

IMPACTS OF ECOTOURISM DEVELOPMENT IN TASIK KENYIR ON THE QUALITY OF LIFE AS PERCEIVED BY THE LOCAL COMMUNITY

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Abstract: This study attempts to investigate how impacts of ecotourism development influence the quality of life, as perceived by the communities. In this study the local community chosen consists of members of three selected villages, within the proximity of Tasik Kenyir ecotourism centre. Data has been collected using questionnaires, during face-to-face interviews with 260 heads of household in the three villages identified. A descriptive analysis shows that, in general, the community agrees with the impacts of the ecotourism development in the area. Multiple regression procedures have been conducted to determine the causal relationships. The findings of the study indicate that four ecotourism impact factors have influenced the communities' perception on the quality of life and these include household income, location of residence from ecotourism site, number of family members participating in ecotourism development, and perceived environmental impacts. This study is important for local authorities to identify possible economic options for local communities and to provide skill training programmes that are related to the tourism industry, to further enhance the quality of life.

Keywords: Local community, safety and security, natural resources, biodiversity, sustainable development

Introduction

Tourism has developed to become a major industry which brings benefits to the economy and the local communities. In Malaysia, the tourism industry is continuously advancing as it serves as an important channel for the economic reinforcement for the country (Jaafar *et al.*, 2015). This industry is the second largest source of foreign exchange earnings as well as an important employment generator (Rahman *et al.*, 2015). Furthermore, structural economic and environmental changes have increased the potential for Malaysian ecotourism development.

The country's Economic Transformation Programme (ETP) aims to make Malaysia a Mega Biodiversity Hub (MBBH), as one of the world's premium nature and ecotourism destinations, which would also contribute to the nation's tourism revenue (National Transformation Programme, 2017). Some of the factors which influence the increase in the volume of tourists to MMBH live sites are the natural resources attraction, the recreational activities available and location accessibility.

With that said, Tasik Kenyir in Terengganu houses important biodiversity and natural resources that need to be protected for the future generations. It also has a huge potential to become a top local and global ecotourism destination. Its potential is identified as a priority

ecotourism development site in the National Ecotourism Master Plan (National Ecotourism Plan, 2017).

The success of ecotourism development at Tasik Kenyir must include strong support and commitment from the local communities, since the development would affect their quality of life. Local communities are considered protectors of natural resources because they possess expert knowledge on local culture, environment and livelihoods in the area. This study attempts to investigate how the impacts of ecotourism development have influenced the quality of life of local communities at Tasik Kenyir.

Impacts of Ecotourism Development and Quality of Life

The impacts of ecotourism development may be economic, socio-cultural and environmental, which, in turn, can contribute to changes in the livelihoods and the welfare of the communities in the area (Ahmad, 2012). Subsequently, ecotourism destinations have become strategic tools for economic development, especially in many developing countries (Tuohino & Hynonen, 2001). Ecotourism could be defined as an activity which maximizes the participation of local communities using the elements of natural and environmental attractions of a site (Adam *et al.*, 2018). According to Jacobs *et al.*, (2014), ecotourism can positively impact people's well-

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being as it targets biological conservation and community development simultaneously.

Teh & Cabanban (2007) provide guidelines for sustainable ecotourism development in a marine site at Pulau Banggi in Sabah. These guidelines include discouraging the exploitation of natural resources, maintaining marine diversity, and supporting those who maintain local resources. Tsaur *et al.*, (2006) mentioned that local communities should play important roles as users, producers and promoters of conservation of the resources in order to achieve a balanced ecotourism development sector. Thus, Styliadis *et al.*, (2014) suggests that understanding the perception of the locals can facilitate policies which minimize potential negative impacts of tourism development and maximize its benefits, leading to community development and greater support for tourism.

Although the sector's development is advocated based on the positive benefits, it should be noted that ecotourism may also produce unwanted impacts on the day-to-day community life as a whole. For example, a case study of Tioman Island in Johor shows that the residents' livelihoods have not improved, even after declaring Tioman Island as an ecotourism site (Ng *et al.*, 2017). Five main challenges have been identified as hindering sustainable tourism development in Tioman Island which include, inappropriate infrastructural development, open burning, improper maintenance of architecture, poor facility maintenance and insufficient supply of well-trained local guides.

