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A body of knowledge representation model of ecotourism products in southeastern Ecuador

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Abstract

The corpus of knowledge or Bodies of Knowledge (BOK) term it used to describe a set of structures than codify all concept, terms, techniques, and sustainable activities that constitute the domain of the exercise of a profession or specific area of knowledge in our case in Ecotourism context. Ecotourism combines passion for travel with the interest in the preservation of nature and it is related to concepts of sustainability, conservation and participation of the local community, this term has been used to promote tourism activities in the natural environment and attract tourists interested in nature and culture of places to visit. In the Amazon rainforest ecotourism is an activity that contributes both to the awareness of travelers and the communities, in addition to income generated by this activity helps to preserve this heritage. The aim of this article is to contribute to the estimation of discrete choice models in order to analyze individual preferences, by analyzing the demand for ecotourism products in Ecuador's southeastern

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region, province of Zamora Chinchipe, using data obtained from surveys conducted during 2018, which provide information about the preferences of visitors to the area, through discrete choice experiments, and supported on BOK model. This experiment consisted in the creation of twelve choice scenarios defined by two hypothetical ecotourism products each. Thus, the alternatives were defined in terms of the following attributes: price, hiking, participation in rituals, tasting local cuisine, visit to crafts center and experience of community life (codes of BOK).

Keywords: Business, Economics, Information science, Tourism

1. Introduction

The first requirement to qualify any area of knowledge as a profession is that it corresponds to an organized body of knowledge [1]. Body of Knowledge (BOK) describes the relevant knowledge for a discipline and it is necessary to reach consensus between the Knowledge Areas (KA) and related disciplines [2] in our case on Ecotourism. The ecotourism is a segment of the tourist activity that uses in a sustainable way the natural and cultural heritage, encourages its conservation and seeks the formation of an environmental consciousness through the interpretation of the environment by promoting the welfare of the communities involved.

For ecotourism contributes to sustainable development of the regions, and to offer alternatives to tourism should be developed according to the guidelines or principles that underpin it, therefore it should be clear what it's the definition. The following are some of the most complete definitions for ecotourism:

Ecotourism is now defined as "*responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education*" [3].

The Nature Conservancy adopts the definition articulated by the World Conservation Union "Environmentally responsible travel to natural areas, in order to enjoy and appreciate nature (and accompanying cultural features, both past and present) that promote conservation, have a low visitor impact and provide for beneficially active socio-economic involvement of local peoples" [4].

Another important definition for ecotourism is the one given by the National Chamber of Ecotourism and Sustainable Tourism of Costa Rica:

> *"It is the specialized segment of responsible tourism, which promotes and supports the conservation of nature and the cultural values of the various locations, interpreting them for general public, and sponsoring the socio-economic improvement of local communities in an ethical fashion, aiming to increase*

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awareness and satisfaction of external customers. Its activities are designed to be carried out in accordance with the environment, leading its customers to a direct and personal contact with nature and the local culture" [5].

The characteristics that UNWTO sets for ecotourism have the same basis for action than those established by the Nature Conservancy, for them the ecotourism possesses the following characteristics:

- Conscientious, low-impact visitor behavior
- Sensitivity towards, and appreciation of, local cultures and biodiversity
- Support for local conservation efforts
- Sustainable benefits to local communities
- Local participation in decision-making
- Educational components for both the traveler and local communities [5].

Therefore, ecotourism is linked to a sense of ethics because, beyond the enjoyment of the traveler, pursues to promote the welfare of local communities, who are acting as recipients of tourism and the preservation of the natural environment. Ecotourism also seeks to promote sustainable development i.e. growth in the present that does not affect future possibilities. It is important to include community's perspective because ecotourism cannot be successful without community support. For successful tourism development, community leaders and tourism planners need to view tourism as a '*local community industry*'.

As an activity directly related to the nature, it involves protecting certain areas, thus achieving preserve the biodiversity of the area and turning it into a factor of attraction for tourists.

It is noteworthy that the importance of ecotourism is based on three fundamental principles, as required by The International Tourism Society:

- Is non-consumptive/non-extractive
- Creates an ecological conscience
- Holds eco-centric values and ethics in relation to nature [3].

Ecotourism is important because thanks to its implementation, the understanding of the impacts of tourism on the natural and human environment are considered, and allows to generate jobs locally, either directly in the tourism sector or in other supporting sectors.

Also, local communities and indigenous cultures can be harmed in different ways by an arrival of foreign visitors, however this same growth generates significant opportunities for both conservation and local communities. It becomes an incentive for the development of industries in the area such as hotels, restaurants, transport, crafts and

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tourist guide services. Achieving well be an alternative source of income for the local industry and Ecotourism can provide revenues for the protection of national parks and other natural areas.

The ecotourism provides some benefits; among which can mention: conservation of natural areas and resources in worldwide, and to promote understanding and respect for cultures, heritage and natural environment. Also, it let to discover natural and rural places of great value and beauty, gives the opportunity to live in contact with nature and interact with it, and therefore get away from all types of pollution that exists in big cities. It is ideal to relax and unwind, allowing tourists who enjoy this type of tourism can perform a host of outdoor activities such as hiking, bird watching, horseback riding etc. Besides, ecotourism can increase the level of education and involvement among travelers, making them engage with the cause and effective help of conservation.

And even more importantly, ecotourism serves as a very effective starting point of rural populations or communities to boost its economy to remain and take care of its natural and ethnographic environment, achieving a sustainable economic development of the population involved. Some nature reserves have tried to promote a mutual economic interest in ecotourism by: subcontracting certain services and products to neighboring communities, buying local produce, offering cultural activities and services to the tourists inside the reserves, providing the opportunity for locals to sell their stuffs.

The UNWTO recognized the importance of ecotourism, and they decided to make a designation of the year 2002 as the International Year of Ecotourism:

> *"In fostering better understanding among peoples everywhere, in leading to greater awareness of the rich heritage of various civilizations and in bringing about a better appreciation of the inherent values of different cultures, thereby contributing to the strengthening of world peace"* [5].

Millions of people visit protected areas each year, the current market trend goes to meet growing needs of a tourist looking to enjoy natural areas and cultural offerings. Ecotourism has been implemented in several countries.

