

A Study on Benefit Evaluation of Recreational Resource by Developing Ecotourism in Tropical Islands

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Abstract

Although sustainable ecotourism has been developing for years, most people still travel purely for sightseeing, not ecotourism. The study applied Contingent Valuation Method (CVM) to analyze the non-use economical benefits of the ecological resource on the Lanyu from the very first of this research, and then applied the SWOT analysis to develop the strategies on Ecotourism. Finally, the research applied the Analytic Hierarchy Process (AHP) to evaluate the strategies and provide the basis of the priority actions to policymaker. The results of this study included: (1) the research indicated that the visitors were willing to pay 785.558 NT dollars per year per person for the resource conservation on Lanyu. The total economical benefits are 45,051,751 NT dollars and this datum also could regard as the funds of ecological conservation applying from the government. (2) The strategies of ecotourism in the future are in sequence: (i) invite the professionals to set up the plans of conservation and integration on Lanyu; (ii) set up the visitor center, offer the interpreter and exhibit the agricultural products; (iii) proceed the control of carrying capacity for the sustainable development on ecology industry; (iv) build the exclusive exhibition and website to display the database of ecological conservation; (v) found the authority institution.

Keywords: Ecotourism; Contingent Valuation Method (CVM); SWOT analysis; Analytic Hierarchy Process (AHP); Willingness to Pay (WTP)

Introduction

Along with the rapid growth of tourism industry, problems of impacts on environment in the touring process appear subsequently, such as traffic jam, over-exploration of natural resources and problems caused by improper behaviours of tourists. Therefore, in the concept of a sustainable development of tourist resources and a reduction of recreation impacts, how to ensure the tourism industry to develop under the principle of sustainable operation and meanwhile to assist the protection of environmental ecological system, furthermore to consider carrying out important environmental protection tasks including species diversity and climate changes become a subject that worth discussing.

In recent years, attentions have been aroused due to the fast development of island tourism, e.g. the "1st World Islands Conference", which was hold in Victoria Island, Canada in 1986 and focused on the research and discussion of mutual environmental problems and development solutions of island countries and regions, meanwhile encouraging experts and scholars who care for the development of islands in the world to devote themselves to relevant studies. Because of the vulnerability of island ecological environment and the restrictions of traffic, land, economic pattern, cultures of ethnic groups etc., the development of island tourism should be considered comprehensively and the planning must take the sustainability of ecology, economy and society into consideration at the same time [1]. Lanyu embodies unique topographic landscape and plentiful ecological resources due to the reason of geographic location, along with the particular cultural assets of indigenous people. It is very suitable to be developed into the base of "Tropical Island Ecotourism".

The so-called ecotourism means to combine the people's demand and environmental values by ecological methods in the premise of not destroying natural resource environment, benefiting the local residents' economy and improving the tourists' recreational experiences. It is a kind of recreation method integrating natural ecology and tourism

activities and belongs to a part of recreational resources. In the statistics of World Tourism Organization, the international tourism industry is growing with a rate of 4%, among which include the nature-oriented tourism with a rapid growth of 10% to 30% annually [2]. The U.N. named 2002 as the Year of International Ecotourism, and Taiwan also set 2002 as the "Year of Taiwan Ecotourism", promoting Taiwan ecotourism activities vigorously. Hence "ecotourism" will become the direction of developing tourism by the government in the future. In facing the tendency of indigenous tribes' expectations to promote the future vitality of the tribes by the development of ecotourism, how to convert the external tourist resources into the power of assisting the tribes to develop sustainably needs a careful planning and supporting measures of community assistance, so as to reduce and avoid the negative impact brought about by tourism activities. How to develop the ecotourist operation model by Yami people's independent management under the principle of sustainable development of ecology, economy and society is a subject that worth discussing.

Previous research results pointed out that there is no objective market value for the comparison of natural environmental resources, which is merely dependable to consumer's subjective values, i.e. the total effectiveness of environment to tourists shall be evaluated by the non-use values of future resource reserves [3-9]. Because many environmental values cannot be evaluated by market price, non-market valuation methods are developed. Among these methods, the one with

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the most extensive field of application is contingent valuation method (CVM), which can measure use value and nonuse value simultaneously.

