brethren.]
>
> (Osman, 1990)

Haji Mohd Daud Abd Ghani, Mohd Awi Awang, Mohd Johari Anang, and H. K. Abd Rahman were the educated Malays and non-Perabangan who wrote based on nationalist themes in local newspapers. The editor in chief was none other than Rakawi Mohd Yusof, who was well known for his books, *Hikayat Sarawak* and *Melati Sarawak*, published in the early 1930s. In the first issue of *Fajar Sarawak* on 1st February 1930, Rakawi (1930) emphasized the importance of education among the Sarawak Malays and he called the Sarawak Malays to support each other, either financially or through education. He also called all educated Malays to educate the people in order to bring progress (*kemajuan*) to society.

Other newspaper publications, such as *Utusan Sarawak*, also propagated the importance of education for social change. *Utusan Sarawak* was founded by Ikhwan Zaini, Johari Anand, and their comrades from *Angkatan Semangat Anak Negeri Sarawak* (ASAS). Its slogan, "*Oleh Ra'yat Untuk Ra'yat*" (By people, for people), sought to establish itself as a medium for exchanging ideas and critics.

Achie (2001) stated that *Utusan Sarawak* emphasized two aspects on the issues of education: first, the importance of education and knowledge, and second, the problems and the future of the Malay education. *Utusan Sarawak* considered education and knowledge important as it is the pillar for progress.

Finally, on initiating change in the society, the early Sarawak Malay intelligentsia, like Rakawi Muhammad Yusuf and Ikhwan Zaini, had always emphasised and propagated on the importance of education among the populace through their newspaper. They criticised the impoverished conditions of the Sarawak Malays of their time hence the call for Malay elites to support the awakening by giving financial aid for the poor Malays to pursue their studies. Here we observed that the educated Malays become an agent for social change by spreading the importance of education among the local populace and called for an awakening to their situation for the betterment of society.

Monopoly of education to maintain the status quo

During the Brooke's rule, the policies on the education of the Malay were restricted. First, not many of the Malays were encouraged to pursue their studies at a higher level as the Brooke's consider this as unnecessary for them compared to their practical knowledge of farming. The policies on the education of the Malays were primarily focused on how to be better farmers than their parents, but not to focus on social mobility. However, according to Osman (1990), Sarawakians were acting passively toward the colonial master. They perceived the Brooke Dynasty as benevolent and treat them in a special manner.

The policies such as giving the Malays autonomy in cultural and religious affairs have the effect of increasing local trust towards the Brooke Dynasty. They did not think of the Brooke as an outsider who is to colonise them. Paulo Freire (1972), through his book, Pedagogy of the Oppressed once mentioned this phenomenon. The oppressor needs to show and express their generosity toward the oppressed at the same time perpetuate injustice itself in the social order.

Contextualising this in Sarawak during the Brooke's rule, the ruling class perpetuated the injustice by maintaining the status quo of the Sarawak Malays at that time: by giving Malay elites favour in return for their loyalty to the Brooke government and to avoid education that would make the Malay peasants politically conscious. As critical consciousness awakens, the oppressed will express the social discontents as discontents are the reality of the oppressive situation (Freire, 1972). If the Malay peasants are ever awake, that would spell the doom of the Brooke Dynasty and may give way to a reality of the second Malay Plot.

Islam as part of Sarawak Malay identity

Abdul Rahman Rukaini (1979) stated that the spread of Islam to Sarawak had changed the worldview or weltanschauung of the Malays and natives. The Islam that is deeply embedded in the Malay worldview is that

becoming a Muslim is often associated with *'masuk Melayu'* (entering Malayness) (Yaacob, 2014). Islam has influenced their language and culture, that which also attracted other natives to profess Islam.

Since the rule of the Datus and nobles under Brunei's Sultanate, the traditional informal religious education was already flourishing. The informal-traditional Islamic education prepared the Malay individual with the necessary knowledge, especially on reading the holy book (al-Quran) and reading the jawi scripts, which also meant the ability to read and write. Ooi (2001) mentioned that the Malay elites' families highly regard religious education, and failure to inculcate religious studies among their children is a humiliation for them.

The Malay-Muslim community was agitated with the establishment of missionary schools, which was supported by James Brooke (Yaacob, 2014). However, Ooi (2001) mentioned that James and Charles Brooke did guarantee that the Christian missionary will not interfere or propagate Christianity among the Malays. Acknowledging the importance of formal education for the Malays, many Malay schools were established. Early Malays schools such as *Sekolah Abang Kasim* (later known as *Sekolah Kampung Jawa*) and *Sekolah Kampung Gersik* have focused on the teaching of Quran reading, read and write Jawi script, arithmetic, geography, and history (Said, 2010). Occasionally, the English language was also taught by the visiting Anglican missionary.

Besides schools, credible ulama (Islamic scholars) were considered important to deepen the knowledge and appreciation of Islam (Drahim & Mat Zain, 2017) as far as the Malays are concerned. However, there are very few writings of Islamic scholars from Sarawak beside Shaykh Uthman al-Sarawaqi. He was considered one of the great scholars of Islam and his students later became the pioneer in the awakening of Sarawak nationalism (Saleh, 2018). One of his students was Datu Patinggi Abang Haji Abdillah. He was mentioned as one of the local Islamic scholars that cooperated with Datu Hakim Imam Haji Morshidi to establish the *Sekolah Kajang Wanita* in order to provide access to education for women (Abd Rahman, 1992).

The colonial government policies on education and the criticism

Ooi (2001) mentioned the colonial government policies in education were based on two objectives i.e. to close the gap of education between the natives and the Chinese, and to establish a national education system. All of these are needed to foster a common Sarawak identity. The mass resignation of the public servants in April 1947 had crippled the education department as 87 of the 152 Malay teachers and all the 56 training teachers resigned. This has caused 22 of the 62 Malay schools and the Batu Lintang Teachers Training College to close. Some of them tried to mitigate the effect with the *Sekolah Ra'yat* (People's School) initiatives however, the efforts were insufficient to fill the vacancies left by the closure of government schools.

One of the earliest policies initiated by the colonial government was the introduction of the local council school system. This system focuses on the ability to read, write, and count at the primary stage (Yaacob, 2014). The students were taught in their respective mother tongue. In the post-primary stage, they were chosen to continue their study in either the secondary, vocational, or technical school. The government also used the self-help strategy to encourage the local community to contribute positively to education. This strategy was introduced to relieve the financial constraints of the local council to maintain and operate the schools (Ooi, 2001). More extensive policies on education were the opening of the Training Centre and School, Batu Lintang in 1948 and the introduction of Grant Code (Regulations) in 1956.

