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Research paper

Determination of the environmental sustainability of tourism in the Pastaza Province, Ecuador

Determinación de la sustentabilidad ambiental del turismo en la Provincia de Pastaza, Ecuador

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ABSTRACT

Tourism causes impacts in the receiving communities and in the ecosystems. To minimize these impacts, the World Tourism Organization and the United Nations have called on governments to consider sustainability as a global objective. Developing policies for a common practical strategy that allows measuring the sustainability of tourism is the current challenge. However, it will not be easy to achieve its implementation in a specific way, if the interests of the stakeholders involved in the tourism sector are taken into account. The objective of this research is to analyze the current state of sustainability of tourism in the province of Pastaza (Ecuador). A mixed methodology is used, which starts from the documentary analysis to determine the variables affected by tourist activity and their quantification through indicators. Based on 19 specific indicators selected for the environmental dimension, a synthetic index of sustainable environmental development of tourism is proposed, as a criterion of the environmental sustainability of tourism. Which contributes to implement decisions to improve the efficiency and sustainability of tourism management.

Keywords: *biodiversity, tourism, sustainability index, Pastaza, Ecuador*

RESUMEN

El turismo genera impactos en las comunidades receptoras y en los ecosistemas. Para minimizar estos impactos, la Organización Mundial del Turismo y las Naciones Unidas han pedido a los gobiernos que consideren la sostenibilidad como un objetivo global. Desarrollar políticas para una estrategia práctica común que permita medir la sostenibilidad del turismo es el desafío actual. Sin embargo, no será fácil lograr su implementación de una manera específica, si se tienen en cuenta los intereses de los actores involucrados en el sector turístico. El objetivo de esta investigación es analizar el estado actual de la sostenibilidad del turismo en la provincia de Pastaza (Ecuador). Se utiliza una metodología mixta, que parte del análisis documental para determinar las variables afectadas por la actividad turística y su cuantificación a través de indicadores. A partir de 19 indicadores específicos seleccionados para la dimensión ambiental, se propone un índice sintético de desarrollo ambiental sostenible del turismo, como criterio de sostenibilidad ambiental del turismo. Lo cual contribuye a implementar decisiones para mejorar la eficiencia y sostenibilidad de la gestión turística.

Palabras clave: biodiversidad, turismo, índice de sostenibilidad, Pastaza, Ecuador.

INTRODUCTION

Tourism is an important sector in the progress of the international economy, the recovery from the economic crisis and the reduction of poverty. In Ecuador, it is the third source of non-oil income, after bananas and shrimp, which shows the relevance of the sector for the Ecuadorian economy. The National Tourism Plan 2030 identifies sustainable tourism as one of the strategies for the economic and social development of Ecuador.

One of the most important challenges facing policy makers and tourism managers is determining whether tourism management meets the principles of sustainability. Tourist destinations that use their natural resources for tourism development must agree, among local stakeholders, the policies and practices necessary to manage, in a sustainable way, the development of tourism activities in their fragile natural environments. The research defines a so-called index of environmental sustainability of tourism (ISAT).

Sustainable development concept

The concept of sustainable development was defined, in the Brundtland Report, as "the type of development that meets the needs of present generations without compromising the ability of future generations to meet their own needs." (UN, 1987). Since the origin of the concept of development, the contradiction between the finite nature of the planet's resources and the exponential growth of the economy has prevailed.

The solution of this dilemma gave rise to the concept of sustainability that supposes a balance between economic growth and the protection of the environment. From the Brundtland Report (UN, 1987) it can be considered that there are several approaches to the concept of sustainable development:

- The ecological approach limits the concept to ecological sustainability, where the indispensable conditions to maintain human life today and in the future prevail. The socio-economic aspect is relegated to overcome poverty.
- The economic approach, exposes a concept of sustainable development from the economic processes. Where economic development is perceived as a condition to protect nature.
- The approach to sustainability as management refers to the fact that on a global level the natural heritage should be used in a rational way. However, the environmental impacts of economic growth are not considered and there is optimism about the future availability of resources.
- The scope of the concept, when trying to bring together economic and social criteria, aims to protect the heritage of humanity, agreeing on the satisfaction of needs and the recognition of the limits of the use of the environment. Since the origin of the concept of development, the contradiction between the finite nature of the planet's resources and exponential growth has prevailed. (Rutherford, 2008; Bramwell, 2017; Higgins-Desbiolles, et al., 2019). As a solution to this dilemma, the concept of sustainability arises, which involves a balance between economic growth and environmental protection.