The objective of CVM is to measure consumer surplus for the environmental attributes [10]. There are two advantages of this method. First, CVM is able to assess an individual's willingness to pay (WTP) in the present conditions and also values their WTP with hypothetical changes. Second, CVM is able to value trips with multi destinations by asking hypothetical questions for each specified destination [11]. CVM is a demand-side approach with hypothetical markets. It allows individuals to state their willingness to pay for changes in the quantity or quality of environmental goods and services [12]. It can be concluded from the above studies that this study plans to apply the CVM of non-use values as the evaluation tool for working out the development strategy by analyzing from consumer aspect, estimating the economic benefits of recreational resources of tourists to Lanyu and then performing SWOT Matrix Analysis Method. Finally, analytic hierarchy process (AHP) is applied to carry out evaluation of ecotourism development strategy, which can be provided to decision makers for their priority reference during execution.

Economic Methods to Measure Value

The CVM assesses individuals' willingness-to-pay for a specific scenario [13]. The underlying assumption is that individuals have preferences that can be elicited by creating a hypothetical market [14], and that conclusions can be drawn about how the utility of a product or service is perceived by individuals. The CVM uses a questionnaire to create a realistic but hypothetical market or referendum. It allows respondents to indicate their WTP [15,16]. The basis of CVM is the questionnaire. In the implementation of investigations, the most frequently used method was interview [17,18], then followed questionnaire mail and phone calls were the least used method. Because CVM is to create a hypothetical market and to ask respondents through the description of the hypothetical market of the price they are willing to pay or accept after the quality or quantity of goods change. Therefore it is difficult to describe clearly in phone calls and easy to have information deviation. Moreover, The National Oceanic and Atmospheric Administration (NOAA) also suggested carrying out questionnaire surveys by CVM, thus most of the researches carried out investigations by interviews.

Regarding the option of willing-to-pay price or willing-to-accept consumption, which has always been one of the controversial topics applying CVM, researches related to the topic mainly suggested that it was better to use willing-to-pay price for the valuation, therefore, most of the studies applied willing-to-pay price to inquire about the value [19]. Regarding the option of payment instruments, there are big differences in different countries. In abroad, most countries use tax as a means of payment [19,20] and then donation [21]; at home, donation is more frequently used than tax method [22]. The factors for consideration in choosing means of payment are whether the payment instrument has sufficient sensitivity and threat. In the pricing of amount additionally, pilot study or pretest are usually used to receive the figure and scope [22-24].

In the establishment of estimation model of WTP, parameters chose often include personal social and economic characteristics such as age, educational status and income [24-27], participation in relevant environmental groups and their donation conditions [26], former visits and application experiences [25] and the distance from resource site etc [24,25,27].

After the classification and analysis of relevant literatures, CVM

is an important approach for value assessment of environmental economy. Based on complete research design and implementation, it receives the pricing amount from respondents by questionnaire surveys and builds the relationship between affecting factors and pricing amounts by econometric methods to develop pricing function. Among the factors that influence pricing amounts, respondent's social and economic characteristic is often one of the key factors, particularly age, educational status and income. And the higher the educational status is, the more the income and the more the pricing amount is. In terms of age, there is mostly negative correlation, i.e. the elder the age is, the lower the pricing amount is. The attitude to environment or the supports to plans are often used in the establishment of pricing functions and the relationship between these two mainly shows positive correlation. Previous experiences, including visiting experience, application condition, participation in relevant protection groups and donation also influence respondent's pricing. The distance from resource site is also a factor affecting pricing amount. From the analysis of review on relevant factors affecting pricing amount, this study will focus on the factors of WTP of Lanyu for exploration.

Research Methodology

This study first investigates the satisfaction degrees of tourists to Lanyu's recreational resources and the willingness existed to assist Lanyu's ecological resources by questionnaires, in order to estimate its non-use economic benefits; secondly, this study simplifies the data by making use of factor analysis supported by experts' questionnaire, favourable to using SWOT matrix analysis method to study and work out the development strategy of ecotourism; finally, AHP is applied to carry out strategy evaluation, which can be provided to decision makers for their priority reference during execution.

Questionnaire design

For the purpose of evaluating the economic values of Lanyu's recreational resources, this study performs the evaluation on the basis of investigations of values felt by tourists on the usage of ecological landscape resources on the island for recreation, as can be taken as the cornerstone for Lanyu's sustainable development. The content of this questionnaire include 3 parts: the first part measures the satisfaction degree of respondents on Lanyu's recreational resources, the second part discusses the willingness of paying resource maintenance fees by respondents and the highest price that they are willing to pay by the method of CVM and the third part includes tourists' personal data of social and economic properties.

Sample design

This study takes tourists to Lanyu as the respondents and uses online questionnaires and on-site surveys as the sampling method, with the formal investigation period from March to May 2012. Questionnaires released actually were 600 copies, deducting the invalid 246 copies, the valid samples amounted to 354 copies, with a valid return rate of 59.0%.

