Trade-Off Analysis for Eco-Tourism of the Tasik Kenyir Protected Area

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Abstract Continuous pandemic of sustainable development rise numerous concern, hence resulting towards integration of multidimensional principle as an underlay in order to form sound decision-making process especially in ecological-sensitive area such as Tasik Kenyir. This study develops the structural framework for decision-making inclusive of all variables in order to strive for sustainable development of Tasik Kenyir in order to promote responsible tourism practices. Several criteria are

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selected and analyzed using Multi-criteria Analysis (to show the corresponding trade-off); ranged from economic, ecological and social variables such as economic revenue, employment, conservation of flora and fauna and environmental quality. The results show that under different scenarios, the score of different type of variables will change accordingly.

Keywords Multi-criteria analysis · Trade-off analysis · Tasik Kenyir · Economic · Social · Environment and eco-tourism

Introduction

Degradation in the quality of Tasik Kenyir resources and amenities in recent years has called for enhanced management in order to improve resource quality and sustainability (Kamarudin et al. 2011). However, environments depreciation in many of the designated Protected Area, has not been arrested by designation and management of the protected area (Hodgson 1997; Dixon et al. 1993). Hence, delicate approaches have to be taken to ensure the direction of developments is in line with the interests of all stake-holders involved in the Tasik Kenyir ecosystem.

Capturing deliberation and evaluation for decision making to take places in real time are the fundamental cores of trade-off analysis (Yoe et al. 2002). The decision will be built based on consideration of specific attributes or criteria. To be precise, the consideration will debate certain attributes of what will exists (made or increase) and what attributes will cease to exist (gone or reduce). There are value of trade-offs that cannot be avoided; choosing one thing simultaneously means not choosing the other.

The human reality is multidimensional, which means it consists of branches of choices (Srinivasan 1988). In developing Tasik Kenyir as a sub-urban and vibrant Eco-tourism place with appeal to a certain type of tourist, we need to consider certain aspects before plans are made; economic, services, environment and socio-cultural developments aspects and their interactions effects on the ecosystem should be highlighted. In brief, this study explores the cost of relaxing previous aspects in order to increase eco-tourism-based goals.

Tasik Kenyir History, Flashback and Decision

Prior to the formation of Tasik Kenyir, this area was a center of early civilization (Mustafa et al. 2013; Chia 2003; Gin 2009). According to Taha (1991), caves around the Tasik Kenyir area, namely recognized as Batu Tok Bidan and Gua Bewah, were proved to have produced significant archaeological discoveries; stone tool artifacts, axes and weapons dating back to the Neolithic era (estimated roughly around 10,000 years ago).

When the area was inundated with water between 1978 and 1985, most of the hilltops remained above the water level and fortuitously creating 340 man–made islands (Shahrom 2012). Many archaeological artifacts and unexplored caves, along with Batu Tok Bidan were believed had submerged during the creation of Tasik Kenyir (Mustafa et al. 2013; Chia 2003). Nowadays, there were Gua Bewah and Gua Taat that are remain accessible to the public.

Prior to its submerge during the flooding of the reservoir, Batu Tok Bidan cave was excavated in 1959 by R. Noone, and later by the Malaysian Historical Society in 1976. Mollusk shells indicating signs of human consumption (tips broken off) discovered at the site suggest that this site were frequently used as a shelter in the prehistoric era (Chia 2003). A Neolithic burial place was also found at the site along with broken pottery laid at the foot of the deceased.

In 2010, human remains believed dated from the Mesolithic Age were found in Gua Bewah. The female skeletal remains were confirmed to be dated back from 13,400 years old. In 2012, the media reported the discovery of a second prehistoric skeleton, also retrieved from Gua Bewah, not far from where the first skeleton was found.

Decision

The finding of archeological artifacts are proof that many intellectual treasure was buried inside when the Kenyir dam was built. And many items or natural resources were sacrificed for the greater good; to provide sources of electricity and fresh water for the human population in Terengganu (Shahrom 2012; Kamaruddin et al. 2011; Zakaria et al. 2000). This is the first example of trade-off that Tasik Kenyir undergoes in the early years. Hence, now, the scenarios are different, but the weight of the decisions are actually pretty much the same.