Sustainable tourism concept

The clearest definition of sustainable tourism was formulated by the International Union for Conservation of Nature (IUCN):

"The process that allows development to take place without deteriorating or depleting resources so that they can be renewed at the same rate as they are being used, or from the use of a resource that is generated slowly to another that does so faster. In this way, the resources will be able to continue supporting future generations". (IUCN, 1991).

According to the World Tourism Organization (UNWTO), it is proposed to consider sustainable tourism as:

"Development that meets the needs of today's tourists and host regions while protecting and fostering opportunities for the future. It is conceived as a pathway to managing all resources so that economic, social and aesthetic needs can be met, while respecting cultural integrity, essential ecological processes, biological diversity, and life-sustaining systems. ' (UNWTO 1999, p 22)

Tourism has impacts on the environment of the destinations, on the receiving communities and on the conservation of the ecosystems of regions and countries. To minimize the unwanted impacts that tourism has on receiving communities and on the conservation of ecosystems in regions and countries, the UNWTO and the United Nations (UN) have called on governments to consider sustainability as an overall goal. At the United Nations General Assembly, an important agreement was endorsed to agree on

the positions of the countries with the purpose of approaching a common practical strategy called Measuring the Sustainability of Tourism (MST) (UNWTO / UN, 2019).

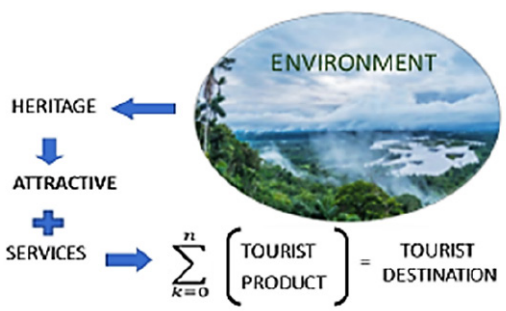
Developing policies for a common practical strategy to measure the sustainability of tourism is the current challenge. However, it will not be easy, the problem will be to achieve its implementation in a specific way, if the interests of the parties involved in the tourism sector are taken into account. According to Sharpley (2020), after more than three decades of international acceptance of the fundamental principles of the concept of sustainable development, real advances in achieving a more sustainable tourism sector have been few.

Interactions between tourism and the environment

Since the sixties, environmental issues have acquired notoriety in society. Despite this, human activities and the economic system have caused the loss of resources that leads, more and more rapidly, to the degradation of ecological systems. The analysis of the relationships between tourism and the environment is essential to achieve the sustainable development of tourism; in a way that contributes to the satisfaction of the needs of the different actors involved.

Actually, the environment and its conservation constitute the fixed capital of any tourism initiative with a sustainability approach. Thus, a difficult relationship is established between the protection of natural resources and the increase in economic profitability. When resources are structured for tourist use and enjoyment, they become products. The tourism products offered in a given geographic region complement and compete with each other. (Figure 1)

Figure 1. Relationship between environment and tourism in the framework of sustainability.



Source: self made. Photo of the Provincial GAD of Pastaza

The attractive resources related to the typologies of the environment, of the region in which the tourist development takes place, are the fundamental source of tourist activities. These resources are the key to the design of the tourism product and its planning in each particular destination.

The growth of demand and the diversification of the offer have originated the contradictions between the environment and the growth of the tourist offer These divergences constitute a threat to the essential resources that are offered as tourist attractions and suppose a danger to development and continuity of local tourism.

The role of tourism in environmental protection as a support for sustainable development must be present in strategic planning, zoning, observation of impacts and approaches to tourism (Sharpley & Pearce, 2007; Job et al., 2017).

Indicators to measure the sustainability of tourism

The UNWTO defines indicators as "the set of measures that provide the necessary information for better understanding of the links and impacts of tourism with respect to the natural and cultural environment in which the activity takes place and on which it is widely dependent" (UNWTO , 2004).

Based on the UNWTO mandates, numerous works have been developed that propose systems of indicators to assess the tourist sustainability of destinations. (Kristjánsdóttir et al., 2018). However, most of them formulate the system theoretically without fully quantifying it, which makes it difficult to use in practice (Kates & 2005; Blancas et al., 2007; Tanguay et al., 2013).