Estimation method of the willing-to-pay value

The estimation of the value that consumers are willing to pay applied dichotomous choice inquiry approach in the past, and the configuration of reaction functions include two types: one is the Indirect Utility Function Method proposed by Hanemann in 1984 and the other is the Expenditure Function Method proposed by Cameron and James in 1987. Because Expenditure Function Method can utilize the information of binary data more completely than the Utility Function Method and it can receive more consistent results in the

empirical estimations, meanwhile the estimation results of these two reaction functions have no significant difference when estimating the economic values of the environmental resources [28,29], this study will use Expenditure Function Method to evaluate the recreational benefits of Lanyu. The following is the explanation of respondents' choices under an open double-bounded dichotomous pattern in the theory of Expenditure Function Method.

Assume Y_i^* is the function of actual willing-to-pay price of respondent i ($i=1, 2, \dots, n$), X_i' is the explanatory variable that influences Y_i^* , the configuration of the reaction function is as follows:

$$Y_i^* = X_i'\beta + \mu_i \quad (1)$$

Among the above: β is the co-efficient influencing X_i' ; μ_i is the error term, a normal distribution.

After the respondents experiencing two phases' dichotomous choice inquiry, they will have a relatively concrete answer on the actual willing-to-pay value in their minds, so if open questions are applied to ask respondents, the WTP amount will be acquired from respondents' answers, thus the amount can be used to perform the analysis and figure out the impacts of all variables to WTP amount. The application of asking respondents by Open Dichotomous Choice Approach will usually encounter the condition of answering the WTP amount by zero in the third phase. This means that maybe the WTP amount is really zero in the respondents' minds, or less than zero, thus the data type will appear with an observed value limited to zero. Therefore, the reason why this study hereby applies Tobit model to implement the estimation of respondents' WTP is because Tobit model can overcome the problem of limited observed value. Tobit model regards that all respondents have demands on the environmental resource commodity and assumes that the respondent i is willing to pay a resource maintenance fee of Y_i^* to ensure the maintenance of resources in his mind, the function type will be the same as equation (1). Therefore, when the WTP amount Y_i^* in the respondent i 's mind is bigger than zero, the answered WTP amount Y_i^T will equal to the actual WTP amount in his mind, as means we are able to observe the actual WTP amount in respondent i 's mind; if the WTP amount Y_i^* in the respondent i 's mind equals to or is less than zero, the filled WTP amount Y_i^T will only be shown as zero, but it may include a negative value of zero observed value for the WTP amount in the respondent's mind, i.e.

$$Y_i^T = \begin{cases} Y_i^*, & \text{if } Y_i^* > 0 \\ 0, & \text{if } Y_i^* \leq 0 \end{cases}$$

When the WTP amount Y_i^T answered by the respondent is bigger than zero, it means the answered WTP amount Y_i^T equals to or is bigger than the actual WTP Y_i^* in his mind; the probability can be expressed as:

$$\begin{aligned} \Pr(Y_i^T > 0) &= \Pr(Y_i^* \leq Y_i^T) = \Pr(X_i'\beta + \mu_i \leq Y_i^T) \\ &= \Pr(\mu_i \leq Y_i^T - X_i'\beta) = \Pr\left(\frac{\mu_i}{\sigma} \leq \frac{Y_i^T - X_i'\beta}{\sigma}\right) \end{aligned}$$

The probability density function can be shown as:

$$\begin{aligned} f(Y_i^* | \mu, \sigma) &= f(Y_i^T | Y_i^T > 0) \\ \therefore \Pr(Y_i^* \leq Y_i^T) &= \int_0^{Y_i^T} f(Y_i^* | \mu, \sigma) \\ &= \frac{1}{\sigma} \int_0^{Y_i^T - X_i'\beta} f(Z) dZ = \frac{1}{\sigma} \Phi\left(\frac{Y_i^T - X_i'\beta}{\sigma}\right) \end{aligned} \quad (2)$$

Among the above, σ is the standard deviation of μ_i , ϕ is the standard normal probability density function.

When the WTP amount Y_i^T answered by the respondent equals to zero, it means the actual WTP amount Y_i^* in the respondent's mind may be zero or less than zero, thus the probability can be expressed as:

$$\begin{aligned} \Pr(Y_i^T = 0) &= \Pr(Y_i^* \leq 0) = \Pr(X_i'\beta + \mu_i \leq 0) \\ &= \Pr(\mu_i \leq -X_i'\beta) = \Pr\left(\frac{\mu_i}{\sigma} \leq \frac{-X_i'\beta}{\sigma}\right) \end{aligned}$$

and the cumulative distribution function can be shown as:

$$F(Y_i^T = 0) = \Phi\left(\frac{-X_i'\beta}{\sigma}\right) \quad (3)$$

Among the above, σ is the standard deviation of μ_i , Φ is the standard normal cumulative distribution function.