The way communities understand impacts of ecotourism development can influence their perceptions on the quality of life. The overall success of the ecotourism development would only be realized if the community believes that benefits are equitably shared among stakeholders, and relationships between hosts, visitors, and nature are harmonized (Anyaku & Martin, 2003). Ecotourism may aid in preserving local culture by encouraging local communities to distinguish and respect all unique cultures and histories (Eshun & Tonto, 2014).

Over the years researchers and policy makers are giving more attention to ecotourism through incorporating ethical issues or normative components into the discussion. Besides, tourism can act as a vehicle to promote world peace by providing incentives for

peacekeeping and by building 'a bridge between cultures' (Dina, 2017).

Social Exchange Theory in Tourism Context

Social Exchange Theory proposes that the individuals' attitudes towards tourism and their subsequent level of support for its development are influenced by their evaluations of the outcomes of tourism for themselves and their communities (Özel *et al.*, 2017). Siu *et al.*, (2013) investigated whether Social Exchange Theory is valid in explaining the locals' perceptions and reactions to tourism trends by using three main pillars of tourism in terms of economic, socio-cultural and environmental impacts. Using this theory, their findings demonstrate that residents who perceive tourism impacts positively are supportive of tourism development, and those who perceive tourism impacts negatively are less supportive. Meanwhile, Swarbooke (2012) argues, that theoretically tourism is concerned with environmental, economic and socio-cultural criteria; its development must therefore be balanced for long term growth. By applying this theory, it is possible to highlight how local communities create their perceptions on projects or policies being implemented based on the expected benefits from the industry.

Conceptual Framework

Based on the Social Exchange Theory, local communities tend to support tourism development when economic, environmental, and sociocultural impacts are perceived as positive. In this study, Social Exchange Theory is used to explain the reasons behind factors influencing the local communities' perceptions. The theory is highly applicable to ecotourism development since it embraces the ways and reasons the local communities perceive the positive and negative effects of ecotourism development on their quality of life. To achieve the research objectives, the research model is grounded by the Social Exchange Theory.

Figure 1 depicts how local communities' perceptions of ecotourism development impacts influence their quality of life. In other words, sustainable impacts of ecotourism development at a destination are highly dependent on the concerns of the local communities towards their quality of life.