The term sustainable tourism has been widely studied, as well as the proposals for indicators and the index to evaluate the sustainability of a tourist destination (Buckley, 2012; Torres-Delgado et al., 2017; Rasoolimanesh et al., 2020). But, studies on tourism sustainability indices applied specifically to protected natural areas (ANP) are scarce. (Li, 2004; Erdogan et al., 2009; Ashok et al., 2017)
Environmental sustainability measurement models

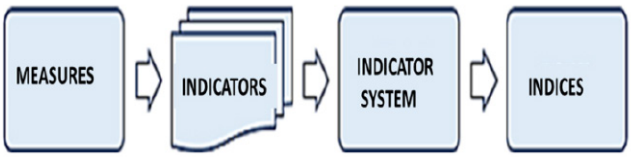
The design of measurement models, especially in the environmental dimension, allows establishing a chain of values and factors that bring transcendence to a fundamental dimension of the concept of sustainable develop-

ment. Indicator systems are a selection of indicators that generate a new context in which it is possible to study a phenomenon. (Figure 2)

According to OMT, (2018) the main characteristics that the indicators must meet to be included in the systems can be summarized in the following.

- Integrators capable of providing summary information
- Easy to measure, to control and supported by available information.
- Appropriate to the aggregation level of the system analysis
- Applicable in a wide range of conditions
- Be based on reliable information
- Easy to understand (not just by experts)
- Focus on the practicalities and be clear
- Temporality allows the detection of trends
- Prediction, provides early warning detection
- Really express the property to be evaluated

Figure 2. Indicator system



Source: Castro, 2004

A system of indicators is more than a sum of statistical figures; since it responds to a specific and joint interest that makes the information greater and incomparable with that offered by each of its parts (Castro, 2004).

The creation and application of indexes implies a scientific design, supported by a prior social assessment. The development of an information system for the development of sustainable tourism is essential to use natural and social resources in favor of the economy (Hinkel, 2011; Cabello et al., 2013; Pulido & Pulido, 2015). Currently, the information available to help local destinations make decisions to improve tourism is limited.

The construction of the indicator system is generally made difficult by a number of problems. The design of an indicator system for the Pastaza province, these problems can be summarized as follows:

- Lack of strategic vision on sustainability as an alternative that promotes new territorial and tourist information systems.
- Limitations of local statistical information, from th- quantitative and qualitative approach.
- Little coordination of the different municipal areas involved in the development of tourism.
- Little use of the possibilities of information technologies to organize data with statistical value.

Essentially, three models have been defined to undertake the process of construction of environmental indicators, which have been applied to obtain sustainable tourism indicators:

- Model PSR (Pressure-State-Response), is based on the impact that human activities have on the environment and modify the original characteristics of natural resources, which facilitate the evaluation of the impact of tourism on the environment.
- DPSIR (driving forces-pressure-state-impact-response) model, was designed by the European Environment Agency (1998). It incorporates the causes of pressure and impacts produced as a result of changes in environmental conditions.
- CMAP Model (World Commission on Protected Areas) (2019), formulated to assess the status of protected natural areas and evaluate their management, proposes the following categories of indicators: context, planning and legislation, means, processes, activities and services, and results. (Hockings et al, 2000)

MATERIALS AND METHODS

Investigation methodology

A mixed methodology is used that, from the quantitative and qualitative approaches, starts from the documentary analysis to determine the variables that can affect the sustainability of the tourist activity and that will require its quantification through indicators. A design is used that involves three processes: establishing the sample box, determining the variables, collecting and examining the data.

The research begins with the bibliographic review around the concepts of development and sustainability and the analysis of the most used tools for their measurement. The analysis of the documentation takes into account conceptual aspects and practical experiences of previous studies in tourist destinations characterized by their natural heritage; those that provide elements to decide which

instruments will be used (Ruiz, et al., 2011; León & Leyva, 2017).

The current state of tourism in the Pastaza province was verified, from the participatory strategic diagnosis, through the use of two traditional analysis methods, SWOT and Delphi (Miller, 2001; Choi & Sirakaya, 2005). Subsequently, the appropriate indicators were chosen to measure the sustainability of tourism through a Relative Operational Index (IOR); constructed from expert criteria on the relevance, specificity and feasibility of each indicator (Grandzol & Gershon, 1994; Tague, 2004).