Based on previous research, the Tasik Kenyir trade-off analysis should include several variables. Some variables could be further separated into independent and dependent attributes such as the following:

Independent Variables

Economic Benefits

This group of five 5-scale Likert-type items was utilized to ask potential respondents about their perception of general economic benefits brought by nature-based eco-tourism such as marketing, stabilized revenues, local tax revenues, and development of related businesses (Zambrano et al. 2010; Stronza and Pegas 2008; Wunder 2000).

Preservation and Conservational Benefits

The assessments of conservational benefits of nature-based eco-tourism according to the past literature (Hill and Gale 2009; Orams 1995).

Socio-cultural Benefits

Incorporated evaluation of socio-cultural benefits for enrichment (promoting cultural for eco-tourism attraction) that are heavily discussed by the previous researchers (Stronza and Pegas 2008; Jamal et al. 2006).

Ecotourism Involvement

The estimation of tour-related revenues derived from ecotourism, spill-over benefits of developing tourism (Berkemer et al. 1993).

Dependent Variables

Conservation Behaviors of Planning and Management Approaches

The value-driven project (Economic boosts, environment exploitation and socio-cultural enrichment) versus value-driven preservation or conservation.

Trade-Off Value Interactions Between Variables

The comparison evaluation between all the variable related towards the research; Ecotourism involvement, socio-cultural benefits, preservation and conservational benefits, economic benefits.

However, available data is limited and certain barriers exist in the research, this study allocate the evaluation into three major variables; Stakeholder (socio-economic), Economic (Tourism and development) and Ecology (Environment).

Multi-criteria Analysis (MCA)

Trade-off analysis is a method which measures the weighing of corresponding respondents' utilities for various product features (Agrell 1995). Hence, respondents are asked to choose or consider alternatives and state a likelihood of purchase or preference for each alternative. Trade off study was performed by using multi-criteria analysis (MCA). In MCA, a set of scenarios and criteria are required in order to construct framework for the MCA within our trade-off analysis. Both the criteria and the scenarios are developed by consultation with the relevant stakeholders and involved discussions, interviews and public meetings (Agrell 1995; Katrina et al. 2001).

Data collection methods that rely on written descriptions or verbal consists of all product attributes by assuming that the behavior being modeled is cognitive, this attributes are because of the process in understanding a verbal or written description is itself a cognitive behavior (McCullough 1998; François et al. 1991; Luce 1959). Corresponding steps for MCA development and data collection could be seen in Fig. 1.

From Fig. 1, a set of scenario and criteria are required to construct MCA framework within trade-off analysis. Both the criteria and the scenarios are developed in consultation with the relevant stakeholders and involved public meetings, interviews and discussions. MCA has been widely applied in planning (Buchanan and Daellenbach 1987; Macmillan et al. 1998; Malczewski et al. 1997; Joubert et al. 1997) and vigorously attempted to incorporate all stakeholders in the process (Tiwari et al. 1999).