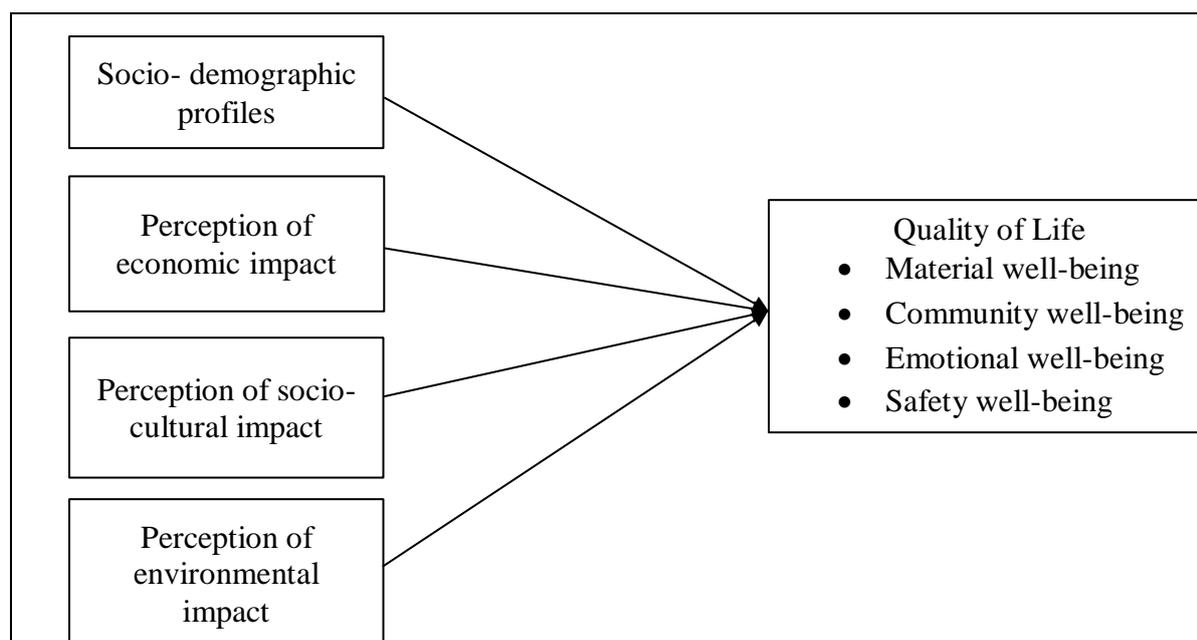


Figure 1: Conceptual framework

The five independent variables consist of socio-demographic profiles, perception on economic impacts, perception on socio-cultural impacts, perception on environmental impacts and perception on quality of life, while the dependent variable is how the perceptions on the quality of life is influenced by the local communities' perceptions on ecotourism development in Tasik Kenyir.

Methodology

The study population consisted of all household heads in the three villages located between 5 to 7 km away from Tasik Kenyir, namely, Kampung Basung, Kampung Pasir Dula and Kampung Padang Setebu. These villages were selected as research sites because of their proximity to Tasik Kenyir and most of the villagers were directly or indirectly impacted by the ecotourism development at Tasik Kenyir (Central Terengganu Development Authority, 2017). A pilot study with 30 respondents (other than heads of household) was done with questionnaires to provide better information on the effectiveness and the importance of the variables in fulfilling the purpose of the study. Data collection consisted of a census on all 260 heads of household through face-to-face interviews, to ensure clarity when answering the questionnaires. Census refers to the

overall number of household heads in the local communities at Tasik Kenyir.

Heads of household were chosen for sampling because of their roles as bread winners of the family. If the head of household was unavailable, the housewife or the eldest person above 18 in the household would be a substitute. This census data helps to avoid sampling bias and thus increases data confidence level. The data collected was analysed using a descriptive analysis and multiple regression analysis. Descriptive analysis was used to analyse information on respondents' demographic profile such as age, marital status, the level of education, occupation, and income. Mean score was used to study the perceptions of the local community on impacts of ecotourism development in order to understand their levels of perception. Multiple regression analysis was conducted to determine the relationship between dependent and independent variables.

Result and Discussion

Socio-demographic Profile of Respondents

Table 1 shows respondents' socio-demographic profiles. The survey has found that all the villagers are of the Malay ethnic group and are Muslims.

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Table 1: Respondents' Socio-Demographic Profiles (n=260).

Variables	Frequency	Percentage
List of Village		
Kampung Basung	171	65.8
Kampung Padang Setebu	75	28.8
Kampung Pasir Dula	14	5.4
Age Group		
18-37 years	77	29.6
38-57 years	118	45.4
58 years and above	65	25.0
Marital Status		
Single	22	8.5
Married	196	75.4
Widower	42	16.2
Level of Education		
Not Formal	18	6.9
Primary	45	17.3
Secondary	165	63.5
STPM/certificate	24	9.2
Diploma	6	2.3
Degree	2	0.8
Occupation		
Government sector	11	4.2
Private Sector	91	35.0
Self Employed	100	38.5
Housewife	41	15.8
Retired/Unemployed	17	6.6
Gross Monthly Income Category		
below B40 group	258	99.2
M40 group	2	0.8

The majority of the respondents (56.5%) were males; of the 43.5% females who have responded, 16.2% were widows who were also heads of household. The majority of respondents were married (75.4%) and 8.5% of respondents were single. In terms of age, 77.7% of respondents were between 18 to 37 years old, while 45.4% were between 38 to 57 years old. Only 25% of respondents were over 58. The majority of the community were in the middle age groups and married. This age and the marital status distributions are consistent with other rural communities in the state. In terms of level of education, 63.5% of the respondents attended secondary school, while 17.3 % of attended only primary school; 9.2 % of respondents have obtained STPM level of education, 2.3 % of them have diploma level education and 0.8% have degree level education. This is typical of rural communities located

close to district administrative centres - in this case, Kuala Berang town.

