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Environmental Impact of Tourism on Vembanad Lake

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ABSTRACT: Vembanad wetland is the largest wetland system in India which is the official site of the Ramsar convention on Wetlands. Human intervention on the lake is severe which affects the function, structure and entire composition of the Vembanad wetland system. There is a drastic growth in tourism sector in and around Vembanadu Lake for the past two decades. This paper focuses on the impact of tourism on Vembanad lake system and also to the environment. As a result of the tremendous growth of Backwater tourism in and around the Vembanad Lake, the waste composition has increased to a large extent. The major waste from tourism sector was identified through a questionnaire survey, on the peoples residing near the lake and these waste were quantified through different methods. The performance evaluation of the existing waste management system was conducted and found to be ineffective. Since a lack of a proper waste management system, this paper aims to propose a modified waste management system which is economically and socially beneficial. The economic analysis was done by conducting cost benefit analysis to the 4 alternatives and the existing system. These four alternatives were designed within the framework of the modified waste management system. The payback period of these alternatives and existing model were calculated and based on this, the most economical and social waste management system was proposed

KEYWORDS: backwater tourism, performance evaluation, waste management, cost benefit analysis, paybackperiod

I. INTRODUCTION

Vembanadu Lake spreads in Alappuzha, Kottayam and Ernakulum districts of Kerala which forms Vembanad Lake wetland system of an area of 2033.02km². In the past twenty years the growth of tourism sector in and around the Vembanad Lake is spectacular. Backwater tourism as emerged as the backbone of the tourism sector of Kerala state which leads to the tremendous increase of Houseboats in addition to many resorts which developed recently around the shore of lake. Kerala comes under the list of 50 places of Life time published by National Geographic Traveler scenic beauty of the region attracts the domestic as well as the foreign tourists. Kuttanad wetland system including Vembanad Lake which is now receiving global attention because of its unique feature which is below sea level permits the cropping of Rice in large quantity and permits the harvest of fish and an area which is thriving for the tourism where the nature beauty is at the peak among the Ramsar site.

Percentage of increase of foreign exchange earnings from tourism in Kerala in last decade is 68.9%. Rise of tourism sector results into shift of employment, one or two member from each house is now engaged in tourism industry as houseboat operators or other employment related to house boat and backwater tourism. This shift in employment sector from agricultural to the service sector is caused as a result of change in attitude and perception to the traditional occupation like agriculture. Shift of employment itself indirectly effects the agricultural production of the region. Uncontrolled growth in the number of the houseboat in Vembanadu wetland system affects the environment system of lake. This project focuses on the adverse effect of the backwater tourism growth on the environment system of wetland and livelihood of the area around the lake and to find out a proper waste management system in the region.

II. LITERATURE REVIEW

There has been an ample amount of literature in the domains of tourism and its causative factors from various studies conducted around the globe. Many of them are based on different aspects. By looking through the literature in environmental impact of tourism the commonality observed in the existing literature is that tourism can affect Socio-cultural of host community which includes changes in traditional lifestyles, value systems, family relationships, individual behavior and community structure. Even though the tourism sector in the region has greater economic