By using equation (2) and (3), we can know the likelihood function of Tobit model is:

$$L = \prod_{Y_i^* > 0} \left[\frac{1}{\sigma} \phi\left(\frac{Y_i^T - X_i'\beta}{\sigma}\right) \right] \times \prod_{Y_i^* \leq 0} \left[\Phi\left(\frac{-X_i'\beta}{\sigma}\right) \right] \quad (4)$$

With the application of Tobit model analysis, if we replace all the variables in equation (1) with observed values received from estimation, we'll figure out the predicted WTP amount of all observed values. At this time, the expected value of tourists' actual WTP amount can be calculated from equation (5) (McDonald and Moffitt, 1980).

$$E(Y_i) = \Phi\left(\frac{X_i'\beta}{\sigma}\right) E(Y_i^*) \quad (5)$$

Under the big sample, the average WTP will be close to normal distribution; therefore the confidence interval can be expressed as:

$$CI_{1-\alpha} [E(Y_i)] = \Phi\left(\frac{X_i'\beta}{\sigma}\right) E(Y_i^*) \pm Z_{\frac{\alpha}{2}} \sqrt{\frac{\sigma_T^2}{n_i}} \quad (6)$$

Among the above, σ_T is the standard deviation of predicted WTP of all sample points in Tobit model.

Empirical Analysis

Sample profile

The results of this study show the following: "Males" are more than females (68.7%), the age scope are mainly between "21 to 30" (40.8%), "Unmarried" takes a larger part in the marital status item (56.5%), the "Undergraduate" takes a larger part in respect of educational background (52.3%), unemployed persons like "Students and houseworkers etc." are more than others in the occupation item (39.6%), many respondents' monthly income are "Below NT\$20,000" (48.6) and the residing county/city is mainly "Taipei county/city" (38.6). It can be concluded from the above that the distance factor has a close relationship with the choice of tourism. There are 92 persons (25.9%) who have participated environmental protection groups or societies, in addition, there are 18.9% of respondents have donated to environmental protection groups. Regarding types of companies, the proportion of "Family or relatives" is the highest, and then is "Friends or colleagues" (22.6%) and "Environmental protection groups or

societies" (11.7%). The visiting times within the past year is mainly "Once" (92.8%), as means that joining in ecotourism activities is not as common as going for a walk to a park. Hence the supply of activity information about the island should be enhanced so as to attract tourists from many places to come. In the question of whether they come here particularly for touring, most of the interviewed tourists come to Lanyu "On a special trip" (82.6%), the average stay of every tourist on the island is mostly "1 day" (72.6%), the major recreational activities that tourists usually enjoy in the island is "Experiencing the indigenous culture" (86.2), and then is "Ceremonies and holidays" (65.7%) and "Exploring natural ecology" (42.6%) etc.

Respondents' satisfaction on the recreational resources of Lanyu

Regarding the satisfaction on the natural landscape by respondents, those who are satisfied take the majority (78.2%), 15.6% of the respondents think it's ordinary. In the aspect of satisfaction on plant resources, 58.4% of the respondents are satisfied, 18.8% of the respondents think it's ordinary. In the part of satisfaction on animal resources, 71.9% of the respondents are satisfied, 12.8% of the respondents think it's ordinary. In the part of satisfaction on human resources, those who are satisfied (60.2%) and those who feel ordinary (29.5%) constitute 80%. In the aspect of public recreational facilities, almost 70% (66.4%) of the tourists feel dissatisfied, only 16.1% of the respondents feel satisfied. In the aspect of tourist crowd degree, respondents who are satisfied (80.6%) and those who feel ordinary (12.1%) are around 90%. Generally speaking, the respondents' satisfaction degrees on every recreational resources of Lanyu all fall in the range from ordinary to satisfied.

Respondents' willingness to pay for Lanyu's recreational resources

When respondents are asked for their WTP for Lanyu's recreational resources in the first phase, 60.6% of them are not willing to pay. When they are asked for the second time about the willingness to pay, there are 56.8% of the tourists are not willing to pay the resource maintenance fee, significantly different from the first phase. When respondents are asked directly for the third time regarding the amount they are willing to pay, it is discovered that the answered value that they are willing to pay is below 500 NT dollar (76.4%) and then is from 501 to 1000 NT dollar (14.8%).