The International Ecotourism Society (TIES) [3] mentions that:

> *"Some examples of best management practices in ecotourism development include preserving cultural heritage, sourcing locally produced foods and souvenirs, supporting community conservation projects, recycling and treating wastes, and hiring local employees, especially women and minorities, and paying them fair wages. In a message delivered to mark the observance of World Tourism Day 2014, UN Secretary-General Ban Ki-moon emphasized the benefits of tourism for local communities, adding that as an industry it "helps people to*

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develop a variety of skills" and builds "stronger and more resilient communities". The power of travel can transform people and create change. When executed mindfully, and with the minimum impact, travel can inspire cultural awareness, tolerance, and commitment to environmental responsibility".

Ecotourism has boomed in recent years, and among countries that have become known as good destinations for this activity are the countries of South America, whose main attractions are based on nature, indigenous culture and history, as stated by the TIES [3].

"We work with hotels and tour operators in Argentina, Bolivia, Brazil, Chile, Costa Rica, Ecuador and Peru who make conservation, sustainability and community development a priority. Because we work directly with locally owned companies who employ the people who live there, the money spent by our clients stays within the community. Our providers are involved in reforestation projects, conservation initiatives and low-ecological footprint programs like incorporating recycling, biodegradable cleaning and bath products and low to no energy devices to power their day-to-day operations."

Ecuador has the largest animal and plant diversity in the world, 10% of all species of plants on earth are concentrated in an area that represents only 2% of the total surface of the planet. Only in Amazon region exists around 8200 species, and identified 2725 species of orchids. Approximately 3,800 vertebrate species, 320 species of mammals, 350 species of reptiles, 375 amphibians, 800 species of freshwater fishes, 450 species of saltwater fish and 1550 species of birds have been documented in Ecuador. Collect 18% of all species in the world, nearly 15% of endemic species in the world are in the mountains, the coast and the Amazon, also is home to more than a million species of insects. Of the twelve key biodiversity areas identified by the naturalist Norman Myers, three are in the continental Ecuador. Ecuador's 2008 constitution was the first in the world to legally recognize the Rights of Nature.

National parks, reserves and wildlife refuges are attracting more and more attention from tourists due to its educational, recreational and aesthetic values. In Ecuador 10 national parks, 14 nature reserves, a refuge for wildlife and recreation area, are considered natural heritage and protected spaces by the state. Its extension approaches 4,669,871 hectares of land and maritime surface 14,110,000, divided into four regions. Biodiversity is the main wealth of these areas, although there are different populations both in urban areas, as in rural the indigenous and peasant.

Ecotourism is beneficial for a country like Ecuador because it is a possibility to increase the attraction of protected areas, because it provides an economic reason for protecting them, besides it provides to local population economic incomes by improving their level of life and encouraging them to respect and conserve protected areas. According to [6] *cites environmental benefits of community participation,*

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arguing that a close working relationship between the local community and the industry will provide the means to support conservation efforts.

The Ecuador is divided into four regions, Coast, Highlands, Amazon and Galapagos Island or Insular region. Ecuador's Amazon region has an area of 120,000 square kilometers that is extending in the western edge of the Amazon River, and is covered by lush rainforest. The Amazonian ecosystem is considered one of the richest plants and animals' habitats in the world, the variety of macro and micro habitats is amazing, since muddy lakes until endless forests.

The Amazon is one of the richest regions of the country, for its culture and associated knowledge, and for its biodiversity; water and mineral resources. Among its main attractions are the different protected areas and the variety of ethnic groups that exist.

The province of Zamora Chinchipe is located in the southeast of the Ecuadorian Amazon, the geographical position has generated an immeasurable and unknown biodiversity with a high degree and cultural richness, and make this area a favorable environment for the development of ecotourism activities, that have great economic importance to constitute a mechanism of growth. Tourism is a possible alternative to exit the postponement and enter as protagonists in equal conditions. This area has a vast natural and archaeological heritage, because it has a range of possibilities that can be visited for different activities such as: archeology, adventure, culinary, agritourist, beach, community, health, cultural, bird watching, ecotourism, etc.

It is considered necessary and urgent to begin to define development alternatives based in the enormous richness and diversity of the natural resources on which human capital have a leading role in their own development, with participatory and ongoing activities in which the cultural and environmental revaluation are the main characteristics of the area, meanwhile is integrating communities in a collaborative and inclusive framework.

The identity of different ethnic groups existing in the province is being lost, the main causes are acculturation, racism, and displacement of native centers. Ecotourism is a means to perform the rescue and preservation of indigenous culture, including knowledge, biodiverse resources and techniques used by native peoples and nationalities, in order to have a population with ethical, moral, identity values and high esteem.

The purpose of this article is to contribute to the estimation of discrete choice models [7] that allows to analyze the individual preferences, i.e. to know how tourists make their decisions when choosing a tourist product or another, by analyzing the demand for ecotourism products in Ecuador's southeastern region, province of Zamora Chinchipe. The experiments were supported with knowledge description model for BOK.

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2. Materials and methods

2.1. BOK model

Bodies of Knowledge (BOK) contain relevant knowledge for several areas. Knowledge representation for BOK is essential to understand the true context and the possible application of BOK in science. Knowledge can be symbolically represented in many ways [8].

In this paper, a BOK model based on [2, 9, 10, 11, 12] was developed, which serves as a support for the use of semantic technologies and knowledge retention in the ecotourism context. In the supplementary file 1 the BOK model is shown.

One of the main concerns of the tourist industry is to develop the talent of its human resources, since the quality and innovation of its products and services depend to a large extent on the knowledge, capacity and talent of its stakeholder.

Regarding the levels of knowledge in a BOK of Ecotourism, they define the amount of knowledge that will be offered within a specific level of activities program. BOK have a specific structure according to the area of science or engineering. The codes and elements of BOK model help to understand the context of ecotourism and the base of factor to develop the products. The BOK model has the advantage that it is capable of representing rich semantic knowledge, including skills and concepts. Furthermore, it integrates skills and concept through a coherent network of associations, in terms of context specifications based on a constructivist approach. In order to define the proposed model, the first step is to establish the concepts associated with BOK on Ecotourism context.

The network of concepts was built using the Atlas TI facilities by adding codes, quotations and displaying their neighbors' and co-occurrences. It helped to identify relationships between codes to build more abstract concepts in the context of knowledge description of BOK [8].

2.2. Demand analysis

2.2.1. The choice experiments

Discrete choice experiments are created with the purpose of analyzing the independent effect of different attributes upon certain observed outcomes or choices [14]. A typical choice experiment consists in a sample of individuals that complete different hypothetical choice tasks according to some behavioral rule. In many experimental settings the utility maximization is considered, therefore the task consists in choosing the alternative with the highest utility, and alternatives are defined in terms of the different values, or levels, that the attributes can take.