In envisioning the national education system for Sarawak, the colonial government introduced English as the medium of instruction, and the government saw that this was accepted by most of the citizens. The English language was perceived as the language of education and economy and to potentially give its learners better opportunity to continue their study and to get better jobs (Ooi, 2001). The conversion to English as the medium of instruction also marked the gradual closure of the communal education on the secondary level, especially the

Chinese vernacular schools. Ooi (2001) also noted that the government introduced a new syllabus, Sarawak-based textbooks and examination to accommodate the changes in the medium of instruction and standardization of syllabus in schools.

In spite of the improvement done by the colonial government, not all new policies were accepted by the Sarawak Malays and the benefits were unevenly distributed. The Malays through their intelligentsia and leaders voiced the need for more schools for the Malays and introduced the religious subject in the syllabus (Yaacob, 2014). The Malays of Miri as such once demanded the Miri City Board for a Malay secondary school, while Haji Suut Tahir from Kuching Municipal Council expressed the need for Islamic lesson to be made compulsory for Muslim students. The Malays saw the advancement of Christian education as worrying and the Malays in general still distrust and wary of the missionary school.

Despite the government initiatives to establish a national education system for Sarawak, the education system in Sarawak is still divided between ethnic groups. This was pointed out by Haji Suut Tahir in the Council Negri (Utusan Sarawak, 1958 as cited in Yaacob, 2014). On 23 December 1959, Utusan Sarawak also published an article that criticised the uneven distribution of grants under Grant Code 1956 that benefits the non-native the most. Yaacob (2014), citing from *Utusan Sarawak*, mentioned, the expenditure for a Chinese was $19.30, $5.80 for a Malay, and $1.18 for a Dayak. The Education Director, M. G. Dickson tried to brush off criticism by arguing that the biggest demand for the grant came from the Chinese School as they knew when to take the chance. However, Yaacob (2014) argued that, contrary to the Chinese, the Malays did not have any private school, while *the Sekolah Ra'ya*t were small in number and most of the Malay Schools were under the administration of the local council, thus at a disadvantage, compared to the well-established Chinese school.

The Sarawak Malay politics of identity and education

As earlier discussed, education has a fair share in bringing political awareness among the Sarawak Malay populace. Education plays its role, not only as part of the instrument in the transmission of knowledge and values, but it also provides the means for uplifting the socioeconomic conditions of the Sarawak Malay. The disadvantages experienced by the Sarawak Malays also gave awareness to uplift their position and compete with other ethnic groups even though their responses toward education and its significance toward their life may differ from one another.

Being one of the many ethnic groups in Sarawak, to maintain the identity of the Malay is to maintain their religion that is Islam. The education centres and institutions claimed crucial in inculcating the knowledge and values of Islam were considered an important part in maintaining Malay identity. Despite being under the rule of the Brookes, this researcher discovered that Islamic education among the Sarawak Malays was well maintained throughout history and being a part of the factors that initiated the social change of Sarawak Malays.

The researcher opined that it was a blessing in disguise that Sarawak was fated to be part of the Malaysian federation. The Sarawak Malay can benefit from the education system where there is an emphasis on Islamic studies, thus enabling them to fill in the gap that was left by the informal Islamic education of Sarawak by accommodating the changing demography of the Sarawak Malay today. The education system and syllabus enable them to be educated and have knowledge of Islam, compared to their parents that neither have the luxury nor access to education.

The political awareness among the Sarawak Malay may never arise if not for the early generation of Malay intelligentsia that fought through the pen to awake their brethren. The education that they obtained enable them to think critically and express their ideas in order to see that the Malays of Sarawak have liberated their minds from the oppressed and siege mentality that resulted from the long colonisation they experienced. The politics of identity of the Sarawak Malay, nevertheless, is driven by education where it enables critical thinking and the rise of

consciousness on thinking and reflecting about the fate of a people's nation. As Freire (1972) said, *"...reflection – true reflection – lead to action*".

CONCLUSION

This study has explored the narratives on education in the past through qualitative method by reviewing available literature and primary and secondary sources related to this study. Education has greatly contributed to the development of the Sarawak Malays' social and political awareness. The struggles of the Malay aristocrats using their political positions and influence to bring education to the Malay populace and the struggles of the new generation of educated Malays by raising awareness through the newspaper have been timeless struggles. Although education was monopolised by the aristocratic families and so goes the restriction of the Brooke policies, in the earlier stage of colonisation, the Malays and their leaders did in fact manage to expand access to education to the wider Malay populace. This allowed the Malays to rise upward the social ladder where new opportunities were open for them. This also allowed the rise of nationalist and educated Malays at the end of Brooke's rule in Sarawak.

The researcher found several interesting findings to be explored more in the future. On the role of education as a medium to inculcate the Malay and Islam identity, it was thanks to the education, either the informal education in the past or the formal Islamic study of today that it manages, at the very least path, the way for the institutionalisation of Islamic instruction alongside the broader secular education to the Sarawak Malay.

As an agent of social change, education proved to be a potent element to bring about awareness and political consciousness of the masses, as what we observed here in Sarawak. However, in the long run, the effect may vary depending on the extent to which the current Sarawak Malays perceive education to be. A more comprehensive study on the development of Sarawak education post-Malaysia 1963 may bring new perspectives on the social change of the Sarawak Malays and their politics of identity.

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Mahathir's Leadership Post-general Election 14: Perspectives of the Malay Community in West Malaysia

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ABSTRACT

New history is created in Malaysia. After over six decades of Federal rule, the Barisan Nasional (BN) government has been replaced by a coalition of opposition parties, the Pakatan Harapan (PH) in the most recent general election. PH also managed to form several state governments traditionally held by BN in Peninsular Malaysia. This study aims to seek the perception of the Malays in West Malaysia in accepting the return of Tun Dr. Mahathir Mohamad into power. It focuses on the so-called political comeback of Tun Dr. Mahathir Mohamad – the first leader to be appointed Prime Minister twice considering this rarely happens in Malaysia. This study was conducted in West Malaysia involving eighty-eight respondents using the 5-point Likert-scale survey questionnaire. Respondents were given an option to answer the questionnaire in Bahasa Malaysia or English. The general result showed that perception towards political issues in Malaysia, especially with regard to Tun Dr. Mahathir Mohamad's comeback drew mixed reactions. On the same note, it showed that people could have lost their hopes and direction of Malaysian politics.