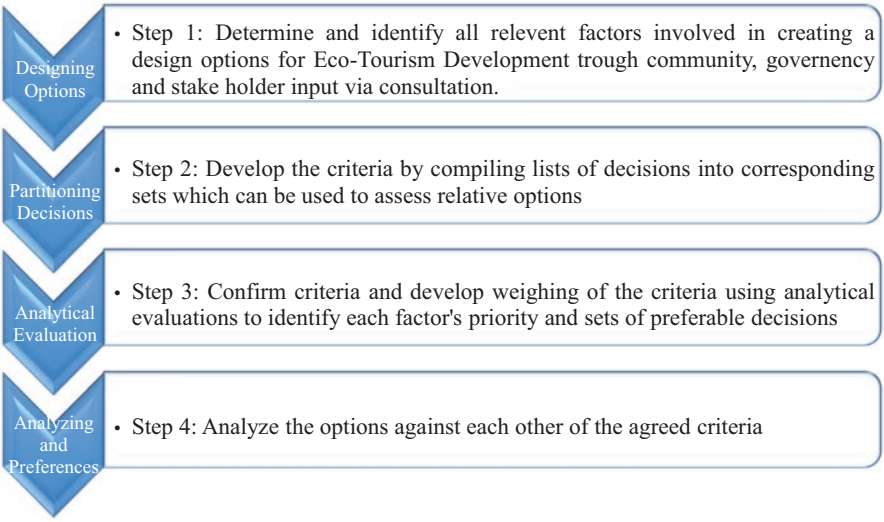

Fig. 1 Steps for trade off – multicrateria analysis (Yoe et al. 2002; Katrina et al. 2001; Brown et al. 2000; Malczewski et al. 1997; Joubert et al. 1997)

Stakeholder

Stakeholders are a group who has direct interest or concern in an organization (Business Dictionary 2016). Other than the corrosponding governing bodies that rule and upper management that are involved in constructing the rules, the masses could be interprated as one of the stakeholders in this matter (Randall and Richard 1982). Delli Priscoli (1989) indicated that a new trend in public involvement was occurring for the development of project that potentially could affect the masses. Hence, obeying the thumb rules of involvement, the stake holder will consist of government bodies, the population and policy makers. Therefore, the study will obey the needs to analyze all stakeholders in order to complete the MCA for determining trade-off of Tasik Kenyir Protected Area (TKPA). By referring to Fig. 2 by Brown et al. (2000), we can conclude the steps necessary to conducting MCA for Tasik Kenyir.

However, to harvest the essential data from the stake holder, we need certain approach to make it work. Therefore, by referring to Table 1, Brown et al. (2001) proposed certain techniques to be used in order to collect sample data from the respective stakeholders.

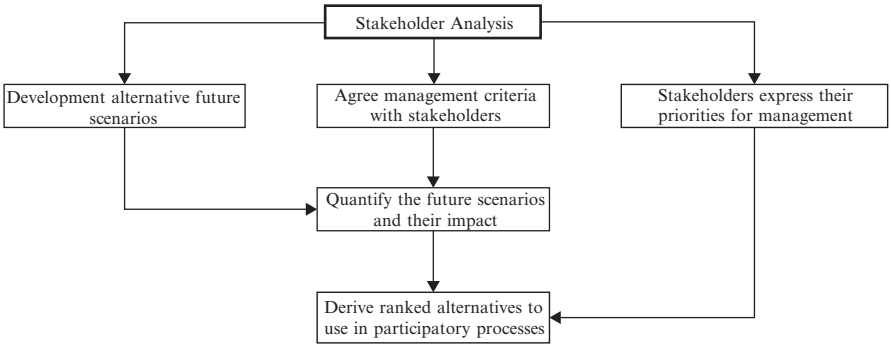

Fig. 2 Stakeholder analysis used for MCA and TDA suggested by Brown et al. (2000)

Table 1 Suggested methods of engaging different types of stakeholder groups (Brown et al. 2001)

Type of stakeholder group	Example of group	Method of engagement
Cohesive organisation with formal structure	Village council	Focus group
Cohesive organisation without formal structure	Informal trade group	Focus group
Mobile individuals, time-limited	Tourists	Questionnaire
Mobile individuals, frequent users	Informal sector worker	Individual interviews
Leaders of hierarchical organisations	Policy makers	Individual interviews
Workers within hierarchical organisations	Government departments	Structured group interviews

Economic

This criterion focuses on recreational benefits and macro-economic benefits. The first concerns are to aim for the maximization of revenue towards all participating sectors (Brown et al. 2001). The maximization of revenue is very essential objective for business owners and stakeholders to continue and expending their operations. Revenues are one of the indirect indicators for the sustainability of tourism.