Estimation result and analysis of empirical models by CVM

Discussion and analysis of impact factors on WTP for Lanyu's recreational resources: Tobit model is applied for the estimation of empirical model. It is discovered through the results of this study that five variables have significant impacts on the WTP for Lanyu's recreational resources, including a special trip, degree of satisfaction on natural landscape resources, degree of satisfaction on public recreational facilities, occupation of public administration clerk (dummy variable 1) and experience of donating to environmental protection groups.

Regarding the coming on a special trip for touring, the variable has negative relationship with the WTP, i.e. tourists who come to Lanyu on a special trip have lower WTP for the recreational resources on the island. This phenomenon is completely different from the former study results. On the basis of this, the study carries out a cross analysis on the two variables of coming on a special trip and WTP and discovers that the satisfaction of tourists who come to Lanyu on a special trip are always not as high as those who call by for a tour, meanwhile the degrees

of their satisfaction on each recreational resources are comparatively low, and they are not willing to pay a higher resource maintenance fee. Thus bring about such an interesting phenomenon.

In the two aspects of satisfaction on natural landscape resources and public recreational facilities, the two variables have positive relationship with the WTP, i.e. the more satisfied the tourists are on Lanyu's natural landscape resources and public recreational facilities, the higher the WTP on recreational resources are, and they are willing to pay a yearly recreational resource maintenance fee to ensure the maintenance of recreational resources in the park.

The occupation of public administration clerk (dummy variable 1) has a positive relationship with the WTP for Lanyu's recreational resources, i.e. tourists who are public administration clerks have higher WTP value for Lanyu's recreational resources. On such a basis, this study also performs an independent sample T test and tries to find out whether tourists with different occupations have different degrees of satisfaction on each recreational resource. It is discovered that tourists who are public administration clerks have significant differences on satisfaction degree of all recreational resources except for human resources. Tourists whose occupations are industrial and commercial service and industry including agriculture, forestry, fishery and animal husbandry only have significant difference on the satisfaction of public facility recreational resources. Tourists who are unemployed have significant difference in satisfaction of natural landscape, animal resource and public facilities. From all the above analyses, we can conclude that tourists who are public administration clerks have higher degrees of satisfaction than tourists of other occupations, as makes them WTP higher amount for the preservation and maintenance of Lanyu's recreational resources.

Regarding the experience of donating to environmental protection groups, the variable has positive relationship with the WTP for Lanyu's recreational resources, i.e. tourists who have donated to the environmental protection groups are willing to pay more. It is speculated that the reason is because those tourists are more conscious of environmental protection, and moreover, they have experiences of donating to environmental protection groups, thus when they face similar contextual choice, they are willing to pay more resource maintenance fee than those who have no such experiences, for the purpose of making Lanyu's recreational resources able to be preserved.

Estimation of yearly WTP maintenance fee by every person: The estimation of yearly WTP maintenance fee by every person can be calculated by replacing every explanatory variables in equation 1 with the estimated co-efficient values. It is received after the estimation and calculation of empirical model that the tourists are willing to pay an annual maintenance fee of 785.558 NT dollar/ person in average, a small difference with 868.75 NT dollars, the average value of WTP amount samples. If the calculation is made by interval estimation, 95% of the tourists' confidence intervals of yearly WTP by every person fall between 748.28 to 826.84 NT dollar.

Estimation of Lanyu's recreational resource benefits: When estimating the future use economic benefits, the most controversial part is the estimation of participants. According to statistical data from Tourism Bureau, Ministry of Transportation and Communications (2007), the number of tourists to Lanyu is 57,350 per year. We know from the above result that the yearly WTP resource maintenance fee by every tourist is NT\$785.558, if calculating it by the number of tourists, the yearly economic benefit estimation of Lanyu's recreational resources can be shown as in equation 7.

Recreational resource benefits of Lanyu:

$$785.558(\text{NT dollar/person per year}) \times 57,350(\text{person time}) = 45,051,751 \text{ NT dollar (7)}$$

Study of Ecotourism Development Strategy

There is a two-phase expert questionnaire survey in the study of strategy

Phase I expert questionnaire: on the impact factors of Lanyu's ecotourism development environment

Questionnaire survey: The content is received from the summarization and classification of literature review data and analysis results of field surveys. The target is to investigate the opinions of relevant units, such as tourists, government officials, experts, scholars, opinion leaders (people's representatives) and local populace etc. on the two major parts of Lanyu: the first part is the development target of Lanyu's ecotourism and the second part is the advantages and weak points of internal environment and the possible chances and threats of the external environment when influencing Lanyu's ecotourism development. Thus the impact factors to ecotourism development can be found out, and a development strategy can be worked out by using SWOT matrix analysis table. Questionnaires were released in mails and the survey was carried out from February to May 2012. The total released questionnaires were 150 copies with a return of 74 copies, including 62 valid copies and 12 invalid ones, with a valid return rate of 41.3%.