Keywords: Barisan Nasional, Dr. Mahathir, General Election 2018, Pakatan Harapan, political comeback.

INTRODUCTION

The 2018 general election has changed the Malaysian political landscape (Mohamed Noor, 2018). Scholars have offered various speculations in explaining the impact of the 14th General Election on Malaysian politics. Many consider this to be a new political phenomenon in Malaysia. It is deemed unique when old political features such as hegemonic politics, racial, developmental politics, and so forth practised by a coalition of major ethnic parties in the United Malays National Organisation-led Barisan National (BN) party have begun to decline and have been abandoned (Moniruzzaman & Farzana, 2018). These new political features are slowly eroding the old political practices, which were nurtured by the ruling party in maintaining power. BN's dominance in Malaysian politics has always been closely linked to the rules of racial politics, unity, break and order, control, and development (Mohamed, 2008).

Within this notion also, many expected the regime of BN to win comfortably, especially when the then opposition coalition was in trouble (Washida, 2018). The dissolution of the opposition party led to a three-pronged rivalry that would typically benefit the ruling party. At the same time, some of the critical and controversial issues of the Najib Razak administration began to settle, particularly the 1Malaysia Development Berhad (1MDB) embezzlement, the RM2.6 billion deposit in Najib's account, and the introduction of a new tax system of Goods and Services Tax (GST) (Mohamed Noor & Jamaie, 2018).

Tun Dr. Mahathir Mohamad is the longest-serving prime minister in Malaysia's political history. His prior terms were from 1981 to 2003 and he was also a seasoned world administrative leader. Before establishing the new party of BERSATU (Malaysian United Indigenous Party), instituted under the formation of an official coalition with the Pakatan Harapan (PH), he was the BN leader throughout his service, the top administrator, primarily during the millennial years (Besar, 2019).

The main objective of this study is to determine the level of acceptance of Tun Dr. Mahathir Mohamad's return into Malaysia's political scene amongst the Malays. As the re-emergence of power is seldom to happen in world politics, especially Malaysia, hence this study is significant as part of a 'New Malaysia' narrative post-BN federal ruling after so many years.

METHODOLOGY

This research was conducted to measure the acceptance of Tun Dr. Mahathir Mohamad's comeback into the political arena. This study mainly focused on the Malays that make up 63.1% of the total population in the country. Using descriptive method, the research problem was structured around understanding the perception of people of an overwhelmingly popular leader. Descriptive characteristics made up most of the feedback. The main idea behind using this type of research was to define better the opinions, attitudes, and behaviours held by a group of people on the issue. This enabled the researcher to gauge the importance of decisions from the study population and their opinions, attitudes, and behaviours based on a particular period in the political history of Malaysia.

From the survey, 50 male respondents (56.8%) and 38 female respondents (43.2%) were involved, whose ages ranged from 21 to 60 years old. In accordance with the initial methodology plan, the study was expected to involve 200 respondents across West Malaysia, but the COVID-19 pandemic and the subsequent implementation of Movement Control Order (MCO) by the government that lasted for months derailed the conduct of this research. Instead of going around meeting potential respondents, the researcher transitioned to using online Google form survey. The age range is to ensure a substantial amount of understanding of the respondents in regard to the issues raised in this survey, which mainly revolved around politics and history. From the total number of respondents, 31.8% worked in the private sector, while 28.4% were students in higher institution of learning. This study also managed to obtain a total view on the political issues circulating around the administration of PH as the former government of Malaysia, in which 53.4% respondents involved reside in urban areas while the rest from rural and semi-urban areas. As different political issues and values stand varyingly in accordance to the background of respondents, this study could have variant perspectives on Malaysia's politics including the administration, economic concerns, social welfare, nation development, racial polarization and many more.

The survey was structured around issues and values on the leadership of Tun Dr. Mahathir Mohamad in PH. It also contained respondents' background, approval on Tun Dr. Mahathir Mohamad's leadership, perception on direction under PH's administration, perception on current issues and concerns, perception on social impacts that mainly revolved around Tun Dr. Mahathir Mohamad's leadership in BN, and general views of respondents towards both PH and BN governments. As the questions focused on respondents' perception, this was to explore their acceptance of the reemergence of Tun Dr. Mahathir Mohamad into power by differentiating his leadership during his term in BN and in PH. A simple encoding using the SPPS software was utilized.

ANALYSIS

From the study findings, most respondents showed a mixed response regarding their approval of Tun Dr. Mahathir Mohamad's leadership in the PH government. Some of the features of his leadership were perceived positively. However, there were still different factors that received opposing views including on their perceptions on the management of the PH government, which was viewed negatively. This can be concluded that most respondents were still in their process of assessing and approving the political conduct of both Tun Dr. Mahathir Mohamad and his administration since they only had a short time to execute all their promises and job scopes.

Differences on social well-being of Malays during the Mahathir years in BN and PH

In discussing the perspective of the respondents regarding their acceptance of Tun Dr. Mahathir Mohamad's political comeback, the researcher needed to explore the differences on the social well-being of the Malays during the reigns of both leadership (BN and PH). In general, there is a significant difference between these two periods, considering that his governing period as the fourth Prime Minister (PM) was longer than the recent one, hence many actions and policies could be implemented and executed. Undeniably, there were many changes and reforms he had done to Malaysia as the fourth PM. One of the prominent contributions was the initiation of mega

development projects. With his idea, Malaysia's stateliest high-rise structure, the Kuala Lumpur City Centre (KLCC), was built. With the inspiration of Islamic motives, not only the KLCC had been the tallest building in the world once, but this structure had also set Malaysia notably in the map of the world. Not only that, other initiatives such as the privatization of Malaysia's public services had also transformed the economic scene and managed to deliver a good projection towards Malaysia's economy. Lembaga Letrik Negara was privatized during his reign in the BN government, and now called Tenaga Nasional and established as the largest electric utility company in the country.

The development initiatives of Tun Dr. Mahathir Mohamad and his administration during the BN regime received mixed reactions from the respondents considering that majority of the respondents once witnessed Tun Dr. Mahathir Mohamad's earlier leadership. Even then, not much can be drawn from the other group of respondents namely those who have not observed his premiership the first time. Interestingly, the respondents believed that Tun Dr. Mahathir Mohamad's policies during his first reign as PM seemed to provide benefits to them although some chose to remain undecided (neutral) on this question.