Of the respondents who stayed near the site, 65.8% of them were 5 km away from Tasik Kenyir, while 28.8% stayed 7 km away and only 5.4% of them were 6 km away. These villages are still classified as rural, even though they are located quite close to the district's administrative town. A small majority (38.5%) of the respondents were self-employed, either in the agricultural or tourism related activities (Table 1). Private sector employees made up 35% of the population, mostly in tourism related businesses; 15.8% were housewives, followed by 6.6% who were retirees or the unemployed and only 4.2% were public sector employees.

As expected, 99.2 % of the respondents are in the 'below B40' group. The 'B40 group' refers to households in the area with monthly earnings of

RM3900 or less. Only 0.8% of the respondents are in the 'M40 group' and these are households with monthly incomes ranging between RM3860 to RM8319. Most respondents earned less than RM1000 a month. Agriculture is still the main sector in the area; even though the development of the ecotourism sector has provided employment opportunities, the types of employment offered are the lower paying and low skilled jobs. Those who are directly involved in tourism businesses make reasonably and relatively higher incomes. Locals are expecting to earn more money by getting involved in ecotourism development at Tasik Kenyir. As a recommendation, the tourism developers could provide workshops or short training courses for the locals, like learning soft skills in handling and communicating with tourists. Other than that, programmes that can teach skills to the locals to operate the boats, to become tour guides as well as to produce goods and souvenirs could be conducted. The increase in the abilities and capabilities can encourage the local

community to get involved in ecotourism development at Tasik Kenyir.

Perceptions of TheLocal Community on Impacts of Ecotourism Development

Since the development of ecotourism, the way of life for the local communities has changed. Even if the natural resources are being consumed intensively in the tourism business, a well-managed sustainable tourism will create greater impacts on the economy, environment and society (Siew *et al.*, 2017). The perceptions of the communities towards the impacts of ecotourism in Tasik Kenyir, are indicated in terms of economic, environmental and socio-cultural perspectives. The perception is measured using the Likert scales ranging in values from one to five (1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree). Table 2 shows that the respondents in the community have positive perceptions, as indicated by the mean score of more than 4.0 for all items.

Table 2: Perceptions of the local community on impacts of ecotourism development at Tasik Kenyir.

No	Item	Mean	SD
Economic impacts			
1	Ecotourism will create employment opportunities.	4.87	0.33
2	Ecotourism will increase the retailing sector.	4.21	0.45
3	Ecotourism will increase income.	4.18	0.54
4	Ecotourism will improve the transportation facilities.	4.12	0.49
5	Ecotourism will ensure that the younger generation will continue working in Tasik Kenyir.	4.12	0.69
Overall mean score for economic impacts = 4.30			
Environmental Impacts			
6	Biodiversity must be valued and protected.	4.68	0.58
7	Community environment must be protected now and in the future.	4.48	0.74
8	Ecotourism will increase conservation of natural area.	4.37	0.80
9	Ecotourism will contribute to conservation of wildlife.	4.36	0.65
10	Ecotourism will increase the environmental awareness among locals.	4.22	0.55
Overall mean for environmental impacts = 4.42			
Socio-cultural Impacts			
11	Ecotourism will increase the image of village	4.48	0.55
12	Ecotourism will increase the quality of life	4.17	0.41
13	Ecotourism will provide more recreational facilities.	4.15	0.58
14	Ecotourism will improve quality of the place of worship.	4.05	0.40
15	Ecotourism will improve quality of social infrastructures.	4.04	0.48
Overall mean score for sociocultural impacts = 4.17			

*Note: Table shows the means of top 5 impacts perceived by the respondents.