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In our case, the experiment consisted in the creation of twelve choice scenarios defined by two hypothetical ecotourism products each. Thus, the alternatives were defined in terms of the following attributes: price, hiking, participation in rituals, tasting local cuisine, visit to crafts center and experience of community life. The attributes and levels considered for this purpose are presented in Table 1. As can be seen, all attributes were defined at three levels with the exception of price that had six. For the selection of both, attributes and levels, the attractions identified in the area of Zamora-Chinchipe during the preliminary phase of the project were considered.

To obtain the combination of attribute levels defining the choice situations, an efficient design using the software N-gene [12]. In order to obtain realistic choice

Table 1. Attributes and levels.

ATTRIBUTES (BOK)	LEVELS	DESCRIPTION
Cost of activity ($)	1	35
	2	40
	3	45
	4	70
	5	75
	6	85
Hiking (waterfalls, scenic beauty, flora, fauna)	1	Not included
	2	2-hour scenic route. You will see one waterfall, primary forest and may take a bath in the crystal-clear waters flowing down from the mountains Chimbutza. The difficulty level is medium and you will walk tour 2 ½ km. Includes native guide and lunch (water, chocolate, fruit and biscuits)
	3	4 hour scenic route. You will use Tarabita (funicular) to cross Yacuambi River. You will observe endemic flora and fauna and enjoy a panoramic view of the area. The difficulty level is high and you will walk 5km. It includes native guide, lunch and dinner (water, chocolate, fruit and biscuits)
Participation in rituals	1	Not included
	2	Dancing
	3	Dancing + ritual in cascade + sanation
Tasting local cuisine	1	Not included
	2	Tasting a basic menu: Ayampaco + Chicha + membrillo juice
	3	Tasting a full menu: Ayampaco + Palmito broth with creole chicken + Chicha + membrillo juice
Visit to crafts center	1	Not included
	2	View and/or purchase
	3	View and/or purchase and participate in the development of local crafts
Experience of community life	1	Not included
	2	1 day performing activities related to: Agriculture/livestock/gastronomy, includes food (lunch and dinner in the afternoon).
	3	2 days performing activities related to: Agriculture/livestock/gastronomy/psiculture and river fishing/poultry/hunting (15 USD), includes food and lodging

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scenarios, some constraints were added to the design. Thus, the ecotourism products showed to the visitors consisted in two or three attractions each. An example of one choice scenario is presented in Table 2, where the individual had to choose among package A, package B or none of the two.

Also, to make the scenarios more credible, some pictures were shown to the respondents to help them to better understand the characteristics of the different product. The creation of efficient designs is focused on the minimization of the sample size required to obtain asymptotically efficient and reliable parameter estimates; or alternatively, minimize the standard error of the parameter estimates for a fixed number of choice observations. Our choice experiment was based on the minimization of the D-error. For this, we have to provide parameter's prior information and the type of model to be estimated.

In this regard, our design was generated for a multinomial logit model capable to account for non-linear effects in qualitative attributes. Parameters' priors were chosen according to some qualitative information in order to obtain reasonable willingness to pay figures for potential visitors of the area.

2.2.2. Discrete choice theory

In [13] assumes that individuals consume both continuous and discrete goods, being the later represented by the choice among a set of discrete alternatives mutually exclusive. According to [14] postulates, the utility of the alternatives depends on the levels of the attributes that characterize them. Thus, under the utility

Table 2. Example of choice scenario.

Attributes (BOK)	Description Package A	Description Package B
Cost	$40	$75
Hiking	LEVEL 3 4 hour scenic route. The difficulty level is high and you will walk 5km.	Not included
Rituals	Not included	LEVEL 3 Dancing/Ritual in cascade/Sanation
Gastronomy	LEVEL 3 Full menu	Not included
Crafts	Not included	LEVEL 3 View and/or purchase and participate in the development of local crafts
Community life	Not included	LEVEL 2 1 day
I choose ① Package A ② Package B ③ None of the two Reason in the case of choose ③		

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maximization behavioral rule, the individual must choose the bundle of continuous goods and the discrete alternative that maximizes his utility, given his constraints.

As the analyst does not know, for each individual, all of the variables that are influencing the choice, neither the exact way that these influence, probabilistic choice mechanisms are required to in order to model individual choices.

The random utility theory is based in that one individual always opt for the alternative with the highest utility. The utility that reports to individual n the alternative j is Unj. This utility is fully known by the one who makes the choice, but partially unknown for the analyst who is trying to model individual's preferences. From the economic point of view, Unj is a conditional indirect utility function.

In this regard, the utility has two components, the observed one, called systematic component that will depend on a number of observed attributes as well as on the socioeconomic characteristics of the individual, and a random part, unobserved by the analyst that will be treated as a random error (Eq. 1).

$$U_{iq} = V_{iq} + E_{iq} \tag{1}$$

The individual will only choose the alternative with the highest utility from all the other alternatives in the choice set. The alternative i is chosen, if and only if (Eq. 2):

$$V_{iq} + E_{iq} \geq V_{jq} + E_{jq} \leftrightarrow V_{iq} - V_{jq} \geq E_{jq} - E_{iq} \tag{2}$$

And the analyst can only obtain the probability of choosing the alternative i as (Eqs. (3) and (4)):

$$P_{iq} = P(E_{jq} - E_{iq} \leq V_{iq} - V_{jq}; j \neq i) \tag{3}$$

$$P_{iq} = P(E_{jq} \leq V_{iq} - V_{jq} + E_{iq}; j \neq i) \tag{4}$$

When the error is distributed identically and independently following the Gumbel distribution, the well-known multinomial logit model is obtained. Less restrictive hypotheses about the distribution of the random errors yield more flexible choice models such as those belonging to the Mixed Logit family.