With this specific research question of "What is the difference in terms of the social well-being of the Malays during the period of Tun Dr. Mahathir Mohamad in BN and PH?", the respondents have been sought to respond with two categories of related questions that revolved around the policies implemented by Tun Dr. Mahathir Mohamad and other general initiatives brought by him. For those who viewed the positive contributions, Tun Dr Mahathir Mohamad's implementation of the Look-East Policy received a high point saying that it was a good policy that his administration has implemented.

Though some other policies and acts have received nationwide criticisms such as the implementation of the Sedition Act 1948, still, the respondents viewed this act positively. They even disagreed with the abolishment of this act. This could be depicted that despite having to be deemed negative, the Malays of West Malaysia seemed to favour these actions as these will not only protect their rights as Malaysians but also create a balanced and harmonious community within the various ethnicities of Malaysia.

Apart from the policies implemented during the BN administration, the development initiatives brought by Tun Dr. Mahathir Mohamad's leadership also was well received by these individuals. The initiatives and actions have been long established hence the impacts and benefits were visible. These development initiatives served not only great impact to Malaysia but also for other countries to benefit from it, such as the initiative of establishing International Islamic University Malaysia, as an international institution of Islamic education in the region. This institution has produced thousands of graduates not only from Malaysia but across the world. These development initiatives have not only improved the social well-being of Malaysians but also brought forward Malaysia's economy, and this could be seen during the 1997 Asian financial crisis in which Tun Dr. Mahathir Mohamad and his government managed to stabilize the nation against a potential major downfall.

While there were differences in opinion, but more dwell on the positive when assessing Tun Dr. Mahathir Mohamad's earlier government, his recent reign as PM under the PH government raised several concerns from across the political divide. The majority of the respondents were skeptical of him and his PH administration. The prominent sector that received major concerns was the economic sector in which every major issue such as inflation, national budget, deficit, and lack of job opportunities have received negative reactions. This could be considered due to the expectations set by Malaysians based on the promises outlined by the previous government, especially before the 14th General Election. In addition, issues related to racial relations were also on the spotlight during the brief rule of PH. Despite of the Malay claim of prioritizing their special rights, they also felt that racial unity in Malaysia needs to be brought forward as a major concern. Disputes were everywhere throughout the less than two years of PH government in Malaysia. This could be proven through the question of, "In which administration do you think Tun Dr. Mahathir Mohamad worked well?", in which the majority with 85.2% chose BN and the remaining opted for PH (Table 1).

From the data, most of the respondents viewed that the social well-being of Malaysians was taken care of better during Tun Dr. Mahathir Mohamad's first reign. Nevertheless, his brief rule under PH government needed to put into consideration as there were not many development initiatives implemented during this time.

Table 1. Distribution of Respondents based on 'In Which Administration did Tun Dr. Mahathir Mohamad Worked Well?' question

	Frequency	Percentage (%)
Barisan Nasional	75	85.2
Pakatan Harapan	13	14.8
Total	88	100

The Malay perception of Tun Dr. Mahathir Mohamad post 14th General Election

In terms of factors that contributed to the positive and negative directions in the management of the previous government, different levels of responses were received. The results showed that there was a significant difference on the overall perceptions of respondents on both directions. In comparison, despite having a substantial amount of respondents agreed on the factors that could contribute to the right direction that Malaysia was heading, still, a higher number of the respondents consistently agreed that factors including economic concerns, negative quality of leadership, political instability (in general), poor administration and racial polarization were heading Malaysia towards the opposite direction (wrong). Regardless of the time spent for PH governing the country, the data showed that respondents had skeptical views on the previous government.

Based on the questions on the Malays perception on Tun Dr. Mahathir Mohamad post 14th General Election in West Malaysia, respondents shared again that Malaysia was heading either way – the positive direction or the wrong direction. It will be a bit difficult to construct thorough judgments on his performance as the previous government had a short time to administer the country. This is where two sides of consideration were configured along with the questions directed to the respondents. Nevertheless, Tun Dr. Mahathir Mohamad received mixed reactions based on his previous administration, as many issues and concerns are being covered. At the moment, a lot is yet to be done to investigate the brief tenure of Tun Dr. Mahathir Mohamad as PM of PH.

Based on the data conducted, the majority of the respondents perceived Tun Dr. Mahathir Mohamad and his administration negatively while considering the country was heading in the right direction. Issues concerning the economic sector, social welfare, and development of the nation were deemed to be a strong point for the previous government. Even though a high number of the respondents opted to be in the intermediate side as they chose to view these issues impartially, the issues the respondents disagreed were at par and even higher in certain sectors. The most obvious figures in the data were on the economic sector. Most of them disagreed on how our economy was run while considering that Malaysia was heading in the right direction. It should be noted that one of the reasons of BN's downfall in the 14th General Election was due to economic concerns and the prominent promises from the PH government prior to the election, which centered on the economy i.e. the abolition of GST. However, their performance during their time had disappointed the citizens, especially the Malays. Nonetheless, several aspects related to running an efficient administration were viewed positively. Respondents perceived the policies implemented, an efficient civil service, and experienced administration as their strong points in which they agreed these factors contributed to positive direction of the government. This could be due to the transition happening from the long-governed BN to the hopeful and reformed PH. Malaysians might have felt a fresh start and had hoped that with this newly elected government, controversial issues faced by BN government such as corruption and the 1MDB case must be resolved soon.

In addition, more than half of the respondents agreed that economic issues such as unfavourable economic conditions, inflation, low wages, budget deficit, and the weakening of the Malaysia ringgit were some of the setbacks raised from the previous administration. To consider most of these issues, they did not directly serve as impacts from the PH government. These problems mainly came from the BN government. Issues such as weakening of the ringgit and low-income families have already been presented back then. However, as a new

government, along with their promises, Malaysians were expecting that PH would initiate reforms by making the country great again - similar to the earlier premiership of Tun Dr. Mahathir Mohamad. With the seemingly excellent form of leadership in Tun Dr. Mahathir Mohamad, PH could have moved Malaysia forward. It somehow did not happen, and the people sorely missed needed it. In view of this, the respondents disagreed on their leadership performance where they perceived PH as politically unstable and failed to deliver their promises. In short, it can be deduced that the recent Tun Dr. Mahathir Mohamad administration was viewed negatively by the Malays.