As shown in Table 2, the highest mean score for the perception on economic impacts is associated with the creation of employment opportunities (4.87) since the development of tourism services and facilities has offered many employment opportunities for the local communities. Besides, the communities also perceive that ecotourism enhances the retail sector, as an extension of tourism business which directly benefits the locals (4.21).

Employment opportunities and involvement in tourism businesses have made the community to believe that ecotourism helps increase incomes (4.18). The

respondents were also very optimistic that ecotourism can improve the transportation facilities as this also encourages visitors to come to the site. Lastly, the respondents also agreed that ecotourism can ensure employment for the younger generations (4.12). If the younger generation can have access to more benefits and opportunities, they would continue to work in the sector.

In terms of environmental impacts, the highest mean value (4.68) shows that respondents acknowledged the value and need for protection of biodiversity in the ecotourism destination, besides their own environment (mean score of 4.48). To that end ecotourism promotes

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conservation and allows for the socioeconomic involvement of local populations with minimal environmental impact (Jaafar *et al.*, 2015). When visitors come to Tasik Kenyir ecotourism area, visitors are able to explore cultural and environmental products when they interact with the local communities. As such, every ecotourism programme should consider the following factors, namely: environmental impact, impact on local cultures, economic benefits for the local community and recreational satisfaction of the tourists (Jaafar *et al.*, 2015).

The involvement of the local communities in conservation programmes allows visitors to absorb knowledge on the natural environment more directly. Furthermore, the mean values of 4.36 and 4.37 reveal the agreement of the communities that ecotourism can increase natural resource conservation.

Ecotourism development would make local communities realize the importance of conservation of wildlife in their area (4.22) through further appreciation and awareness of the environment and environmental problems which may have been taken for granted previously. For example, Kenyir Elephant Conservation Village (KECV) is one of the conservation programmes and tourist attractions at Tasik Kenyir. KECV has claimed to be an environmental protection and conservation initiative for wildlife. Only 10 % of the 256 area is developed, while the rest is preserved as a natural forest, to ensure a 'home' for elephant orphans living in the village. Kelah Sanctuary at Tasik Kenyir, managed by The Central Terengganu Development Authority (KETENGAH), is another protective zone for the protection, preservation and reproduction of fresh water

fish. Fishing activities are strictly prohibited at the Kelah Sanctuary.

In general, the local community believe that the development of ecotourism in Tasik Kenyir can aid in improving their socio-cultural environment. Their image as rural agricultural communities is often taken for granted, however, with the development of ecotourism they feel that it can bring about a new modern image. Azis *et al.*, (2018) revealed that a key weakness at ecotourism destinations is insufficient or a lack of facilities and infrastructure available. Infrastructural and recreational developments which attract visitors are also complementary benefits to the community. Local governments must give priority to basic infrastructure investment in rural areas to help facilitate and provide backing for communities (Kunasekaran *et al.*, 2018).

Perception on Quality of life

The dependent variable in this study is perception on quality of life. These perceptions are measured through four main domains; material well-being, emotional well-being, community well-being and health well-being. The perceptions are measured according to a Likert scale ranging from one to five (1= strongly dissatisfied, 2= dissatisfied, 3= neutral, 4= satisfied, 5= strongly satisfied).

Table 3 shows that the communities have satisfactory perceptions towards the impacts on their quality of life with respect to the material well-being where all variables have mean scores higher than 3.0.

Table 3: Perception on main domains of quality of life.

No	Item	Mean	SD
Material Well-Being			
1	Income from your current job in ecotourism	3.78	0.76
2	Your family income	3.94	0.64
3	The pay and fringe benefits you receive	3.75	0.81
4	Cost of living in your community	3.58	0.96
5	Cost of basic necessities such as food, housing and clothing	3.43	0.99
6	The economic security of your job	3.50	0.87
7	Facilities that you get in this community	3.78	0.69
8	The conditions of the community environment	4.32	0.52
9	Services that you get in the community	3.90	0.53
Overall mean score for material well-being=		3.78	
Emotional Well-Being			
10	Your leisure life	4.11	0.49
11	Your social status	4.07	0.52
12	Your home life	4.10	0.51
13	Your spiritual life	4.15	0.48
14	Your cultural life	4.03	0.61
15	The way you are spending your life	4.18	0.44
16	Your life as a whole	4.24	0.47
Overall mean score for emotional well-being=		4.13	
Community Well-Being			
17	Conditions of the community environment	3.98	0.47
18	Community services	3.07	1.02
19	Community facilities	3.29	0.98
20	Community wellbeing	3.91	0.52
21	The way we live in this community	3.97	0.41
22	Availability of tourism services in my community	3.93	0.46