In the survey one section was dedicated to the choice experiment were responses in the 12 different scenarios were collected. The distribution of choices across the scenarios is presented in the Fig. 1. In the first scenario the option A was the response that obtained the highest percentage of choice as well as on tasks 3, 4, 8, 9 and 11. In the scenarios 2, 5, 6, 7, 10 and 12 the option with the highest percentage was B. It is also important to highlight that scenario 11 exhibit the highest proportion of no choice responses, notwithstanding the number of individuals who did not choose any of the packages offered was relatively low in most of the scenarios. This means

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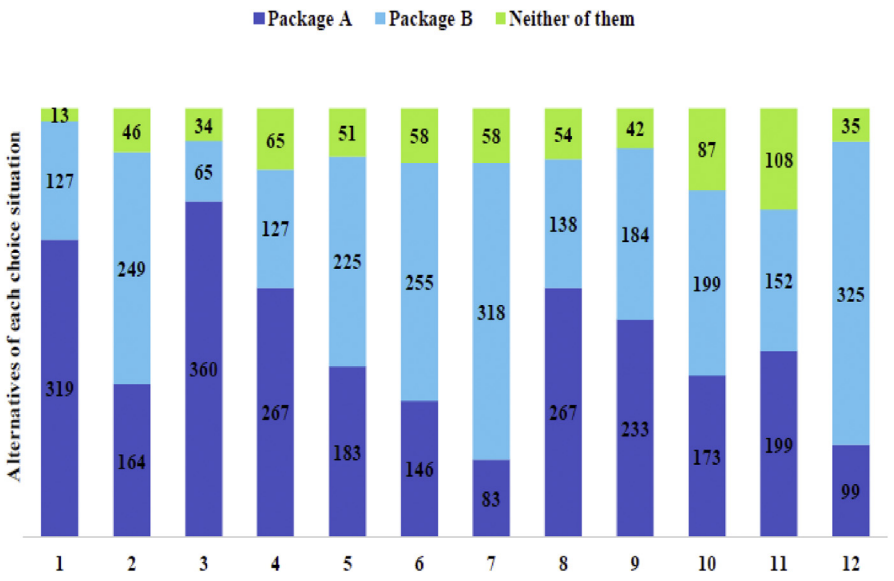

Fig. 1. Choice situations.

that the characteristics of the ecotourism products offered to individuals resulted attractive to them.

After completing the choice experiment, respondents were asked to rate the level of importance that each attribute had in their choices. In this regard, cost, hiking, and tasting local cuisine were the attributes that exhibit the highest level of importance. These attributes were considered very or totally important for more than 56% of the sample. In contrast, the participation in rituals, experiencing community life and visit to crafts center were rated with a low level of importance for the highest proportion of individuals in comparison with other attributes (Fig. 2). In fact, these attributes

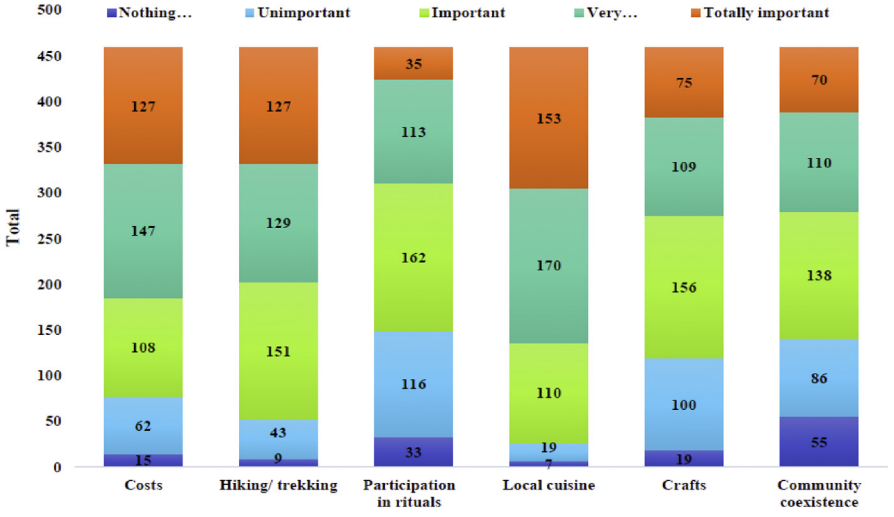

Fig. 2. Degree of importance of the attributes.

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were considered unimportant or nothing important for more than 119 individuals, approximately, 26% of the sample.

The modeling strategy starts by analyzing models accounting for linear and nonlinear effects, and eventually testing for their statistical significance.

- Linear effects model
- Linear effects models are based on the fact that the impact of passing from level 1 to level 2 is identical to that of passing from level 2 to level 3 for qualitative attributes. As can be seen in the next Fig. 3.

For these models the specification of the utility is as follows (Eqs. (5), (6), and (7)):

$$U_1 = \theta_p P_1 + \theta_s S_1 + \theta_R R_1 + \theta_G G_1 + \theta_A A_1 + \theta_E E_1 \quad (5)$$

$$U_2 = \theta_p P_2 + \theta_s S_2 + \theta_R R_2 + \theta_G G_2 + \theta_A A_2 + \theta_E E_2 \quad (6)$$

$$U_3 = \theta_{ASC3} \quad (7)$$

Where P is the price of the alternative, S represents the level of hiking, R that of rituals, G that of gastronomy, A that of crafts and E that of experience of community life; and θs are the unknown parameters. As the third alternative is the do-nothing option, only one alternative specific constant is specified in this alternative accounting for the status quo preference.

The estimation results are presented in the Table 3. This model corresponds to a linear effects Multinomial Logit Model with a linear-in-the-parameter utility

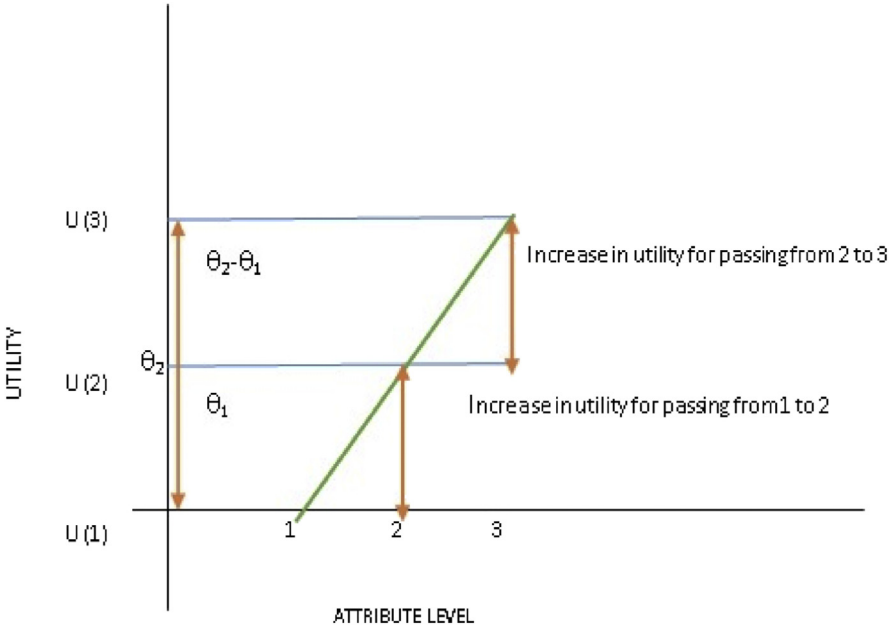

Fig. 3. Linear effects model.