The relevance of Tun Dr. Mahathir Mohamad in today's political scene

Tun Dr. Mahathir Mohamad is considered as a notable leader and politician of Malaysia. From his remarkable academic background of medicine to his outstanding contributions to Malaysia, undeniably, he is well respected not only in Malaysia but also all across the globe. His amazing leadership skills once again have been proven when he was appointed as the PM of Malaysia twice in the history of the country. However, despite having noble achievements, he was still criticized and looked down, especially during his latest Prime Ministership in PH.

Based on the results, majority of the respondents either approved or undecided in the way Tun Dr. Mahathir Mohamad handled his job in PH. While it may be true Tun Dr. Mahathir Mohamad managed his administration well, a large number of respondents disapproved of the administration of PH as a whole. It was surmised that Tun Dr. Mahathir Mohamad may be a good leader but surrounded by inexperienced administration. This depiction directly led to the perception of the respondents especially when he offered resignation as the seventh PM. More than half of respondents (62.5%) (Table 2) approved of his decision to resign from the highest executive position.

This might be due to the idea that even having a good leader, but with no solid management team, a leader could also be tarnished with negative reviews and performances. Despite the majority of them were having this hopeful sense over the new government with a percentage of 56.8% (Table 3), most of the respondents were not proud of Tun Dr. Mahathir Mohamad during his stint in PH.

To summarise, Tun Dr. Mahathir Mohamad could be considered as irrelevant in today's political scene, based on the kind of setback, and downfall of PH. Strangely, 85.2% of the respondents perceived that Tun Dr. Mahathir Mohamad worked well only during the BN government. Accordingly, Tun Dr. Mahathir Mohamad was a great leader, and with a good and solid team of BN, it could act as a catalyst for his performance (Table 4).

Table 2. Frequency distribution of Approval of Tun Dr. Mahathir Mohamad's Resignation.

	Frequency	Percentage (%)
Yes	55	62.5
No	18	20.5
Maybe	15	17.0
Total	88	100

Table 3. Frequency distribution o Approval of Tun Dr. Mahathir Mohamad's Management in PH.

	Frequency	Percentage (%)
Approve	33	37.5
Disapprove	22	25.0
Neutral	33	37.5
Total	88	100

Table 4. Frequency distribution of approval of PH management.

	Frequency	Percentage (%)
Approve	18	20.5
Disapprove	48	54.5
Neutral	22	35.0
Total	88	100

IMPLICATIONS AND CONCLUSION

Tun Dr. Mahathir Mohamad and his administration were conceived negatively by the Malays as many of the concerns that were raised from their predecessor still continued to exist. They also have crashed the hopes and expectations of the people by not fulfilling their promises. For this, Tun Dr. Mahathir Mohamad could be considered as irrelevant in today's political scene, due to the setback experienced by his PH administration. As such, a staggering 85.2% of the respondent perceived that Tun Dr. Mahathir Mohamad worked well only during the BN government. Tun Dr. Mahathir Mohamad was himself a great leader, and with a good and solid team of BN, it could act as a catalyst for his performance. These premises could have sparked as one of the major factors that led to the sudden change of government from PH to PN (Perikatan Nasional) through the 'Sheraton Move'.

All in all, the changes happening in our political scene are still a new thing that all Malaysians need to digest after being ruled with the same government for decades. Therefore, each Malaysian must be aware of current political issues happening daily for us to be equipped of what is yet to come. There must have a way to construct criticisms to provide check and balance but at the same time, criticisms must be tempered with a rational thought.

This study suggests that the return of Tun Dr. Mahathir Mohamad into Malaysia's political scene was not well accepted by the Malays in West Malaysia. The respondents believed that Tun Dr. Mahathir Mohamad worked best during his reign as PM under the BN banner. This study also proved that to govern a country is not all about the leader, but the systematic and holistic administration as a whole, needs to be taken into consideration. From this study as well, the emerging PH government has crashed the hopes and expectations mandated by the people. To develop further, they should not only rely on the power of an experienced leader such as Tun Dr. Mahathir Mohamad, but they also need to strive further to equip them with what is required to govern a country.

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Fire Disaster and Its Implications on Survivors and Social Work Practice: The Case of Rumah Lepang Sayat, Engkilili

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ABSTRACT

This paper focuses on the implications of a longhouse fire on its survivors. It also presents the assistance that survivors received during post-disaster and the implications on the social work practice. It draws on qualitative research based on in-depth interviews with survivors selected through purposive sampling. The data of the study were analysed based thematic analysis. The findings revealed that the survivors faced both short-term and long-term implications after the fire disaster. The assistance received was mainly focused on responding to the short-term implications and was less focused on long-term implications. In the scheme of things, these implications bear on the social work practices as well as on the conditions of the fire disaster survivors.

Keywords: Fire Disaster, Long House, Social Work Practice, Survivor

INTRODUCTION

Fire disaster is one of the most common disasters which may be natural or man-made. Natural causes may come from hot climate, volcano eruptions or man-made causes like fire disasters may arise from technological error or accidents. In Sarawak, longhouse fire is becoming a concern (Nais, 2018) and has resulted in over RM 10 million losses (Pei, 2019). Sarawak has recorded a total of 14 longhouse fires in just first eight months of 2019 and leaving 1300 villagers homeless (Pei, 2019). The longhouse fires have affected the villagers and local communities in different ways. This study aims to look at the implications of fire disaster on the local communities and to analyze the implications on social work practice revolving around post-disaster recovery and in a social development context. The location chosen for this study was Rumah Lepang Sayat Engkilili where a recent longhouse fire occurred when this research began. The findings highlighted in both long and short-term implications faced by the longhouse fire survivors are significant as longhouse fires are very common disasters in Sarawak. Moreover, these findings can be used as premises for a bottom-up approach to help those affected communities.

LITERATURE REVIEW

Impacts of disaster on survivors

There was not much past research done on longhouse fire disasters. While discussing the impacts of disaster topics such as psychological issues, impacts on economics and social impacts should be highlighted too. One of the most popular topics is on the psychological distress faced by survivors. According to Davidson and McFarlane (2006), disaster is a collective social suffering that challenges individual's capacity of adaptation that can lead to a range of mental health problems including post-traumatic psychopathologies such as post-traumatic stress disorder (PTSD). This statement becomes evident as North *et al*. (1999) revealed that more than half of the research subjects were dissatisfied with their work performances and observed negative changes in their personal relationships, in addition to having symptoms of PTSD. The research subjects in North *et al*. (1999) research were based on the proximity of the subjects to the disaster. When compared to the setting of this research, such outcomes could be expected when research participants are based on the proximity of the occurrence of longhouse fire.