The calculation of tourism sustainability is carried out from indicators that are selected according to the relevance, specificity and feasibility of each one. The sustainability index for each dimension was established according to the adequacy of the methodology developed by Torres-Delgado (2018). The evaluation criterion was adopted from the methodology to measure sustainability in tourist areas characterized by their high biodiversity, which is recommended by the IUCN (2001). To guarantee the objectivity, reliability, efficacy and applicability of the results, a methodological triangulation was used (Forni, 2020).

Importance of research and delimitation of the study area The dependence between tourism and the environment requires the establishment of measures to plan and manage the use of these areas, in order to improve their services, offer a variety of alternatives to visitors and contribute to their sustainability, in their biophysical dimensions. , social, ecological and economic (Buckley, 2012; Acosta, 2017; Reyes-Vargas, 2019).

The potential for tourism development in the Pastaza province is based on its natural resources; which are affected by the unplanned expansion of the agricultural and livestock frontier, and the increase in urban areas. However, the province lacks instruments to evaluate the environmental sustainability of tourism; lack that limits the possibilities of defining correct policies, strategies and decisions to achieve a rational use of its natural and cultural heritage. In this context, the research proposes three objectives:

1. Analyze tourism performance from an approach that contemplates the perspective of environmental sustainability.

2. Delineate a tool to measure, conceptualize and quantify the performance of the environmental sustainability of tourism in the Pastaza province; by synthesizing the information into indicator values that are easy to interpret and apply.

3. Apply the tool to the Pastaza province in a way that provides tourism managers with a judgment on the environmental sustainability of tourism management.

General characteristics of the Pastaza province

The Pastaza province is located in the center of the Ecuadorian Amazon Region. It is part of one of the hot spots of biodiversity on the planet, due to its exceptional concentration of species and high levels of endemism. It is located entirely in the Ecuadorian Amazon between 500 and 1500 meters above sea level (Aguirre, 2017).

Pastaza is located between the geographic coordinates of 1 ° 10´ south latitude and 78 ° 10´ west longitude; and 2 ° 35 'of south latitude and 76 ° 40' of west longitude. The province is located in the central zone of the Ecuadorian Amazon; Its cantonal head, the city of El Puyo, is one of the most important accesses to the Ecuadorian East and is part of a road axis that connects with the central area of the country.

It is the largest province in Ecuador with 29 643.33 km2; but the second least populated, after Galapagos. Its estimated population, year 2019, is 111,270 inhabitants, which represents a population density of 3.75 inhabitants / km2; the lowest in Ecuador (INEC, 2020). For decades the province was the object of displacement, but today it has become a consolidated province, with poles of economic development and urban growth such as Puyo and Shell,

Pastaza has a high percentage of NBI (poverty due to unsatisfied basic needs); In 14 of 21 parishes in their territory, poverty exceeded 70% (INEC, 2019). Health, education, housing, water and sanitation are priorities of the strategy prioritized decentralized autonomous governments (GAD) Cantonal Pastaza will prioritize the updating of the Development Plans and Land Planning.

Pastaza is also characterized by conserving a large part of the country's biodiversity and cultural wealth. More than 94% of this territory is tropical humid forests, inhabited by seven of the 11 indigenous nationalities of the Ecuadorian Amazon: Kichwa, Shuar, Waorani, Achuar, Sapara, Andoa and Shiwiar.

Figure 3. Geographic location of the Pastaza province

Source: GADPPz provincial de Pastaza

Approximately 20% of the natural forests that the country has are in the province of Pastaza. The region belongs to the humid tropical zone of the continent, with an average temperature range between 18 and 24 ° C and an average rainfall of 3,570 mm per year.

The majority of tourist attractions in the province are natural environments related to its aquatic resources such as spas and waterfalls, and others related to the rich landscape such as viewpoints, nature trails, caverns, etc. (Figure 3). In addition, it has multiple attractions associated with its cultural wealth.

Figure 3. Panoramic view of the Pastaza river in the jungle area

Photo: GADPPz provincial de Pastaza

Its capital, the city of Puyo, is one of the most important steps towards the Ecuadorian east, which connects to the central area of the country. In this context, water is an essential element of biodiversity and ancestral cultures, it represents the central argument of tourism and its contribution to local development (Torres, 2017).