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Table 3. Estimation results. Linear effects model.

Attributes		Estimate (t-test)
Hiking (S)	θS	0.664 (17.27)
Experience of community life (E)	θE	0.196 (4.85)
Gastronomy (G)	θG	0.512 (11.75)
Cost (P)	θP	-0.0109 (-9.37)
Crafts (A)	θA	0.256 (6.35)
Rituals (R)	θR	0,329 (7.97)
ρ2	0.165	
Adjusted ρ2	0.164	
l*(0)	-6051.156	
l*(θ)	-5050.605	
Observations	5508	

specification. All the parameters estimate corresponding to qualitative attributes present a positive the correct sign and are significant at a confidence level higher than 95%. The cost parameter (θP) instead presents a negative sign as expected.

2.2.2.1. Non-linear effects model

When the non-linear effects specification is considered, the impact on utility of passing from level 1 to level 2 is different than that of passing from level 2 to level 3 (see Fig. 4).

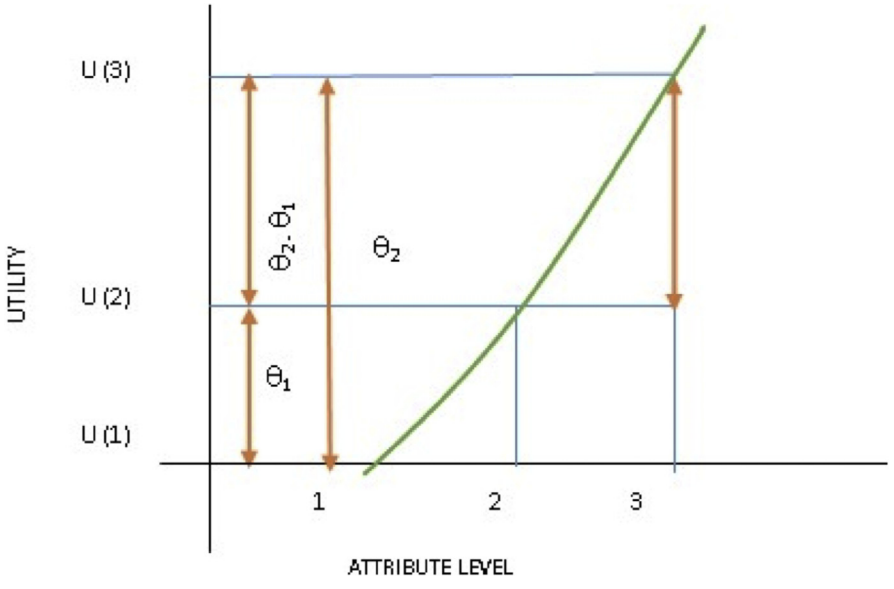

Fig. 4. Non-linear effects model.

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In this case, the utility specification is as follows (Eqs. (8), (9) and (10)):

$$U_1 = \theta_P P_1 + \theta_{S1} S_1^1 + \theta_{S2} S_1^2 + \theta_{R1} R_1^1 + \theta_{R2} R_1^2 + \theta_{G1} G_1^1 + \theta_{G2} G_1^2 + \theta_{A1} A_1^1 + \theta_{A2} A_1^2 \quad (8)$$

$$U_2 = \theta_P P_2 + \theta_{S1} S_2^1 + \theta_{S2} S_2^2 + \theta_{R1} R_2^1 + \theta_{R2} R_2^2 + \theta_{G1} G_2^1 + \theta_{G2} G_2^2 + \theta_{A1} A_2^1 + \theta_{A2} A_2^2 \quad (9)$$

$$U_3 = \theta_{ASC3} \quad (10)$$

Where X^1 is the dummy equal to 1 when the level of the attribute X is 2 and 0 otherwise; and X^2 is the dummy equal to 1 when the level of the attribute X is 3 and 0 otherwise.

In the Table 4 the estimation results of the nonlinear effects model are presented. Here you can find two parameters for each attribute, for example in the case of hiking we have θS1 and θS2. The first parameter θS1 measures the impact on utility of passing from level 1 to level 2, and θS2 that of passing from level 1 to level 3. Thus, according to this model, enjoying a 2-hour scenic route increases the individual's utility by 1.05 units; and enjoying a 4-hour scenic route raises the utility to 1.19 units. The difference between these two parameters is interpreted as the impact of passing from level 2 to level 3. Thus, in order to obtain consistent results, the second parameter must be higher than the first. For this model, all estimates are consistent and significant at a significance level higher than 95%, with the only exception of the

Table 4. Estimation results. Nonlinear effect model.

Attributes		Estimate (t-test)
Hiking (S)	θS1	1.05 (10.78)
	θS2	1.19 (8.35)
Experience of community life (E)	θE1	0.198 (2.43)
	θE2	0.307 (2.01)
Gastronomy (G)	θG1	0.780 (11.57)
	θG2	0.924 (6.17)
Cost (P)	θP	-0.00872 (-4.95)
Crafts (A)	θA1	0.219 (1.70)
	θA2	0.548 (4.43)
Rituals (R)	θR1	0.337 (3.87)
	θR2	0.697 (5.03)
ρ2		0.179
Adjusted ρ2		0.177
l*(0)		-6051.156
l*(θ)		-4970.451
Observations		5508

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first parameter of crafts. As in the former case, all parameters were estimated with the expected sign.

In order to test for the statistical significance of the non-linear effects, we need to check whether in fact all the effects of the second model are present in all the attributes:

This is equivalent to test if the following condition is held (Eqs. (11), (12)):

$$\theta_2 = 2\theta_1; \tag{11}$$

$$\theta_2 - 2\theta_1 = 0 \tag{12}$$

Or, in contrast (Eq. (13)):

$$\theta_2 - 2\theta_1 \neq 0 \tag{13}$$

For this, we undertake a hypothesis test with the following null hypothesis (Eq. (14)):

$$H_0: \theta_2 - 2\theta_1 = 0 \tag{14}$$

Facing the following alternative hypothesis (Eq. (15))

$$H_1: \theta_2 - 2\theta_1 \neq 0 \tag{15}$$

The statistic used in this contrast is (Eq. (16)):

$$t = \frac{\theta_2 - 2\theta_1}{\sqrt{Var(\theta_2 - 2\theta_1)}} = \frac{\theta_2 - 2\theta_1}{\sqrt{Var(\theta_2) + 4Var(\theta_1) - 4Cov(\theta_2, \theta_1)}} \tag{16}$$

And the decision rule at the 95% confidence level is:

If $|t| < 1.96$ accept H0 i.e. there are linear effects in the attribute.