Analysis of degree of agreement on the ecotourism development target: This study is for the purpose of finding out the agreement degree of respondents on the development target of Lanyu's ecotourism. After calculating the mean (M) and standard deviation of the agreement degree of every target by the questionnaire statistics, the analytical results are as follows: the sustainable operation and development of the comprehensive environment (M=1.78; SD=0.36) and the establishment of a set of suitable management system (M=1.68; SD=0.35) receive the highest identification; others with 1 score on the agreement degree are orderly care and protection of natural ecological environment and landscape resources (M=1.58;SD=0.58), display and care of environmental resources and cultural completeness (M=1.54; SD=0.52), promotion of social development, environment quality and resident's living quality (M=1.50; SD=0.54), integrity of economic, social and ecological benefits (M=1.46; SD=0.52), the provision of long-term benefits to resources, local communities and industries (M=1.42; SD=0.58) and finally the provision of maximum recreational experience and the best recreational contentment (M=1.40;SD=0.52).

Analysis on the agreement degree of impact factors in internal and external environments: Through the questionnaire statistics of the means and standard deviation tables on the agreement degree of impact factors in internal and external environments in Lanyu's ecotourism, the analytical results are described as follows: 1. The most identified strength (S) is the plentiful natural ecological resources among all advantage factors of internal environment have the value of environment education (M=1.28; SD=0.61), and the storage of nuclear waste in local industries (M=0.11; SD=1.08) gets the lowest score. In the aspect of weaknesses (W), the agreement degree on the lack of long-term monitoring plan on the basis of developing ecotourism is above 1 score (M=1.02; SD=0.70); while the opinions on Lanyu peoples' dislike of the impact to the island brought by tourism development varies greatly. 2. Regarding the opportunities that the external environment faces (O), the principal one is the attention to ecotourism

due to increasing popularity of leisure tourism (M=1.22; SD=0.63); other opportunities include the provision of professional training, consultation, research of ecotourism by academic institutions and their promotion on development of ecotourism (M=0.98; SD=0.65), emphasis on the touring purpose of tourists and the deep acknowledge of local natural environment and human history with an attitude of self-study (M=0.92;SD=0.68), and the chances of practicing ecotourism development strategy in local industries (M=0.81;SD=0.70). In the respect of threat (T), deficiency of convenience in mass transportation (M=0.92; SD=0.78) has the highest agreement degree. The impact on natural environment due to large amount of tourists in holidays (M=0.68; SD=0.82) is also a threat. The reduction of leisure consumption caused by the entire economic contraction (M=0.21; SD=0.86) has the lowest agreement degree and is of less threat to the development of Lanyu's ecotourism.

Factor analysis: In order to facilitate the study of strategy and the establishment of AHP evaluation framework, factor analysis is applied to simplify the development targets of Lanyu's ecotourism and the variables of internal and external environmental impact factors. The choosing method of factors uses Principal Component Analysis to extract the factors. The KMO and Bartlett's test of sphericity is conducted by the method of extracting the feature value of 1. According to results of factor analysis, the naming of factors is executed in the principle of containing the majority variable with higher factor loads. The two named development targets of ecotourism after simplification will be used in the establishment of AHP evaluation framework. The 5 advantage factors, 3 weak point factors, 1 opportunity factor and 3 threat factors after the simplification of internal and external environmental impact factors for the development of ecotourism will be utilized in the SWOT matrix analysis table (as indicated in Table 1), for the purpose of studying the ecotourist development strategy in Lanyu.

Phase II expert questionnaire: questionnaires on the evaluation of ecotourist development strategy in Lanyu

Questionnaire survey: The content is the ecotourist development strategy that'll be received through the study of SWOT matrix analysis and on the basis of the statistical analysis of phase I expert questionnaires. In addition, the AHP questionnaire of ecotourist development strategy is utilized to evaluate the priority level of executing the ecotourist development strategy of Lanyu. The first level general target in the AHP evaluation hierarchy table is "Sustainable development of ecotourism", which is acquired from the ecotourist development target of Lanyu. The two development targets in the second level including "The establishment of management policy complying with the entire social, industrial and recreational benefits" and "Protection, cultivation and sustainable development of nature and culture" are the development targets of Lanyu's ecotourism simplified by factor analysis. The four evaluation items in the third level is to divide the development target of "The establishment of management policy complying with the entire social, industrial and recreational benefits" into two evaluation items, i.e. "Community and industrial development" and "Tourism marketing"; and to divide "Protection, cultivation and sustainable development of nature and culture" into two evaluation items including "Protection and cultivation of natural environment" and "Preservation of human culture". The total sent-out questionnaires in the way of release were 60 copies from April to June 2012. The copies were returned by mail with a number of 38, including 4 invalid ones, with a valid return rate of 56.6%.

