Redefine Green Economy and Sustainable Development: A Trade-Off Analysis Approach on Tasik Kenyir, Terengganu, Malaysia

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Abstract This paper discusses the assessment of a green economy in Tasik Kenyir using trade-off analysis to uncover its potential as an eco-tourism attraction. Trade-off analysis is a statistical method composing many tools for identifying optimal solutions to solve complex problems, and is commonly used in decision-making; utilising statistical formulas combined with soft science, policy studies and economics. Considering certain aspects and dynamics of variables in Tasik Kenyir and its development policies, trade-off analysis should play an important role in planning formulations for its "trading-path", and determine the most sustainable approach in handling its development, ecology and other resources. Hence, using

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numerical research, this study aims to develop a number of strategies for sustainable development to meet stakeholder values, instead of presenting alternatives with inherent benefits. This will assist stakeholders in terms of promoting conservational benefits of nature-based development activities without neglecting the ecosystem's balance in Tasik Kenyir.

Keywords Green economy · Trade-off analysis · Policy · Sustainable development · Tasik Kenyir

Introduction

The green economy and sustainable development concepts have emerged in recent years to counter adverse changes in the environment (e.g. climate change and decrease in non-renewable resources). Due to this, many scholars are convinced that we cannot continue to utilise the world's resources without consequences (Lynn and Eda 2013; Ottman 1998; Wasik 1996). Lynn and Eda (2013) defined "green economy" as a method that aims to reduce the use of ecological scarcities, environmental risks and ultimately promote sustainable development without degrading the environment. The United Nations Environment Programme (UNEP) task force, environmentalists, researchers and many organisations have conducted research and talks regarding the green economy to orchestrate a better understanding. However, the discussions cover a wide range of subjects, including fiscal reforms (Markandya et al. 2013; Ekins and Speck 2000; Kosquela and Schob 1999), financing, energy transition, greening of agriculture or aquaculture (Safiih et al. 2015; Mu'tamar et al. 2013), green jobs promotion, economic modelling and green economy indicators.

According to experts, the most complements for green economy initiatives come from green tourism, also known as eco-tourism (Maharaj and Keith 2015). Terengganu has the most abundant green tourism sites in the east coast of Peninsular Malaysia. The rich biodiversity and unique natural places, such as islands (Pulau Redang, Pulau Perhentian, Pulau Bidong, Pulau Yu Kechil/Besar and Pulau Kapas), wetlands (Setiu Wetlands), cascades (Tembakah cascade, Sekayu cascade, Belatan cascade and Payung cascade) and Tasik Kenyir (the largest man-made lake in the country) may be explored to discover their full potential as green tourism sites. Tasik Kenyir still has plenty of room for future growth and development in terms of facilities and services to meet the state's vision on eco-tourism (KETENGAH 2012, 2013, 2014; Zakaria et al. 2000). However, to uncover its potential, there is a need to understand the value of Tasik Kenyir as a tourist attraction. To evaluate the values, its existence may be categorised into two as shown in Fig. 1, which are use value and non-use value (Rusli et al. 2008; Munasinghe 1993).

From Fig. 1, we may conclude that there are different types of economic valuation that describe each and everything in green economic valuation. Eugine and Miller (1974) indicated three, namely bequest value, existence value and option value, which have been amended by Munasinghe (1993) into direct and indirect

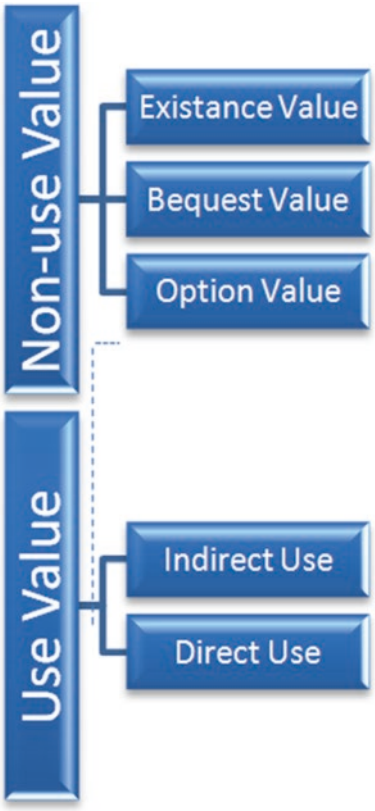

Fig. 1 Total economic value, concept and value in application of Tasik Kenyir as a tourist attraction. (Rusli et al. 2008; Munasinghe 1993)

values. The bequest value, in economics, is the value of satisfaction from preserving a natural or historic environment. In other words, the natural heritage or cultural heritage for future generations. It is often used when estimating the value of an environmental service or product. Existence values are an unusual and somewhat controversial class of economic values, reflecting the benefits people receive from knowing that a particular environmental resource, such as the Antarctica, the Grand Canyon in the United States, and even endangered species or any other new organisms that exist. The option value refers to what is placed on private willingness to pay for maintaining or preserving a public asset or service, even if there is little or no likelihood of the individual actually ever using it.