Overall mean score for community well-being= 3.69		Health Well-Being	
23	Water quality in your area	4.21	0.42
24	Environmental cleanliness in your area	4.13	0.36
25	Garbage well managed from the ecotourism activities	3.99	0.53
26	Air quality in your area	4.24	0.43
Overall mean score for health well-being= 4.14			

The mean value of 4.32 implies that the respondents are satisfied with the overall conditions of the community environment. This may be in conjunction with the availability of facilities and services, with mean values of 3.78 and 3.90 respectively. The impacts on family income, job security and other benefits derived from ecotourism development are reflected in the mean values of 3.94, 3.50 and 3.75 respectively. In all societies, more money for the individual typically means more individual happiness (Layard, 2006).

For the emotional well-being, the higher mean scores (4.03 to 4.24) obtained show that the local communities are satisfied with their emotional well-being. They are satisfied with the life they have in the area, as shown by the highest mean score of 4.24. Most of them are satisfied with the way they spend time in their daily life (4.18) and spiritual life (4.15). Their involvement in the ecotourism development increases their sense of status accomplishment compared to other rural communities. The satisfaction with the emotional well-being variables are important aspects to the overall satisfaction of quality of life among local communities.

In Table 3, it can be seen that the perceptions of the locals on the impacts to their quality of life with respect to the community well-being are generally satisfactory. The respondents are satisfied with conditions of the community environment (3.98) and the way they live in this community (3.97). The communities are satisfied with the availability of tourism related services in their villages which are complementary to them (3.93). There are many tourism services that are provided at Tasik Kenyir such as boat transportation, parking facilities, security services, communication and health facilities, registration counter and so on which are basically meant for the visitors. These services are also available for the local communities to use.

With respect to the health well-being, the higher mean scores (3.99 to 4.24) reveal that the local communities are satisfied with impacts of the

environmental conditions on their quality of life (Table 8). Ecotourism development in Tasik Kenyir area can enable the conservation of the natural resources which usually leads to better air quality (4.24) and water quality (4.21). Overall, they are satisfied with environmental cleanliness in their area (4.13). For example, in order to guarantee that the visitors to Tasik Kenyir enjoy the natural atmosphere, cleanliness with respect to management of garbage must be properly done. The communities feel that with proper garbage management their quality of life would simultaneously be safeguarded.

Factors Influencing Quality of Life

The findings of the study indicate that four ecotourism impact factors have influences on the perception on the quality of life. These are household income impacts, distance of residence from ecotourism site, number of family members participating in ecotourism development, and perceived environmental impacts.

In Table 4, the R² value indicates that the four variables explain 14.1% of variance in the quality of life. The R² value is acceptable because in social science, to examine the effectiveness of a factor, the value of R² can be either low or high as long as the potential independent variables are included (Itaoka, 2012). The perception of the quality of life is influenced by income ($\beta = -0.00006553$), however, while income is significant, the influence on the quality of life is inverse. The result shows that if the income is increased by RM1, perceptions of the quality of life will decrease by -0.00006553%. Based on this study, the average income of the community members is below RM1000. The negligible negative impacts on the quality of life are not unexpected since the increase in income with ecotourism development is minimal, as many of them are still dependent on the agricultural activities.

Table 4: Multiple regression analysis.