To evaluate the total revenue for tourism activity in TKPA, we use the formula to determine the volume of tourist spending per day during their stay in TKPA (Sun and Styres 2006; Agarwal and Yochum 1999).

$$Per\ Day\ Spending\ \left(P_{MYR}\right) = \sum_{n}^{i=1} \frac{Trip\ Spent\ \left(MYR\right)}{Length\ of\ Stay\ \left(n\right)} \tag{1}$$

Sun and Styres (2006) propose *Per Day Spending* formula in order to determine the average spending per day/night based on tourist's total spending and the length of stay. By understanding Eq. (1), we applied the data gathered from the tourists against duration of stays to determine what is the average of spending in TKPA. We then applied the numerical data to Eq. (2) to determine the estimated total revenue generated.

$$Total\,Estimate\,Revenue = \left(No.Tourist\right).\left(P_{MYR}\right) \tag{2}$$

However, the total estimated revenue are applied to the total spending of accommodation or basic provided tourism package that was applied in TKPA. To understand further the value of cents and dollars that circulate in tourism activity in Tasik Kenyir, we have to further analyze the willingness to pay (WTP), as an indicator of tourist satisfaction or visitation enjoyment (Breidert et al. 2006; Schiffner et al. 2002; Rodgers 2001). Hence, we refer to Eq. (3);

$$WTP_i = \alpha + \beta X_i + v_i \tag{3}$$

Where, α is the spending per night, β is the total tourist or respondent per group of X, X is the matrices value of spending for tourist and v represent the value of. While $i = 1, \ldots, n$.

Ecological and Environmental

Ecology and environment are the cog and gear that grind all aspects into place. Without the attraction of nature, Tasik Kenyir will lose its brilliance. Hence, it is important to manage and preserve the natural environment of Tasik Kenyir while producing development plans to align with economical aspects that correspond to

Table 2 Possible impacts of scenario drivers on income based onto ecological value (Brown et al. 2001)

Scenario driven	Enhanced environment management	Impact	Without enhanced environment management	Impact
Extensive tourism development	1. Larger hotels, houseboats, more amenities produce a larger range of tourists	+	1. Larger hotels, houseboats, more amenities produce a larger range of tourists	+
	2. Increase in management of environment leads to strict regulations and developments of research and conservation bodies	+	2. No change in Park or Environmental Management	−
Restricted tourist development	1. Smaller hotels, houseboats, some amenities restricted for adventurous tourists	−	1. Smaller hotels, houseboats, some amenities restricted for adventurous tourists	−
	2. Increase in management of environment leads to strict regulations and developments of research and conservation bodies	+	2. No change in Park or Environmental Management	−

Table 3 Summary report on Tasik Kenyir (Ketengah 2015)

Year / Item	2010	2011	2012	2013	2014
Total tourists arriving	221,302	265,241	309,908	467,678	649,94
Total spending for TKPA (MYR '000)	1605	2507	4500	3735	3640

Sources: Annual Report for 2012–2014, Lembaga Kemajuan Terengganu Tengah (Ketengah 2015)

the expectations of stakeholders. Based on Table 2, there are some scenarios that are used to determine the direction of MCA's in Tasik Kenyir.

The scenario in Table 2 was divided into two categories; Development with Enhanced Environmental Management or Development without Enhanced Environmental Management. This two scenarios were introduced by Brown (2002) as indicators of development direction. Hence, by using these indicators as a framework of evaluation, the following variable was developed; accommodation (Hotels and houseboat), amenities, management and restrictions. The impact was noted using positive (+) and negative (−) based on its effects towards the economy and environment. Hence, the overall picture of evaluation could be seen.

Discussion

Based on data that was provided by the Terengganu Tengah Authorities (KETENGAH), the basic situation of TKPA was as shown in Table 3.