If $|t| > 1.96$ reject H0 i.e. there are not linear effects in the attribute

Results of this test are presented in Table 5.

Table 5. Results of test of no-linearity.

Attributes	**H0:**	
	t -test	**Decision**
Hiking	-9.931	Reject
Experience in community life	-0.76014	Accept
Gastronomy	-5.948	Reject
Crafts	0.6829	Accept
Rituals	0.23524	Accept

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According to the test results, nonlinear effects are only perceived for hiking and gastronomy attributes. This means that for experience in community life, crafts and rituals, the effect of passing from level 1 to level 2 is not significantly different of that of passing from level 2 to level 3. This contrast with results obtained for hiking and gastronomy where the effect of passing from level 1 (i.e. when the activity is not offered) to level 2 is substantially higher than that passing to a higher level.

2.2.2.2. *Mixed linear non-linear effects model*

In light of results obtained in the previous section, the specification of a mixed linear non-linear effects model is suggested. Thus, the former model will be re-estimated but now incorporating the constraints given by the null hypothesis when this is accepted. The estimation results of this model are presented in the Table 6.

Like in the previous model, all parameters were estimated with the expected sign and all estimates are consistent and significant at a significance level higher than 95%. Given the introduction of parameter constraints, as we have pointed out, now the effect is not linear for hiking and gastronomy. Thus, in this case not offering hiking activities against offering this product at the intermediate level (level 2) increases the individual's utility by 1.12 units. On the other hand, if a higher level with more hiking activities is offered, that is the move from level 2 to level 3, the utility is increased 0.19 units, being this increment substantially lower.

Table 6. Estimation results. Mixed linear non-linear model.

Attributes		**Estimate (t-test)**
Hiking (S)	θS1	1.12 (17.97)
	θS2	1.31 (15.67)
Experience of community life (E)	θE1	0.218 (4.90)
	θE2	0.435 (4.90)
Gastronomy (G)	θG1	0.816 (14.39)
	θG2	1.04 (10.35)
Cost (P)	θP	-0.00857 (-7.03)
Crafts (A)	θA1	0.317 (7.27)
	θA2	0.634 (7.27)
Rituals (R)	θR1	0.406 (9.33)
	θR2	0.811 (9.33)
ρ2		0.178
Adjusted ρ2		0.177
l*(0)		-6051.156
l*(θ)		-4971.109
Observations		5508

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A similar effect is perceived for gastronomy, where offering this attribute at the intermediate level increases the utility by 0.82 units, whereas improving this attribute to the highest level increases the utility by 0.22 units.

In order to compare the magnitude of the impact of the different attributes on the utility, for the three models analyzed, these effects are depicted in Figs. 5, 6, and 7.

A common characteristic of these three models is that the attributes which produce the highest impact on the utility are those for which the nonlinear effects are proved,

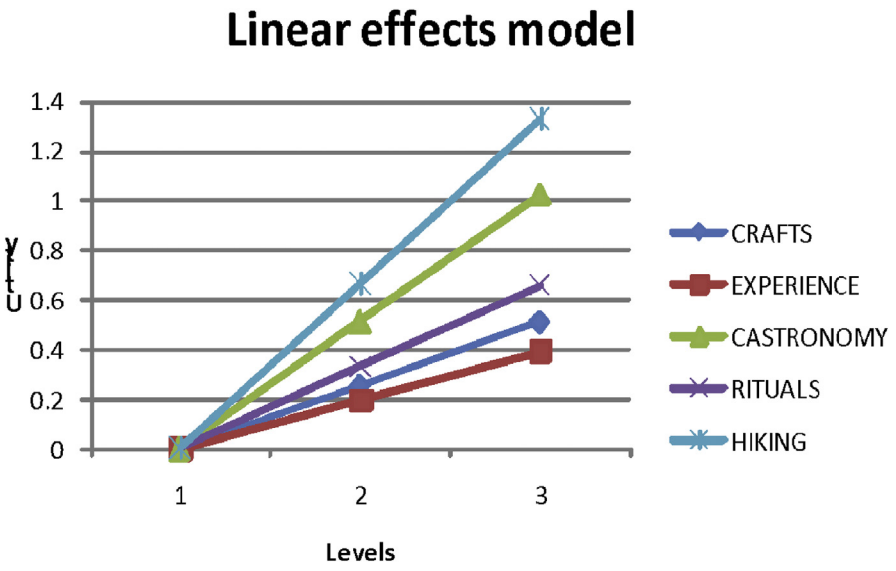

Fig. 5. Attributes impact. Linear effects model.

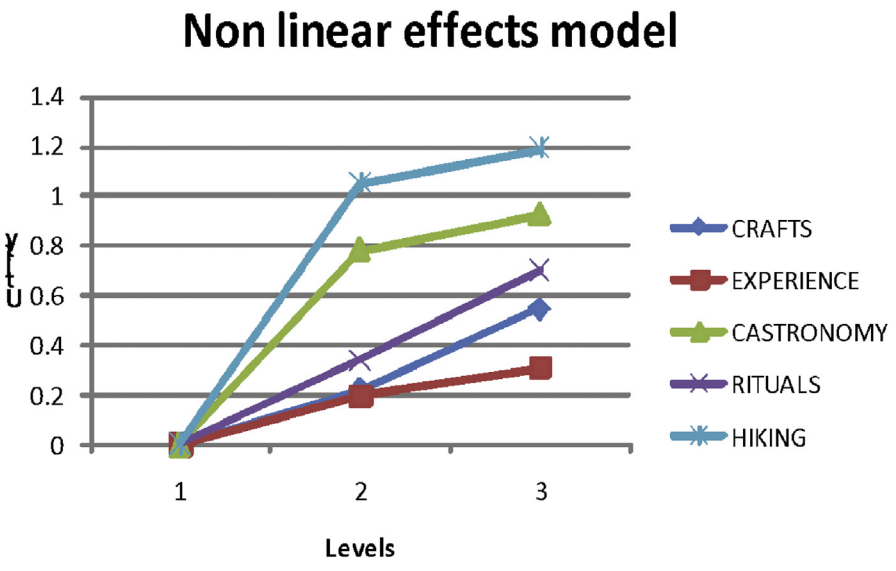

Fig. 6. Attributes impact. Nonlinear effects model.