benefits which are employment income and foreign generations there are also negative socioenvironmental impacts (Zacharias and Manalel, 2010). Tourism development can be of benefit (e.g., job creation, image enhancement). However, it could also have negative impacts on the biophysical environment (e.g., soil pollution, water pollution, air pollution, ecosystem degradation) and social/cultural environment (e.g., loss of the traditional culture, increase in crime) if not well planned, developed, and managed (Mohammad, 2016). In another one the impacts of tourism on environmental attributes such coral reefs, water, fisheries and beaches are discussed briefly. The impacts of tourism towards environmental attributes range derives from tourism activities such as boating, snorkeling, diving and fishing. Improper and irresponsible behavior of tourist is also believed to be a significant reason that contributes to detrimental effects on the environmental attributes (Murugadas and Badaruddin, 2014). The different mind-set of tourist derives from the different level of environmental literacy that they have. The concept environmental literacy that consists of not only knowledge on the environment and its issues but also includes disposition components of attitudes, sensitivity and motivation are discussed thoroughly. Intention to act or intended behaviour that is explored in this (Ferry, Lucky, Dietrich and LilikBudi, 2016). The link between the number of threatened plant species and tourism which was proxies by the number of international tourist arrivals (Muzafar and Radamd, 2016),). Tourism has been an important sector to both the developed and the developing economies. Although we recognized the great benefits of the tourism sector to the national income, the tourism activities have also been connected to the negative impact on the economy in particular to the environment. One crucial aspect of the negative impact as a result of increased tourism activities are on the loss of biodiversity. Tourism has an adverse effect on the environment in Eastern EU. Finally, short-run heterogeneous panel causality test results suggest that tourism, causes CO₂ emissions in Eastern EU while economic growth and CO₂ emissions cause tourism in Western EU. Overall, findings suggest that tourism plays an important role in accelerating economic growth however; its role on CO₂ emissions largely depends on the adaptation of sustainable tourism policies and efficient management (Alexandra, Christos, Nicolas, Dimitra, 2015). On the other hand, protected riverside area can make rivers as a source of water, water transport and water tourism destination. Nowadays, water tourism is increasingly popular to people. Local residents should be given an understanding of the importance of tourism activities mainly based on the river environment and things that need to be done to support these activities. River cleanliness must be maintained and preserved (Tri Rahayuningsiha. Hariri and Lilik, 2016). Another one puts forward a generic methodological scheme, based on Life Cycle Assessment (LCA) principles, in order to estimate the environmental load in areas of considerable tourism activity. A comparative assessment is realized for characteristic hotel categories. Their respective contribution to environmental burden attributed to tourists' transport and accommodation services is assessed. Upmarket hotels impose larger absolute impacts on the environment, especially in the consumption of resources. LCA can play a crucial role in decreasing the complexity in the strategic planning of tourism, especially in local-to-regional areas of concentrated tourism activities (Orkut and Murat, 2014). Tourism is being considered as a development instrument in order to boost a country's economy and has become part of the global industry. However, tourism is also one of the actors that is responsible for environmental depletion, due to the constructions of buildings and tourism activities (Hsin and Shiann, 2013).

III. METHODOLOGY

Research is a process of arriving at an appropriate solution to a problem through a systematic approach. This systematic approach will be obtained through a well-defined research methodology. In this project the methodology involves three phases. In phase-1, the problem was identified through a clear background study. After the problem identification a detailed literature survey is a need to define the problem. From the problem definition, the main objectives of the project were determined. As the first step the different types of waste generated from tourism, that affect the Vembanadu Lake was identified. In phase -2 the major waste from the generated waste should be identified. For this a questionnaire survey was conducted and the data was collected from the people residing near the shores of the Vembanadu Lake. In this phase the most predominant waste was determined and was estimated. In phase -3 the existing waste management for the major waste was studied and the performance evaluation was conducted. Based on the evaluation, modification was done to the existing waste management system. Different alternatives were identified and conducted a cost benefit analysis, to find out the best alternative in the waste management.

IV. RESULTS AND DISCUSSIONS

Rapid increase in house boats, hotels and resorts due to the fast growing back water tourism in Vembanadu Lake causes a tremendous increase in waste generation. Hence there is a lack effective of waste management system in Kumarakom. The main objectives were to identify and estimate the amount of major waste generated from tourism which affects the

Vembanad Lake, to conduct a performance evaluation of the existing waste management system and to modify the existing system and conduct cost benefit analysis.

4.1 Questionnaire Survey

A questionnaire survey was conducted as part of the study to understand the major waste from the listed ones and to evaluate about the existing waste management system. The questionnaire consists of 29 questions, out of which first 27 questions were using five scale and these questions were used to measure the effects of each waste components. 28 and 29 were used for rating the waste components for identifying the major waste. The survey was done with the people residing near Vembanadu Lake. Major waste generated from tourism was identified. Survey was conducted with 180 people residing in a stretch of 30km length and a width of 2km from the lake. The sampling technique used is area surveying. 3 respondents from 1Km² area are selected. The number of household units who participated in the survey was 180. The respondents were approached individually at their homes to get their responses [3]. The major findings from the survey include different negative impacts of tourism and focus on the waste generation. By the help of this survey ,it has being identified that sewage from house boats, resorts and hotels and plastic waste dumped in boat jetties and small tourist spot are the major waste from tourism.

4.2 Quantification Of Major Waste

The major waste from tourism is found to be sewage and plastic waste from houseboats, resorts and hotels. The quantity of waste generated from tourism is identified. The unavailability of predetermined data of amount sewage and plastic generated was a limitation. So the quantification was a big task. The average estimation of waste generated was calculated by conducting a survey and field visits. Sewage from house boat is treated at DTPC sewage treatment plant and the sewage from resorts and the hotels is treated in their own plant. The quantity of sewage treated from house boats was obtained from DTPC sewage treatment log book, but the amount treated in resorts and hotels was not obtained, because they won't keep any records. Estimation of sewage is given below. Kumarakom, 103 registered house boats are there, as per the records given by the DTPC. The maximum amount of sewage is treated at the months of December and January. From the data an average of 65,520 litre of sewage is treated in every month.