Keane (1994) mentioned the triggers of psychological distress faced by residential fire survivors. For example, loss of possessions and not having insurances to cover such loss gives a financial burden to the survivors. Gangemi (2003), as cited in Stephenson (2010), shared that "people in the caring profession such as priests and nurses were denied access to the area of the bushfires because they were not seen as accredited professionals by police". It is argued that these 'psychological first aid' in the form of social contact and support should be allowed to access these areas because this may help the survivors to recover and communicate their emotions (Gordon, 1997 as cited in Stephenson, 2010). Having said that, doing this research on how longhouse fire survivors were impacted both in short-term and long-term to see how the survivors coped after the disaster and to see what kind of social intervention these survivors had access to.

Besides psychological impacts, they also have economic impacts on the survivors. Stephenson (2010) discussed on the loss of economic resources due to bushfire. For example, the economic losses mentioned were crops being destroyed, loss of homes and access to roads. The longhouse fires have resulted in millions of money and property loss (Pei, 2019). The homes were destroyed, and personal property of the longhouse dwellers was lost to fire disaster. This impacts the survivors economically because of the recovery of their longhouse and other basic needs to be paid.

Fires also caused cultural heritage loss. In the recent longhouse fire, several longhouses were earlier claimed as a cultural heritage of the community. According to The International Council on Monuments and Sites [ICOMOS] (2002), in Stephenson (2010), cultural heritage is defining as "the way of living developed by a community passed on from generation to generation, including customs, practices, places, objects, artistic expressions and values. Very often, cultural heritage is viewed as either "tangible or intangible". Longhouses are where heirlooms and traditional crafts are stored and when these cultural properties are caught in the fire, it would cost the communities involved their cultural heritage. It takes time to rebuild these longhouses that were lost in the fires and for safety reasons, these wooden structures were replaced with concrete structures and not anymore displaying the authenticity of the traditional structure, hence losing a cultural value (Nais, 2019).

Disaster social work in Malaysia

Social work profession has always been involved in bringing about the change of the well-being of individual, families, groups, communities, the marginalized, minorities and society as a whole. When a disaster occurs, the welfare of the affected population is the main topic to be discussed either in the level of preparedness, during disaster or post-disaster and recovery. However, Pyles (2007) has a point in criticizing the social work practice in disaster recovery.

> "A core and often neglected element of disaster recovery has been the rebuilding and community development phase. A review of the literature showed that social work has been less involved in this phase than in traumatic stress intervention and the coordination of relief efforts"
>
> (Pyles, 2007)

Social work did not stress on social development in post-disaster recovery because of reasons such as involving focused attention on macro-level (housing policy, urban planning, and development of the economy) and that the social work education is heavily focused on human behaviour theories, mental health and organizational administration (Pyles, 2007). The approach in disaster management in Malaysia is following the examples from developed countries but with the implementation capacity of a developing country (Roosli & O'Keefe, 2013). In observation, issues highlighted were centered on manpower, the country's economy and roles of social workers in Malaysia. Chan (1995), as cited in Rahman (2018), wrote that the disaster management in Malaysia has generally been considered as a government function and is largely based on top-down government-centred machinery.

In 2015, the National Disaster Management Agency (NADMA) of Malaysia was formed as Malaysia's national focal point for disaster management. In NADMA (2017), the roles and responsibilities under welfare are evacuating victims, preparing food for victims/duty officers, providing/managing places of evacuation and providing first aid. It is still missing the element of post-disaster social development as proposed by Pyles (2007). Lacking in such practice can affect the affected populations of disasters in the long term as post-disaster social development such as rebuilding their lives, homes and getting back to the normal livelihood is a tiring and a long process. The assessment work in any practice areas done by the social workers and, as highlighted by Carlo (2020), should be carried out not just as a requirement and procedure to determine what services could be offered. It should be undertaken from a holistic standpoint with the view of understanding the situations and identifying the underlying needs to come out with appropriate recommendations and interventions for the clients, and the environment or both. A holistic assessment on the fire survivors and their environment, and their implications and intervention not just for short-term but long-term must be in place. Again, Carlo (2020) emphasised that the assessment work should also be about reviewing and evaluating the situation or needs of the clients and also on the effectiveness of interventions that have been carried out for fire survivors, particularly in the context of this study.

Drolet and Ersing (2014) stated the need for a long-term disaster recovery and to develop new knowledge based on communities' experiences of disaster recovery. This is supported with the research done by Rahman (2018), whereby involving and empowering a community in disaster risk reduction programmes is the key to successful mitigation. It is believed that the affected communities are the best judges of their own vulnerabilities and can make the best decisions about their well-being (Yodmani, 2001, as cited in Rahman, 2018). Efforts on building a resilient community are crucial in Malaysia as disasters such as longhouse fires and floods are still very common and affected a large number of people. A community that is resilient towards disaster will be able to recover in a much shorter time (Chong, Kamarudin & Wahid, 2018).

METHODS

The study adopted a qualitative approach using a case study. Data were obtained through in-depth interviews with selected respondents using purposive sampling. This study is located in Rumah Lepang Sayat, Engkilili in Lubok Antu, Sri Aman district. This district recently experienced a longhouse fire affecting 167 residents (Urana, 2019) and is located approximately 20 to 30-minute drive from Engkilili town. The interviews were conducted in the Iban language. Materials used during data collection were audio recording software through a mobile phone, notes taking and a set of interview questions as a guideline. A total of 17 respondents were interviewed in the study and they are permanent residents of the longhouse, adult members and were present when the fire broke out. Data collection was done through interview only because this research aimed to look at the respondents' point of view, telling what they think about their situation. According to Taylor and Bogdan (1984), face to face interview encounters between the researcher and the respondents are conducted to understand their perspective on their experiences and situations as expressed in their own words. In this context of study face to face interview with the fire survivors are suitable in the context of the study. The data analysis was done in thematic analysis method. The transcriptions from the interviews were analyzed through thematic analysis to interpret the experiences of the longhouse fire survivors.

FINDINGS AND DISCUSSIONS

The initial target number of survivors to be interviewed was 26 each representing a 'pintu' (household). Due to availability issue (e.g. some were in the 'ladang' when the fieldwork was conducted), only 17 were interviewed face to face. As shown in Table 1, 12 survivors were farmers, two (2) women respondents were 'not working' and have health problems (knee injury), while two (2) were retired.

Table 1: Demographic profile of respondents.