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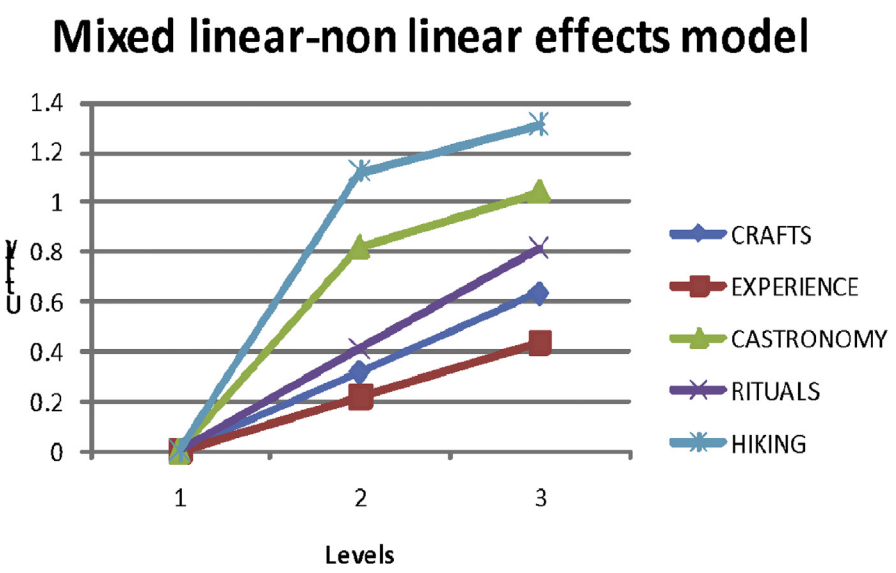

Fig. 7. Attributes impact. Mixed linear-nonlinear effects model.

that is to say hiking and gastronomy. In particular, in the case of intermediate level (level 2) the impact on the utility of these two attributes is more than twice the impact produced by other attributes when nonlinear effects are considered. In this regard, it is also important to point out that the experience of community life is the attribute producing the lowest impact for visitors of the area under analysis.

2.2.2.3. Willingness to pay for ecotourism products

Discrete choice models can be used to calculate the amount that a respondent would be willing to pay for a particular good or service. The willingness to pay (WTP) measures are express in monetary terms, the changes in the utility produced by changes in the attributes. These measures can be obtained once the utility function of the different alternatives is estimated.

The WTP for continuous variables is calculated as the ratio of the marginal utility of the attribute and the marginal utility of price as Eqs. (17), 18) and (19)):

$$WTP = \frac{\frac{\partial U}{\partial \theta}}{\frac{\partial U}{\partial P}} \tag{17}$$

$$WTP = -\frac{0.664}{(-0.0109)} \tag{18}$$

$$WTP = 60.91743119 \tag{19}$$

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When the resulting value is a negative number (as in all the attributes in our case), the interpretation of the willingness to pay should be in absolute terms since the individual is willing to pay a positive amount of money to obtain improvements in the attribute. In the linear effects model, all variables are treated as continuous, thus, for example, in the case of the WTP for hiking we obtain:

It is important to note that in this model the individual's willingness to pay for moving from level 1 to level 2 is the same as the willingness to pay for moving from level 2 to level 3 in monetary terms. The values obtained for all the attributes are seen in the Table 7.

For the non-linear effects model to obtain the WTP for passing from one level to another we consider the difference in the utility in monetary term that is, divided by minus the coefficient of price, which is equal to the marginal utility of income. Thus, the WTP for passing from level 1 to level 2 is obtained as (Eq. (20)):

$$WTP_{1-2} = \frac{U^2 - U^1}{(-\theta_P)} \tag{20}$$

In the case of the WTP for hiking as an example, we obtain (Eqs. (21), (22), (23), (24), (25) and (26)):

$$WTP_{1-2} = \frac{U^2 - U^1}{(-\theta_P)} = \frac{\theta_{S1} - 0}{(-\theta_P)} = \frac{\theta_{S1}}{(-\theta_P)} \tag{21}$$

$$WTP_{1-2} = \frac{1.05}{(-0.00872)} = 120.412844 \tag{22}$$

$$WTP_{1-3} = \frac{U^3 - U^1}{(-\theta_P)} = \frac{\theta_{S2} - 0}{(-\theta_P)} = \frac{\theta_{S2}}{(-\theta_P)} \tag{23}$$

$$WTP_{1-3} = \frac{1.19}{(-0.00872)} = 136.467888999 \tag{24}$$

Table 7. Willingness to pay estimations. Linear effects model.

ATTRIBUTES	WTP
Hiking (S)	$60.92
Experience of community life (E)	$17.98
Gastronomy (G)	$46.97
Crafts (A)	$23.49
Rituals (R)	$30.18

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$$WTP_{2-3} = \frac{U^3 - U^2}{(-\theta_P)} = \frac{\theta_{S2} - \theta_{S1}}{(-\theta_P)} \tag{25}$$

$$WTP_{2-3} = \frac{1.19 - 1.05}{(-0.00872)} = 16.05504587 \tag{26}$$

Table 8 shows the WTP figures obtained for the nonlinear and the mixed linear nonlinear effects models.

It is worth to note that in the mixed model when the effect is linear for an attribute, the WTP for improving the attribute from level 1 to level 3 the value obtained when passing from level 1 to level 2. For nonlinear attributes (hiking and gastronomy) the WTP figures obtained with these two models are substantially higher than those obtained by the linear effects model.

In general, we think that the willingness to pay figures obtained in the analysis represent rather high values for a country such as Ecuador where the average family income is $893.00 A possible explanation of this result could be explained by the socioeconomic profile of the average visitor of the area which belongs to a high-middle income segment. Notwithstanding these estimates are pretty consistent with the profile of tourists who more visit this area, they are considered within the economically active population, which are public and private sector officials in addition to an academic level of higher education. In addition, when comparing our WTP figures with market prices for similar products in other areas of the country our results turn more consistent. For example, if we offer a touristic product that has hiking, gastronomy and the experience of living with the community with the estimated values the total price of the package would be about $324.95 and "*Cotococha Amazon Lodge*" offer products with similar characteristics with prices ranging from $275.00 to $400.00 (http://www.cotococha.com/), as the same as the travel agency "*SelvaVida*" (http://selvavidatravel.com) that offers packages with different activities; such as rituals and the price is about $170.00. However, a more in deep research must be undertaken in order better understand the factors defining preferences for ecotourism products.