To identify the amount of plastic waste generated in a month we conducted a survey and field visit to selected tourist spot. The survey was conducted for five consecutive days, at three times a day to get the exact amount of plastic items are dumped in six different spots. Table I shows the mean of the amount of plastic waste generated from the six tourist spot in Kumarakom, for five consecutive days. The plastic waste we are considering are drinking water bottles, soft drink bottles, ice cream cups, plastic glass, are the main plastic waste in these tourist spot.

From the survey the amount of plastic waste generated from hotels and resorts was calculated. In a month approximately 4,665 kg of plastic is generated from the hotels and resorts in Kumarakom. It's just an approximate amount, this can vary on seasons. From the 21 resorts and hotels these quantities of plastic waste is generated. In this we are considering only on drinking water bottles of 1 litre and ½ litre. In addition to these many other type of plastic waste can be generated such as icecream cups, plastic bags, and soft drink bottles so on. This waste can't be estimated due practical difficulties.

Annually the least amount of plastic generated will be 55,985 kg from hotels and resorts

Table I
Quantity of main plastic waste generated at different tourist spot

Sources	Unit	Wt./No.	Mean Total(No:s)	Mean Wgt(Kg)
Water Bottles	No.s	27.98	112.2	3.13
Soft drink bottles	No.s	30.25	94.8	2.86
Ice-cream cups	No.s	5.97	73	0.435

4.3 Performance Evaluation Of The Existing Waste Management System

The major waste from tourism are found to be sewage and plastic waste from houseboats, resorts and hotels. The present system of waste management in Kumarakom is not very efficient. The only way of treatment is done for sewage. The sewage from the hotels are treated in their own treatment plants. Most of the resorts and hotels have treatment plant. The sewage from house boats are treated in sewage treatment plant in DTPC, from the data obtained it is also ineffective. Out of the 103 registered house boats, only 70 of them is undergoing sewage treatment from the plant at DTPC. They are charging a minimum amount of Rs.1250/- monthly from these house boats. The existing system has a cash inflow of Rs.1, 26,500/- and has a payback period of 10.5 years. In the case of plastic waste there is no proper segregation from the panchayat or from the DTPC Kumarakom. The plastic waste are simply dumped in open spaces and also near the shore of the Vembanadu Lake. These waste are collected by some unauthorized people daily. There are a limited number of waste bins are situated at different locations. Most of these plastic waste are dumped in open spaces.

The performance of the waste management system in Kumarakom was also evaluated in the questionnaire survey. The questionnaire survey also consists of questions about the management of waste and the satisfaction of people towards the waste management. Out of 180 respondents, 73% of the respondents say that sewage treatment is ineffective and also 67.2% strongly agree that waste management system in Kumarakom is no properly managed. 69 % of respondents stated that cleaning is very important because their no collection or segregation process is taking place.

4.4 Modification of the Existing Waste Management System

The present waste management system in kumarakom has to be modified. From the performance evaluation of the existing system there should be proper way of collection and segregation of the waste. Sewage from house boats should be collected by some water transport and some fees should be collected from the house boats for treating the sewage, since most of the hotels have sewage treatment plant their isn't necessity of collecting sewage from the resorts and hotels. Since there isn't a proper management of plastic waste, the collection and segregation is also important. the establishment of collection bins at different spots are important for collection. These waste are should be collected by worker and to be segregated in a collection center and to be sold to get some benefit. This system has social benefit than economic benefit. The modified waste management system focuses only on two predominant waste i.e. Plastic and sewage. by the questionnaire survey it has being already stated. the above frame work is used for modifying the existing waste management system. Here the sewage from the resorts, hotels and house boats are collected and then transported to the treatment plant. The treated sewage is flowed out to the Vembanadu Lake. Similarly the plastic waste from resorts, hotels and from other tourist spot should be collected accordingly and transported and segregated at suitable collection centre. This frame work will help to reduce the effects of plastics and sewage. Within this frame work we implementing four models. Since this is a social issue, it has more social benefit than economic benefit. In this project we are dealing with four alternatives models from this frame work. For deciding the best alternatives we are conducting a cost benefit analysis for each alternatives. These alternatives will be made from this frame work. The implementation of this modified waste management system has both social and economic benefit.