Table 4 Estimate impact of four possible scenarios and one existing scenario on TKPA

Criteria	Scenario				
	A	B	C	D	E
Economic					
1. Economic revenue to Tasik Kenyir (MYR'000)	25,000	35,000	40,000	120,000	90,000
2. Visitor enjoyment of TKPA (MYR '000)	–	–	–	–	–
3. Rate of revisits (%)	−1.31	0.921	−4.032	3.0	1.0
Social					
4. Local employment (jobs)	30	50	84	84	42
5. Informal benefits (score)	2	4	4	6	3
6. Local excess (score)	6	5	6	7	6
Ecological					
7. Water quality (score)	3	1.2	2.2	1.9	2.2
8. Management of protected species (score)	2	7	4	7	5
9. Management of protected land (score)	3	6	1	5	4

This research part describes an entry point into stakeholders led negotiations on priorities for management. The set of standardized order information for the MCA's is adopted in order to engage with all stakeholders for evaluating their priorities in terms of decision-making criteria based on development scenarios and outcomes that have been introduced (Randall and Richard 1982). Evaluation of repercussion for all scenarios and outcome on the criteria as shown in the effects table (Table 2) is the initial step in MCA and help to generate order ranking for the advancement of the scenarios, the highest scoring scenario can be treated as the most preferred scenario. Table 4 shows the ranking order of characters for a range based on preferences. These ranking were compared with a base case of equal weighting of economic, social and ecological criteria.

Based on Table 4, the different scenario schemes contribute to different outcomes. By using scenario E as the controller, the classification of results could be organized from poor to excellent based on their performance. Scenario A proves to be the poorest approach as it produces a total of MYR 25mill of revenue per year based on the same number of tourists in 2014. This, however, worsens as the amount of revisits plummeted to −1.31% from 1% total revisits. Due to the limited development, the amount of spill-over are especially low as scenario A provides 30, 2 and 6 for employment, benefits and local accessibility. However, scenario B produces more pleasant results as the total revenues are MYR 35mill from the same amount of tourist arrival. However, as the development strategies are very limited, the amount of revisit was only 0.921% due to the limitation of amenities and 50, 4 and 5 for employment, benefits and local accessibility, respectively.

For scenario C performance, the total revenues are MYR 40mill and the rate of revisiting are −4.032%. The negative rate of revisiting are due to the overall performance of the environment and amenities in TKPA that received minimal or no maintenance. However, the employment, benefits and local accessibility score are relatively high at 84, 4 and 6, respectively, due to the demand. However, for scenario

D, the total performance are excellent compare to scenario A, B, C and E. The revenues are MYR 120mill yearly with the same amount of tourists arriving. The relative revisit rate of 3% represent the satisfaction of the tourists from the services and nature evaluation. Scenario D also provide a satisfactory score for both social spillover and ecological variable. Hence, scenario D; Extensive tourism development with complementary environmental management are the best direction of development of TKPA.

Type of Scenarios Involved in estimation:

A: Restricted tourism development without complementary environmental management.
B: Restricted tourism development with complementary environmental management.
C: Extensive tourism development without complementary environmental management.
D: Extensive tourism development with complementary environmental management.
E: Stagnant tourism development and environmental management.

Conclusion

By embarking this concept, it means that not only can stakeholders be definitive about their arrangements of preferences for decision-making, but they could also see the potential outcomes and impacts in terms of the ranking of development strategies based on these priorities. In a nutshell, they can be notified about the trade-offs inherent on management decisions for resource use. The trade-off approach that was used to understand the different introduced schemes that can be used to determine the direction of development in Tasik Kenyir could be enhance with further assessment using other method in Multi-Criteria Analysis. Findings from this study and the approaches on Multi-Criteria Analysis could use to sizing up the ripple effects onto biological, ecological and economical aspect of Tasik Kenyir and this could be used by other researchers as a baseline comparison or even guideline for their study in this area. However, this study approach are more onto relational approach on limited aspect from the study and trade-off analysis was used to bring together diverse quantitative and qualitative information for decision-making to rank development scenarios on the basis of stakeholder values. Hence, a deeper study focusing on wider reciprocal relationship between economic, heritage, ecology, society, tourism and their values should be applied. The state activities, projection governance and policy intervention that effluence onto all the variable mention seldom shows the effects on short-term period of time. Hence, a continuation of the study and comprehensive research are needed to develop further understanding of what happened and what will happen in the future.

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