Table 8. Willingness to pay estimations. Non - linear and mixed linear non - linear models.

Attributes	Non − linear effects		Mixed linear non − linear model	
	1–2	1–3	1–2	1–3
Hiking	120.41	136.47	130.69	152.86
Experience of community life	22.71	35.21	25.44	50.76
Gastronomy	89.45	105.96	95.22	121.35
Crafts	25.11	62.84	36.99	73.98
Rituals	38.65	79.93	47.37	94.63

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The data process is shown in the Supplementary File 2.

3. Discussion

The ecotourism has shown to be a strong force in the field of ecological restoration that's what [7]. affirms, other researchers say that ecotourism is a vehicle to generate economic growth that is compatible with sustainable natural resource use [15]. In [16] also the ecotourism contributes directly with its economic benefits to the conservation of some species of animals [14] and as well others academics says that the majority of tourists and tour operators are in favor of ecotourism activities that might benefit local rural communities [17].

Among the methodologies most used concerning to the economy and ecotourism are contingent valuation [18, 19], cost and benefit analysis [20], travel cost model [21], contingent ranking [22], and discrete choice models.

The choice experiments are a useful tool in the analyses of tourist preferences in relation to a specific place or area, and have more direct links with economic theory [23]. The choice experiment is implemented as a stated preference technique that may be suitable for the valuation of ecosystem services [24], also, through the choice experiments the tourist preferences can be analyzed in the development of new tourism sites or in enhancing existing ones in developing countries [25, 26]. The estimation of discrete choice models is required in order to analyze individual preferences [27].

The research carried out in this dissertation provides preliminary results that open the door for future research. Few applications of choice experiments are known in the field of ecotourism. In fact, this case study represents a precedent in Ecuador which encourage us to continue under these research methodologies.

These are some the lines that could be developed in future research:

i) Analysis of systematic and random taste heterogeneity as well the incorporation of panel correlation effects by estimating more flexible choice models of the family of Mixed Logit.

ii) Analysis of Latent class models who can help us to detect the existence of latent behavior regarding the perception of the attributes and their willingness to pay, not accounted by the classical analysis of taste heterogeneity.

iii) Analysis of Hybrid choice models incorporating information on individual's attitudes regarding environment conservation.

3.1. Research setting

In the Table 9 the most important aspect of this research is show.

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Table 9. Relevant research aspect.

Interviewed	459
Scenarios	12
Place	Southeastern Region of Ecuador
Models	Knowledge Representation Model for BOK [8] applied on Ecotourism Demand Analysis (different Multinomial Logit models considering linear and non-linear effects in the explanatory attributes.)
Attributes	Hiking Experience of community life Gastronomy Crafts Rituals These attributes were further tested to determine their relationship with a tourist's tour intentions [28].
Codes	Model and attributes of knowledge Area Two ecotourism packages characterized by six attributes, namely, price, hiking activities, participation in rituals, tasting of local gastronomy, visit to crafts centers and experience community life; and the status quo represented by the non-choice option and supported in tourist BOK

Ecotourism is one of the core tourism products that is highly promoted by the government; ecotourism is one of the means for income and employment opportunities in the rural communities due to the integrative nature of the state's resources that combines culture, nature and adventure into one ecotourism package [29].

Understanding the complex interactions between ecotourists and Eco destinations is important to ecotourism decision making, including regulatory, operating, and marketing decisions [30].

The majority of tourists and tour operators are in favor of ecotourism activities that might benefit local rural communities [19]. Ecotourism can be an incentive for conservation, especially when it triggers positive economic change [31].

Tourists wish to see and would support conservation and community development programs both financially and via their future selection of ecotour operators [32].

4. Conclusions

In this article we have carried out a first approach to the analysis of the demand for ecotourism products in the province of Zamora Chinchipe located in the southeastern region of Ecuador, where local population and indigenous communities could find a good opportunity to increase their income, improve their living standards, and help in the conservation of protected areas. In the analysis we use data from a discrete choice experiment which faced visitors to the choice among two hypothetical ecotourism packages characterized by six attributes.

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Choice experiments offer the advantage of obtaining information from each respondent who faces a series of choice scenarios characterized a number of attributes that have different levels. In our survey we interviewed 459 individuals that provided useful information, such as their travel preferences, their attitudes regarding certain environmental issues, and socioeconomic information. This information was supplemented with that resulted from the choice experiment where individuals selected the option that was consider more attractive according to their preferences, under 12 different choice scenarios.

The demand analysis is based on the estimation of different Multinomial Logit models considering linear and non-linear effects in the explanatory attributes. The main conclusions derived from the analysis are the following:

i) In spite of considering an experimental design with potential for measuring non-linear effects in all qualitative attributes (as all the attributes were defined at three levels), in our case these non-linear effects only resulted significant for activities related to hiking and tasting of gastronomy. For the rest of the attributes, a marginal improvement is identically perceived independently of the departure point.

ii) Regarding attributes importance, again hiking and gastronomy where the ones that produced the highest impact on tourists' utility. Community experience as presented in the experiment has not been highly valued by respondents, and the same happens with the rituals and crafts.

iii) We obtained willingness to pay figures for the attributes considered in our analysis that resulted consistent with market prices of similar products offered in the area. As expected, the activities with highest value were hiking and gastronomy. This means that people visiting the area greatly values these two activities from the rest, thus promoting it would lead to higher revenues.

iv) Results of our analysis provide useful information for local authorities responsible of tourism departments to promote the development ecotourism products in the area.

Ecotourism activities are a strategic product designed to be sold in a market segment where people have a high average income. It is important to point out that in Ecuador, the tourism expenditure of the nature tourism segment provided in the Amazon, which combines experience with indigenous communities, is greater than that carried out by the mass tourism segments, such as sun and sand tourism that occurs in the cost areas.

Declarations

Author contribution statement

Pablo Alejandro Quezada Sarmiento: Analyzed and interpreted the data; Wrote the paper.

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Jessica del Cisne Macas Romero: Performed the experiments; Wrote the paper.

Concepción Roman: Conceived and designed the experiments.

Juan Carlos Martin: Contributed reagents, materials, analysis tools or data.

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The authors declare no conflict of interest.

Additional information

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