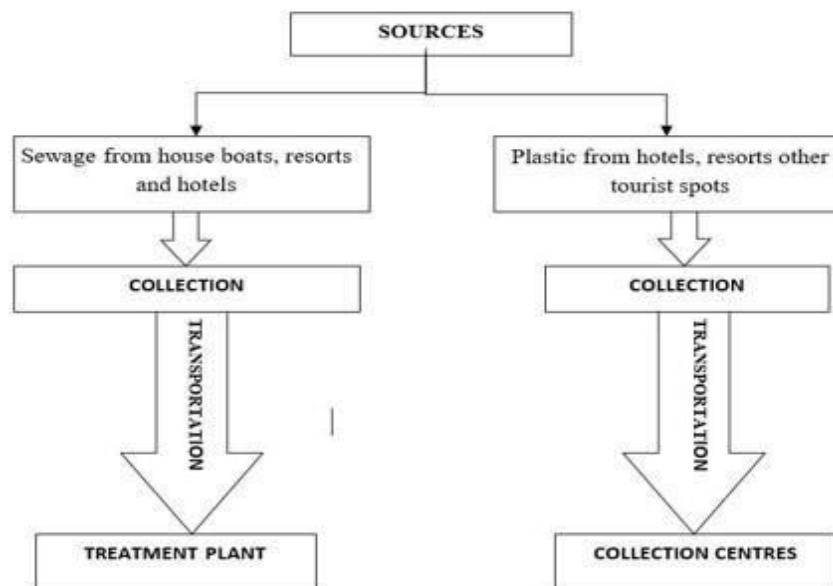


Fig. 1 Modified Framework of the waste management System

4.4 Pay Back Period

The payback period can be calculated. For computing the payback period the fixed investment required for every model and cash flows from that model have to be calculated. For calculating fixed cost of alternative models the expenses related to machinery and other pre-operative expenses are estimated. Next step was to calculate the variable costs associated with different models. This calculation not only helps in DPP but also it will provide an idea about working capital requirements. Here the variable costs involves, labor payments, utilities payments and maintenance costs. After calculating the variable costs the total revenue that can be obtained from the models are calculated considering the price of outputs from the model. This total revenue is subtracted with current revenue to find out the additional revenue obtained from the models. Additional revenue is further subtracted with variable cost to calculate the additional cash inflow per year for a models.

Table II
Cost Benefit Analysis for Different alternatives

Model	A	B	C	D	E
Existing model	13,30,000	9,23,500	10,50,000	1,26,500	10.5
Alternative-1	Nil	Nil	Nil	Nil	Nil
Alternative -2	28,46,000	29,16,900	34,51,102	5,34,112	5.5
Alternative -3	38,31,000	33,12,900	28,39,893	Nil	infinite
Alternative-4	37,15,500	29,96,000	31,42,102	5,46,012	7.5

A-Total Fixed investment B-Variable cost per year C- Total revenue
D-Cash inflow E- Payback Period

Mathematically Fixed cost (A) = cost of machinery + installation charges Variable cost (B) = labor payments+ utilities payments+ maintenance costs Total revenue(C) = Sum of revenues obtained from all output products from the alternative Cash inflow per year (D) = Total revenue – Variable cost Pay Back Period (E) = Fixed Cost/Cash inflow All of these parameters for different models are calculated and the results are as shown in table –II. By conducting the cost benefit analysis for each alternative, the best alternative was found to be the second alternative.in this case the payback period was found to be 5.5 years. In these alternatives the sewage is not collected but these are directly treated from transporting the sewage from the house boat to the tank. In this the number of house boat treated should be noted, the first and the third alternative can't be implement because the total variable cost is more than the total revenue. The fourth alternative has a payback period of 7.5 years. In this alternative the collection is done properly as compared to the fourth alternatives. For an effective waste management the fourth alternative will be selected, because it provides both social and economic benefits. When compared to existing model, collection of sewage and plastic waste was not done.

V. CONCLUSION

Even though the tourism sector in the region has greater economic benefits which are employment income and foreign generations there are also negative socio-environmental impacts. To understand these impacts to the environment of the Vembanadu Lake and to find an action plan is a need to the society. To understand these impacts a questionnaire survey can be done. For this a questionnaire was developed on the basis of the sources which affect the environment. The predominant waste from tourism were identified through detailed literature survey, field visits and also by conducting a questionnaire survey. By studying the existing waste management system in Kumarakom, it was found to be in efficient. A modified system was proposed for the proper management of waste. A frame work was suggested for this purpose, which mainly include collection and transportation. Within this frame work four different alternatives were made. The four alternatives were proposed, on looking forward the social and economic benefit of these different system to the environment and to the society. The decision of finding the best alternative was done, by conducting cost benefit analysis.Since this is a social issue we have certain limitations for making the profit.

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