Analysis on evaluation results of the strategy: The analysis

		Strengths (S)	Weaknesses (W)
Internal factors	External factors	S1: Cognition and devotion to environment protection, local features and culture by the industry, residents and social groups. S2: Possibility that tourists can participate and gain recreational experiences from culture and nature S3: Planning and management measures complying with ecotourism S4: Value of environment education on the special natural landscape and regional ecological system S5: Shifting of leisure industry within the region to the operating method of ecological theme	W1: Lack of supervision on load quantity, monitoring and planning. W2: Lack of environment education professionals and existence of sensitive areas within the region W3: Lack of planning on protection, cultivation, integration and marketing. Lack of tourist center and commentary media to carry out correspondent education and publicization of ecological protection to tourists, people work for tourism and local residents.
Opportunities (O)	O1: Attentions on ecotourism, academic and industry development strategy assisting in promotion of ecotourism	SO1: Establishment of Lanyu's human and natural ecological data book reservation exhibition place and website. SO2: Establishment of featured Lanyu human scenic spots and touring scenic areas. SO3: Measures or plans of conducting base management (landscape protection, protection and cultivation of plants and animals, maintenance of culture assets) environment management (water resource, energy, waste management), recreational development management (block management, attractiveness creation, fundamental construction, landscape project, recreational facilities, monitoring and planning).	WO1: Invitation of scholars and experts on the supervision study of load quantity and monitoring plans in order to guarantee the sustainable development of ecological industry. WO2: Invitation of scholars and experts to make protection, cultivation, integration and detail plannings on the basis of ecological industry development target
Threats (T)	T1: Competition of ecotourist activity with neighbouring areas T2: Space for reinforcing traffic system and tourist management T3: Less attractiveness than surrounding areas	ST1: Survey and evaluation on tourist demand performed upon tourist sources and features for the purpose of finding out recreational demand. Considered planning on the "customer value"-oriented service model ST2: Planning for the renewal of traffic communication network, signs and old facilities, especially the sanitary fixtures.	WT1: Establishment of a professional management institution with special responsibilities. WT2: Comprehensive ecotourist marketing planning, an effective shaping of tourist image. WT3: Establishment of tourist service center to provide tour guide, commentators and display of agricultural specialties.

Table 1: SWOT matrix analysis table of Lanyu's ecotourist development strategy.

tables of each strategy evaluation results are indicated in Table 2. After the weighted calculation, "Invitation of scholars and experts to make protection, cultivation, integration and detail planning on the basis of ecological industry development target" (6.166) receives the highest score in the development strategy, the following three are orderly "Establishment of tourist service center to provide tour guide, commentators and display of agricultural specialties" (5.954), "Implementation of supervision on load quantity" (5.769) and "Establishment of Lanyu's human and natural ecological data book reservation exhibition place and website" (5.719). The last is "Survey and evaluation of tourist demand shall be performed on Lanyu, for the purpose of recreational demand and the considered planning for the provision of Lanyu's tourism should be based on tourist attractiveness, service facility, traffic transportation, tourist information, tourist marketing and the "customer value"-oriented service model" (4.851). After comparing with the unweighted original scores of agreement degree, a few orders of the strategies change due to the influence of weighing, for example, "Measures or plans of conducting base management (landscape protection, protection and cultivation of plants and animals, maintenance of culture assets) environment management (water resource, energy, waste management), recreational development management (block management, attractiveness creation, fundamental construction, landscape project, recreational facilities, monitoring and planning)" grow from the 7th before non-weighting to the 6th due to the high degree of agreement and the influence of the comparatively high weighing value of community, industrial development and natural environmental protection and cultivation. However, the orders of 8 strategies are not changed after the weighing, especially the top 5 strategies. It can be witnessed that they not only are identified in the general degree of agreement, but also hold the same positions after being bestowed with weighing relations. Therefore, decision makers can consider to execute those strategies in priority and the two development strategies in the end before and after the weighing can be carried out in different phases according to the

capacity, including "Establishment of featured Lanyu human scenic spots and touring scenic areas" and "Survey and evaluation of tourist demand shall be performed on Lanyu, for the purpose of recreational demand and the considered planning for the provision of Lanyu tourism should be based on tourist attractiveness, service facility, traffic transportation, tourist information, tourist marketing and the "customer value"-oriented service model".