RESPONDENTS	SEX	AGE	STATUS	OCCUPATION
1	Female	32	Divorced	Engkilili Internet Centre Manager
2	Female	51	Married	Retired
3	Female	51	Married	Not working
4	Male	83	Married	Farmer
5	Male	70	Married	Farmer
6	Male	69	Married	Head of village, Farmer
7	Female	40	Married	Farmer
8	Female	38	Married	Farmer
9	Male	83	Married	Retired
10	Female	52	Married	Farmer
11	Male	48	Married	Farmer
12	Female	49	Married	Not working
13	Female	54	Married	Farmer
14	Male	69	Married	Farmer
15	Female	44	Married	Farmer
16	Female	51	Married	Farmer
17	Male	53	Married	Farmer

Implications to survivors

Fire disaster has several implications on the survivors, namely physical, emotional and financial. The implications are not necessarily one-off effect, but these are related to each and every aspect of the survivors' lives, which both are short- and long-term implications. The longhouse fire survivors were impacted on short-term implications immediately after the fire whereas long-term implications after months from the fire incident.

In terms of health, the survivors' health was affected by their immediate surroundings, their age and the time fire disaster happened. The physical implications that the survivors described are in terms of their physical well-being such as having high blood pressure, weight loss, coughing and body aches. For example, whereas the elderly did not have any complications, such as high blood pressure etc., before the incident, they have developed such issue after it. The sharing of the survivors revealed that,

> *"The elderlies were affected in their health. Those who once did not have high blood pressure, they suddenly have high blood pressure. As for me, I lost weight from 50 kilos to 48 kilos. A loss of 2 kilos in a week only"*
>
> (Respondent 1, single mother, 32, Internet Centre Manager)

The survivors noted that they had excessive exposure to smoke, tension and due to the panic they faced when they had to carry and save their personal belongings from the fire.

> *"Someone even fainted that day because of the smoke. Even if we do not fell sick but our bodies were all sore from carrying the things."*
>
> (Respondent 8, female, 38, farmer)

This finding was similar to the heroic phase as explained by Fahrudin, Baco, Hj Abdul Malek and Haji-Yusuf (2002), where people will struggle to prevent fatalities and minimize damage of their property.

Due to drastic changes in the survivors' immediate environment, it affected the survivors emotionally, where the survivors describe their feeling such as worrying, sleep-deprived, shocked/trauma, loss of appetite, overwhelmed, including mourning. These feelings emerged as they had to deal with multiple issues within a period of time such as losing their home, their properties and constantly worrying about how they could recover.

> *"Remembering our house, no place to stay makes us worry. Moreover, properties bought all these years disappeared in a short time. We worry about how we are going to collects those things again. That caused our health to deteriorate. Flashbacks of our house burning in front of our eyes give trauma."*
>
> (Respondent 1, single mother age 32, Internet Centre Manager)

> *"I was traumatized. Keep thinking about the incident. There was a lot in my mind. I lost interest in working. The land was already cleared for new crops but I did not continue to work on the land. I lost interest in working about two to three months. It was serious because we never experienced this in our whole life that it shocked us, traumatized."*
>
> (Respondent 17, male, farmer, age 53)

> *"No appetite to eat because the rice was not our harvest. We were used to eating the rice of our harvest."*
>
> (Respondent 3, female, unemployed, age 51)

> *"It almost felt like mourning, it felt as if my parents have passed away leaving me when I think of what happened."*
>
> (Respondent 6, male, Head of village, age 69)

> *"It is hard, felt like going insane, wanted to die. Tired of remembering it (fire incident), I can hardly sleep."*
>
> (Respondent 15, female, farmer, age 44)

These feelings were highlighted as normal stress reactions when under these circumstances (post-disaster) in Fahrudin *et al*. (2002). Disasters challenge the individual's capacity of adaptation which can lead to mental health impacts (Davidson & McFarlane, 2006). The survivors turned emotional and their physical health condition was also affected, especially when the existing was less than ideal and had to deal with the unexpected loss. Losing their family home, bereavement, a threat to life and their behaviour during post-disaster are viewed as 'psychological toxins' in which the disaster has impacted mental health (Davidson & McFarlane, 2006). They explained that these 'psychological toxins' have greater impact on those in close proximity to the location of the disaster.

The survivors too faced several types of losses that eventually affected them financially. Losing their home lead the survivors to rebuild a temporary shelter and re-purchase essential things such as cooking and eating utensils and toilet bowl. Rebuilding the temporary shelter had already cost the survivors a lot and they still had to cover expenses to rebuild another longhouse. In addition, expenses such as payment of road tax, bills, and school fees for those who have children, burdened the survivors heavily.

> *"It was hard managing our money because if it wasn't because of the fire, we could have saved more because that time palm oil was quite expensive. Moreover, July was time to pay the car's road tax but the house also burnt down that month."*
>
> (Respondent 1, single mother age 32, Internet Centre Manager)

> *"Nothing, because when we had money it was used to buy things. It was used to buy things for the store, for us to build this temporary shelter to stay. There was aid given but it was used to buy zinc roofing, buy toilet bowl, pipes."*
>
> (Respondent 17, male, farmer, age 53)

> *"Pay workers for the farm which is using a lot of money from the aids given. Now it is all finished, just use once; moreover, I still have kids who go to school."*
>
> (Respondent 3, female, unemployed, age 51)

Survivors faced difficult times to manage their household finances as there was a lot of expenses to consider. They needed to divide their finance to save for rebuilding their new longhouse, buying materials for their current temporary shelter, car loan, electricity bills, their children's education and meeting their daily needs. Moreover, they have lost most of their personal properties and home to the fire, and not having an insurance scheme to cover the losses contributed to more psychological distress (Keane, 1994).

Another reason as to why the survivors were impacted financially was from the loss of their cultural heritage and heirloom such as *'tajau'* (traditional treasure jar), '*engkerumung', 'gong',* and *'tawak'* (traditional music instrument).

> *"Cannot sleep because I kept thinking about the things that were gone, the old heritage inherited from ancestors are all gone to the fire."*
>
> (Respondent 6, male, head of village, age 69)

> *All gone, 'tawak'* (traditional Iban music instrument), *'benda'* (traditional ceramic treasure jars) *and 'engkerumung'* (traditional Iban music instrument)*."*
>
> (Respondent 2, female, retired, age 51)

Losing these heritage items impacted them as much as these things hold a high value in the Iban society. The community viewed these relics as irreplaceable and rare possesssions. Finally, other financial impacts were caused by the loss in farming produce. As displayed in the survivors' demography, the main economic activity in the community was farming. The loss of farm produce such as seeds and other crops directly affected their income as farmers.