Independent Variables	B	t-value	Sig.
(Constant)	3.439	8.409	.000
Household Income	-0.00006553	-2.199*	.029
Distance of Residence from Ecotourism Site	.045	2.263*	.025
Number of Family Members Participating in Ecotourism Development	-.038	-1.873**	.062
Perceived Environmental Impacts	.067	2.112*	.036

a. Dependent Variable: Quality of Life

R²=14.1

*Significant at t-value > 1.96 and p-value < 0.05

**Significant at t-value > 1.82 and p-value < 0.10

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The second predictor is distance ($\beta = 0.45$). If the distance is increased by 1km, perceptions on quality of life increase by 0.045%. The finding is consistent to the findings by Jurowski & Gursoy (2004), Khoshkam *et al.* (2016) and Ahmad *et al.* (2012). These studies have found that the local people who are living further away from the centre of tourism attractions have relatively more positive perceptions of tourism development impacts. The characteristics of ecotourism differ slightly from the tourism industry, whereby the focus of ecotourism attractions is on the surrounding environment and a given destination's natural setting (Azis *et al.*, 2018). Even so, communities living closer to the development site have significant interest in ecotourism practices because they receive relatively higher negative impacts from the development. On the other hand, communities living further away from the ecotourism site do not have to bear the increase in negative environmental, economic and cultural effects.

The effect of the number of family members participating in ecotourism ($\beta = -0.038$) is negative to the perception on the quality of life. The results show that if the number of family members participating in ecotourism is increased by 1 person, perceptions on quality of life decreases by 0.038%. According to Ibrahim *et al.* (2018), the involvement of the local community has been accepted as part of the component for sustainable tourism development. However, the types of employment offered to community members are low paying and unskilled, which do not necessarily increase quality of life. Family relations may take a toll when those who are involved in the tourism related businesses and operations have to spend more time at work, especially during peak holiday seasons. Furthermore, during the development stages in the ecotourism sector, family businesses become heavily involved; this could impact quality of life, specifically in terms of family relations (Chia *et al.*, 2018).

The fourth predictor is the perceived environmental impacts ($\beta = 0.067$). If the environmental impact is increased by 1%, perceptions of quality of life increase by 0.067%. The communities believe that the development of the ecotourism infrastructures and services, as well as the resultant conservation of the natural resources can improve environmental conditions in the area, thus they perceive that this improvement would have a positive impact on their quality of life.

Conclusion

The main objective in this study is to identify the influences of the perceived impacts of ecotourism development towards the quality of life of the local communities surrounding Tasik Kenyir. The results of the study reveal that, in general, the local community

References

have positive perceptions on the ecotourism impacts which are categorized into economic, environmental and sociocultural impacts. Consistent with the Social Exchange Theory, those who benefit from tourism would generally support it. The local community with rural characteristics and are directly or indirectly involved in the ecotourism industry at Tasik Kenyir, have positive perceptions on the impacts of ecotourism development. Positive perceptions of the impacts are also held by members of the local community who are not involved in tourism.

The study has shown that perceptions on environmental impact are significant in influencing the quality of life of the local communities. The environmental impact has been gaining much attention among the locals compared to other impacts as the locals feel their quality of life is improved with a better environment, spurred by the ecotourism development. Although income is significant in this study, the influence on the perceptions of the quality of life is inverse -as activities related to ecotourism sector have not increased their income, and subsequently, their quality of life.

The tourism developers must incorporate the monitoring of the perceptions of the locals so as to evaluate local feelings, and their overall quality of life into tourism projects. This would help planners to focus on what the locals consider important to enhance their quality of life. The findings of this study are important to tourism stakeholders, community, and developers like government agency, private agency and local authorities in providing possible options for the local communities to uplift their quality of life. Strong ties with the communities and a focus on long-term impacts toward local communities' quality of life should be included in the overall tourism development strategy in the future.

The study has included only three villages which are located quite close to the ecotourism development site but there are other villages located further away. Future research should include these distant villages as results have shown that the quality of life is positively related to the distance of the residence. In the study area, there are also several Orang Asli communities who are highly dependent on the environmental resources in the area for their livelihoods and their perceptions on the impacts should be included in future studies.

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