Furthermore, we need to look at other dimensions of common valuations in economics, the direct and indirect values (Rusli et al. 2008). The most common explanation of direct value is the primary spillover of a development. This amplifies the direct use or value of the first cluster of people or organisation that directly benefits from economic spillover (Fig. 2). Thus, the subsequent groups may be defined as the indirect value.

All related values are simple to be determined as it only consists of singular dimensional valuation. However, in green economy, we face difficulty in this study because some variables are hard to determine its value as the perception changes

Fig. 2 Total economic value, or general spillover for direct and indirect tourism expenditure. (WTTC 2016; Dwyer et al. 2010)

according to conditions (multi-dimensional); e.g. the value of bees is different when presumed for making honey or being used to pollinate flowers. Therefore, to fill the gap, many researchers have come up with mathematical methods to estimate the values of nature; and one of those used in this study is known as trade-off analysis (Lola et al. 2019).

Green Development

Valor (2008) believed that perceptions of green consumption practices are more time-consuming, costly and stressful. This is true in some sense as we observed that majority of the green products compared to non-green products are priced significantly higher, making them niche products targeted mainly to people with higher disposable income (Markkula and Moisander 2012). This principle also applied onto tourism development, especially in green tourism (eco-tourism) that are one of the many sub-system in the green economy. Menning (1995) indicated that tourism development is not as easy as matching product and supply with tourists, but it must also consider the locals' acceptability. Local acceptability of tourism development is the outcome of what Telfer and Sharpley (2008) called the "development dilemma," i.e., for tourism development to be successful, communities in the destination must perceive that the benefits from tourism will outweigh its costs. Since resident support for tourism development is essential, it is also important to

understand the type of tourism that is most likely to succeed in the development region (Suess and Mody 2016). Therefore, there is a need to explore the potential trade off that includes different perspectives of development to satisfy the above dilemma. Since residents, stakeholders and others are involved in the development region, Suess and Mody (2016) suggested the involvement of all participants to gather the clear view of trade off. By accessing Table 1, we can gather enough data regarding trade-off analysis that are needed in the study (Brown et al. 2001).

By relying on verbal or written descriptions of product attributes, it can be presumed that all behaviour being modelled is cognitive, because the process of understanding a verbal or written description is itself a cognitive behaviour (McCullough 1998; Francois et al. 1991; Luce 1959). Hence by understanding certain virtues of Terengganu tourism and Malaysia's policies, we concluded that the expectations of green economy application in Tasik Kenyir would give birth to those stated in Table 2.

Table 1 Suggested methods of engaging different stakeholders (Brown et al. 2001)

Type of stakeholder	Example of group	Method
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	Policymakers	Individual interviews
Workers within hierarchical organisations	Government departments	Structured group interviews

Table 2 Expectations in trade-off analysis for Tasik Kenyir based on preliminary analysis

Variable	Expected Sign	Explanation
Ecological management	+	Utilisation of ecological management leading to expectations of higher sustainability of environmental entities. Green visitor preferences surplus will result in higher tourism preferences.
Tourism capacity	–	Expectation of overall utilities, physical attractions and other preferences to decline with congestion. This will cause the site to experience a reduction in tourism preferences and tourism life cycle (TLC) degradation.
Economic spillover	+	The expectation of tourism bloom leading towards higher growth of tourism services, and contributing positively to local economic growth. Tourists believe that an increase in employment may support the needs of tourism and sustainable development of the local economy.
Conservation charge	–	Expectation that users are unwilling to pay more for better services. This situation explains the reduction of marginal utilities, which indicate visitors will pay if and only if the services are on a par with the price, or when the price offered is lower.
Accessibility	+	The increase in transport services to the tourist attraction will lead to better accessibility. Increase in information accessibility will also contribute to positive development.
Fiscal growth	+	Expected revenue towards government coffers via taxes as more visitors arrive.

Methods

Trade-off analysis measured the weighing of respondents' preferences for various product features (McCullough 1998; Francois et al. 1991; Luce 1959). In these cases, respondents were asked to consider alternatives and state a likelihood of purchase or preference for each alternative (Lola et al. 2019). This method was suitable only for simple decision analysis. In order to simulate multiple criteria, the corresponding situation required the involvement of several decision tools.

Conditional Logit Model

Conditional Logit is a common estimator for choice modelling (Train 2003; McFadden 1973). In trade-off, Conditional Logit was used to empirically determine the preferences of subject n, towards J alternative (consider J as an alternative set of n). Hence, the Conditional Logit vector could be written as in Eq. 1

$$P_{in} = f\left(X_{in}, X_{jn}; j \neq i, \beta\right) \tag{1}$$

where;

X_{in} = choice of alternative i over n respondents; where the alternative is mutually exclusive and finite;

P_{in} = probability of respondents n choosing the alternative i depends on the objective alternative i compared to other alteratives. (X_{in} related to all X_{jn}; $j \neq i$, β where all choice set exhaustive in all possible alternative are included); and,

β = marginal value of each green economic attribute in respondent choice set.