> *"Black pepper was all lost to the fire. There was a lot, it was the season, just ripen and harvested, more than 15 sacks were burnt."*
>
> (Respondent 2, female, retired, age 51)

> *"That time I wanted to carry some of my black peppers but the fire came so I could not continue to do so. They were all gone to the fire."*
>
> (Respondent 4, male, farmer, age 83)

> *"All potato leaves are gone. These ones are newly planted crops because the previous ones are all taken out to build shelter on this land" [The word 'shelter' here refers to a temporary shelter for the respondent's household after the longhouse was burnt down. It was built on a patch of land used to grow potato leaves]."*
>
> (Respondent 3, female, unemployed, age 51)

The survivors had lost their farm and where farming was the only source of income. Their crops or farming produce were either lost to the fire or sacrificed to provide land to build their temporary shelter. Fire disaster has also resulted in cultural impacts (Stephenson, 2010) where, in this study, the survivors have lost traditional heirlooms. Losing the longhouse to the fire has impacted them socially and culturally as the longhouse was a place of social gathering, where the way of living including customs, objects, artistic

expressions and values (Stephenson, 2010), was passed from generation to generation. The new longhouse that will be rebuilt can never replace the authenticity of the traditional structure, hence losing its cultural value (Nais, 2019).

Fire survivors had no choice but to build a temporary shelter before they can recover and rebuild a new longhouse. Note the word temporary, the shelter was built based on the car shed and storeroom (*Rumah Padi*) that they have left from the fire and was made from plywood and zinc roofing. This shelter was built without adequate planning as they needed immediate shelter after the fire incident. These issues (safety, hygiene, flooding and hot) have interrupted their daily way of living and added to the challenge to adapt to their new shelter.

> *"Cannot sleep, no appetite to eat, there was a lot, worrying. After the house burnt down, we slept here [car shed] but the walls were not built yet, camps that do not have covers."*
>
> (Respondent 2, female, retired, age 51)

> *"Staying in this shelter [Store room] is very hot, there is nothing here. We cannot accommodate guests, no place to stay, we eat, we sit and sleep at the same spot."*
>
> (Respondent 6, male, Head of village, age 69)

> *"Why is that like that (referring to wiring in her shelter [car shed]) I asked him. I got injured, I knocked my head because of the wood" [Respondent 10 was worried about how the new wiring was done in her temporary shelter since the temporary shelter was poorly built and prone to flooding. The respondent was worried that the poor wiring would make things worse as she has already suffered some minor injuries from staying in the poorly built shelter.]*
>
> (Respondent 10, female, farmer age 52)

> *"Water will be up to my knees when it rains. It will be flooded. If it does not rain, then it will be very hot." [car shed]*
>
> (Respondent 11, male, farmer, age 48)

The long-term impact that survivors faced such as safety, hygiene, comfort and structural issues are indirect impacts that the survivors go through as not much assistance in social development was provided in post-disaster recovery (Pyles, 2007).

Assistances received by the survivors

The survivors in the study did receive assistance from different sources in response to their different needs. The main assistance that they have received was financial aids. They received financial aids from the Welfare Department of Sarawak (JKMS) and donations collected from nearby longhouses. The financial aids were distributed to the head of the household of each family. More money was given to families with more family members and children who are still going to school.

The survivors also have received support such as food assistance. Non-governmental Organizations (NGOs) gave food essentials such as rice, salt, cooking oil, bread and sugar. Besides, nearby longhouses helped to cook meals for the survivors while the wet food came from JKMS. However, the food aids with the collaboration of JKMS and nearby longhouses just lasted about two weeks after the fire incident.

The types of assistance such as financial, food and health that the survivors received were only in the first month after the longhouse fire incident. Although some of the assistance received, for example, the food aid such as rice lasted long, other needs such as the survivors' mental health in coping with their new living conditions were not quite being addressed despite the presence of health assistance. The result has shown that there is a need for social work roles is assisting the survivors facing the 'second disaster' (Fahruddin *et al*., 2002). 'Second disaster' refers to the implications such as paperwork, insurance claims and bureaucracy before

the survivors can regain their sense of stability. Therefore, social work practice is lacking of the element of disaster recovery in rebuilding and developing the community (Pyles, 2007).

Health aid was also available where the survivors were given free check-ups from the Health Ministry and those who were sick were given medication accordingly. The survivors were also assisted in legal procedures such as making their new identification cards and birth certificates.

They were also given timber, nails and roofing materials to be used to build their longhouse. Friends and family also helped by providing them clothing, supported in cleaning up the longhouse area, and helped organised things in their temporary shelter.

Drolet and Ersing (2014) highlighted the fact that there is a need in long term recovery for social work practice to back up and support by the communities' experiences in disaster recovery as the communities are the best judges of their own vulnerabilities and can make the best decision for their well-being (Rahman, 2018). Therefore, the findings of this study provide significant contribution to developing disaster recovery framework for social work practice in the local context.

Limitations of study

This research was conducted in only one specific longhouse in Sarawak because resources such as time and funding were lacking. Therefore, findings obtained are not likely to be generalized although longhouse fires are quite common in Sarawak. Knowing the limitations of this study and the researcher's first experience in conducting research, new researches can develop a more inclusive (geographically) research from these findings. Extending more research areas can help develop more data and improvement of services in the future.

CONCLUSION

In conclusion, as findings have proven, longhouse fire impacts are more than just being homeless. It affects the survivors in different aspects of their life be it physically, psychologically, financially and socially. It is seen that a longhouse community is thrown off course in their social system. These findings should be useful for social work practicing agencies such as the Welfare Department to plan and restructure interventions especially for longhouse fire cases in the future. The practice framework of social work in disasters can be reviewed and reconstructed to address the needs of the survivors both in response and recovery phases. The works of Carlo (2020), which emphasized on the assessment carried out by the welfare workers in Malaysian context, should be strengthened. The findings of this study have implications on the social work practice in Malaysia, which requires the perspectives of welfare workers to widen their scope and exploration of assessment by looking at the fire survivals' systems, their physical and social interactions, and their relationship with the environment as a whole. These perspectives, as Carlo (2020) stressed, between people and environment could be fully understood only in terms of their social relationship where each continually influences the other within a particular context. In this way, it could subsequently improve the welfare services provided to disaster survivors in the future.

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