Conclusions

The principal objective of this study is to find out the WTP to Lanyu's recreational resources and the impact factors, establish the empirical model of the WTP for recreational resources, study the ecotourist development strategy by SWOT matrix analysis approach and apply AHP method to perform strategy evaluation after the strategies are worked out, all for the purpose of providing decision makers with reference for the priority orders in execution. The conclusions and recommendations provided specifically by combing various data and results of empirical studies are as follows.

Tourists' WTP for Lanyu's recreational resources

When facing the set price of first phase resource maintenance fee, 60.6% of the tourists answer that they are not willing to pay; after the first inquiry, when respondents are asked for the second time about whether they are willing to pay for the set price of the second phase, 56.8% of the tourists answer they are willing to pay for recreational resources; when being asked directly for how much the respondents are willing to pay for resource maintenance fee in the third phase, it is discovered that the WTP of 76.4% of the tourists is lower than 500 NT dollars.

Factors that impact the WTP for Lanyu's recreational resources

It is discovered through the results of empirical models that there

Evaluation of project weighted value Development strategy	Community industry development	Tourism marketing	Protection and cultivation of natural environment	Preservation of aboriginal culture	Original score	Ranking	Weighted score	Ranking	Note
	0.360	0.184	0.238	0.218					
5. Invitation of scholars and experts to make protection, cultivation, integration and detail plannings on the basis of ecological industry development target	6.723	5.684	5.329	6.566	24.302	1	6.166	1	No change
10. Establishment of tourist service center to provide tour guide, commentators and display of agricultural specialities	5.932	5.084	6.231	6.424	23.671	2	5.954	2	No change
4. Invitation of scholars and experts on the supervision study of load quantity and monitoring plans in order to guarantee the sustainable development of ecological industry	5.986	5.212	5.545	6.126	22.869	3	5.769	3	No change
1. Establishment of Lanyu's human and natural ecological data book reservation exhibition place and website	5.783	5.682	5.463	5.924	22.852	4	5.719	4	No change
7. Establishment of a professional management institution with special responsibilities.	5.426	5.108	5.726	6.322	22.582	5	5.634	5	No change
8. Comprehensive ecotourist marketing planning, an effective shaping of tourist image.	5.127	4.864	5.926	6.126	22.043	6	5.487	7	Descend in order
3. Measures or plans of conducting base management environment management, recreational development management	6.408	5.182	5.168	4.746	21.504	7	5.525	6	Increase in order
6. Planning for the renewal of traffic communication network, signs and old facilities, especially the sanitary fixtures	4.672	4.465	6.128	6.184	21.449	8	5.310	8	No change
9. Establishment of featured Lanyu human scenic spots and touring scenic areas.	4.572	4.863	5.483	5.672	20.590	9	5.082	9	No change
2. Survey and evaluation on tourist demand performed upon tourist sources and features for the purpose of finding out recreational demand. Considered planning on the "customer value"-oriented service model	4.683	4.294	5.068	5.362	19.407	10	4.851	10	No change

Table 2: Comparison table of order before and after the weighing of scores on Lanyu regional ecotourism development strategy.

are 5 key factors that impact the WTP for Lanyu's recreational resources, including the coming on a special trip, the degree of satisfaction on natural landscape resources, the degree of satisfaction on public recreational facilities, the occupation of public administration clerk and the experience of donating to environmental protection groups. Among the five key factors, the WTP for the recreational resources in Gaomei wetland if they come on a special trip is lower. The other four items have positive relationships with the WTP for Lanyu's recreational resources.

Benefits of Lanyu's recreational resources

It is figured out from empirical estimation that the yearly WTP resource maintenance fee by every tourist for the purpose of maintaining its recreational resources is 785.558 NT dollars in average. If calculating by the estimated basic number of 57,350 persons, the benefit that is produced by Lanyu's recreational resources is about 45.05 million NT dollars, which can be taken as a reference data for the application of ecological protection and cultivation funds from government.

Study and evaluation of ecotourist development strategy of Lanyu

This study applies SWOT matrix analysis approach and works out 10 ecotourist development strategies. Hierarchy analysis is utilized for the evaluation of the strategy after the strategies are worked out. The results of study show that the top 5 strategies among all are orderly (1) "Invitation of scholars and experts to make protection, cultivation, integration and detail planning on the basis of ecological industry development target"; (2) "Establishment of tourist service

center to provide tour guide, commentators and display of agricultural specialities"; (3) Invitation of scholars and experts on the supervision study of load quantity and monitoring plans in order to guarantee the sustainable development of ecological industry; (4) Establishment of human and natural ecological data book reservation exhibition place and website; and (5) Establishment of a professional management institution with special responsibilities.

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