In this case, the functionality of observer data, f, was the function that related all observer data with choice probability. Conditional Logit specified up to some vector of test parameter, β, to be estimated.

Trade-Off Analysis

Considering the basic linear programming problem, we needed to identify all (infinite) possible combinations of values of a set of decision variables, x_j; a set which maximised a given linear objective function while also obeying a set of constraints which restricted the combinations of x_j values that were admissible (Community 2009). The constraints were also all represented by linear functions and, in addition, the decision variables were required to take only non-negative values as in Eqs. 2 and 3:

$$maximise \sum_{n}^{j=1} a_i x_j \tag{2}$$

Subjected to;

$$\begin{gathered} \sum_{n}^{j=1} a_{ij} x_j \le b_i \left(i = 1, \ldots, m\right) \\ x_j \ge 0 \left(j = 1, \ldots, n\right) \end{gathered} \tag{3}$$

where;

x_j = decision variable where the stakeholder holds control;
a_i = numerical parameter whose related and have reflect relative contribution;
$\sum_{n}^{j=1} a_i x_j$ = objective function;
$\sum_{n}^{j=1} a_{ij} x_j \le b_i$ = function constrain which expresses the value of x_j are limited towards the environment of the decision-maker; and,
$x_j \ge 0$ = non-negative constrain that requires x_j to not take a negative value.

However, assuming the corresponding analysis consists of (1) and parts of all decision variant (V_i) and a multidimensional option or scenario (S_j); i = 1, 2, …, m and j = 1, 2, …, n. Hence, a matrix consisting of $m \times n$ evaluated criteria, the evaluation of the best scenario (R_{ij}), could be determined in Eq. 4.

$$R_{ij} = \max/\min \sum_{n}^{j=1} a_i x_j = \left(V_i, S_j\right) \begin{bmatrix} C_{1,1} & \cdots & C_{1,j} \\ \vdots & \ddots & \vdots \\ C_{i,1} & \cdots & C_{i,j} \end{bmatrix} \tag{4}$$

where each criteria ($C_{i,j}$) is determined using score-based evaluation of data collected (Rotarescu 2011).

Discussion

This part of the study described an entry point into stakeholder-led negotiations on priorities for management. The set of systematically-ordered information for the trade-off analysis was used to engage all stakeholders to evaluate their priorities in terms of decision-making criteria based on development scenarios and outcomes that had been introduced. Therefore, by understanding the point of multi-evaluation

by Rotarescu (2011), we could determine that there were at least four kinds of trade-off probabilities (P_{in}) that could be considered for analysis later in the extensive study on Tasik Kenyir. The probabilities involved were:

A:	Limited tourism development without complementary environmental management;
B:	Limited tourism development with complementary environmental management;
C:	Extensive tourism development without complementary environmental management;
D:	Extensive tourism development with complementary environmental management; and,
E:	Stagnant tourism development and environmental management

It is fair to say that out of five, four probabilities represented the surface of green economy and tourism application of trade-off analysis in Tasik Kenyir. Choosing between scenario for tourists to determine the value of green economy and sustainable development was one of the ways to evaluate the core in feasibility of applying green economy in Tasik Kenyir. Hence, with further research in this direction, we could provide insight for the deification of a green economy.

However, the preliminary research was insufficient to cover the overall aspect in valuation. Hence, to amplify the needs of evaluation, new dimensions need to be covered. Marginal Values (Ecological Management, tourism capacity, tourism life-cycle evaluation, economic spillover, conservation, accessibility and fiscal growth) that emerged from eco-tourism should be further evaluated and investigated. Therefore, we suggest some model that should be used and incorporated in the trade-off analysis based on previous studies, such as the "spending per day" model (Sun and Styres 2006; Agarwal and Yochum 1999) with its "per day spending" formula, the "willingness to pay" (WTP) concept as an indicator of tourist satisfaction or visitation enjoyment (Breidert et al. 2006; Schiffner et al. 2002; Rodgers 2001), and other suitable models. This would hopefully help to cover all necessary dimensions of green economy evaluation.

Conclusion

If the Malaysia was to meet its environmental targets, it would need to apply a wider range of measures; research, policy and assorted application. Trade-off analysis was a collection of standard statistical techniques that provided objective insight into consumer preferences using a quantifiable and repeatable approach. There was a perception that trade-off research was expensive and difficult to conduct, but with the right design, it could be surprisingly efficient and flexible. Trade-off analysis extended to informed policy planning, setting of fees and charges, understanding consumer behavior, and identifying values and priorities. The trade-off approach that was used to understand the different introduced scheme that might be used to determine the direction of development in Tasik Kenyir could be enhanced with further assessment using other methods. These included the analytical Hierarchy

Process (AHP), multidimensional analysis or multi-criteria analysis, and other suitable methods that could bring the trade-off analysis onto another level.

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