Main productive activities that take place in the Pastaza province

The oil industry continues to be the most important economic activity for the country and this resource is extracted mainly from the Ecuadorian Amazon region. In Pastaza there are several oil wells in production that are located in the northern part. However, and with the exception of the protected areas of the province, practically the entire territory is segmented into oil blocks, most of them still without a concession for exploration or exploitation. Of particular importance for the environment is the oil exploitation in the upper area of the province, since in this territory are the sources of water for human consumption of most of the population of Pastaza.

Among the main non-oil productive activities that take place in the province are:

- The manufacture of clothing, except leather.
- The manufacture of metal products for structural use.
- The retail sale of food, beverages and tobacco.
- The retail sale of food in specialized stores.
- Restaurants and mobile food services.
- Telecommunications, construction and transportation.

Prospects of the Pastaza province for the development of tourism

The extension of the Amazon rainforest, with its extraordinary biodiversity, offers very good prospects for the development of activities such as scientific tourism and tourism associated with natural heritage. Life and costums of the Zápara, Shiwiar and Andoa, in danger of extinction, are reason for trips and tourist excursions.

Despite the interest aroused by the attractions of the Ecuadorian Amazon, there are few comprehensive technical studies that induce the enhancement of the extraordinary tourist potential of the region and the economic benefits that this activity could provide and above all the way to access a market as competitive as tourism.

However, there are some successful experiences with positive effects in which the potential of scientific tourism is presented as well as the existence of research projects that respond to themes in the lines of Ecosystems, Biodiversity and Species Conservation, Environmental Management and Conservation, (Reyes & Ortega, 2013; Bravo, et al., 2017). According to the inventory of natural and cultural attractions of the GADPPz, (2019), in the province of Pastaza there are a total of 64 tourist attractions.

RESULTS AND DISCUSSION

Participation of tourism in the economy of the Pastaza province

The activity with the highest share of gross value added (GVA) in the province of Pastaza corresponds to the exploitation of mines and quarries with 51.2%, followed by public administration with 5.7% and transportation and storage with 5.6%. Tourist activities, accommodation and restaurant services only represent 2.2%. (Central Bank of Ecuador, 2019).

In the Pastaza province, income from tourist activities, in the period 2012-2019, registered an annual growth rate of -2.4%. In the same period, Ecuador achieved a compound annual growth rate (CAGR) of 9.9% in income from tourism. (Table 1).

In 2019, tourism in Ecuador directly contributed 2.2% of the national GDP and favored the creation of 408,774 jobs in the sector. The country's tourism activity stands out for being the third source of non-oil income, which shows its relevance for the Ecuadorian economy (INEC, 2020).

Table 1 Income from international tourism (GVA, US $ million): Ecuador and Pastaza province

	Ecuador		Pastaza	
Year	Sightseeing	Total	Sightseeing	Total
2010	1.031	56.481	18,8	759,7
2011	1.092	60.925	15,1	1.135
2012	1.136	64.362	19,6	1.042
2013	1.191	67.546	18,5	1.033
2014	1.218	70.105	17,1	981,7
2015	1.173	70.174	16,1	613,0
2016	1.166	69.314	17,8	546,7
2017	1.234	70.955	13,7	634,6
2018	1.871	108.398	17,2	713,8
2019	2.422	100.871	16,1	730,9

Source: Own elaboration from https://www.entaciónrencifras.gob.ec/cuentas-economicas/

The impact that the tourism sector has on the economic growth of Ecuador and the Pastaza province was determined from the dependency relationship between the variables economic growth of the country and the economic activity of the tourism sector by means of the Pearson correlation of the VAB. (Table 2)

Table 2: Correlations: contribution of tourist activities to the economy of Ecuador and the Pastaza Province (2010-2019) (thousands of US dollars)

Pastaza	Average	Deviation Standard	Pearson's correlation
VAB- tourism	17,197	1,702	0.273
GVA-Total	745,325	198,326	0.273
Ecuador	**Average**	**Deviation Standard**	**Pearson's correlation**
VAT- tourism	1,768,681	389,444	0.909
GVA-Total	88,493,325	1,096,230	0.909

The correlation is significant at the 0.01 level (bilateral)
Source: Own elaboration with, SPSS Statics 25

Selection of indicators to measure the environmental sustainability of tourism in the Pastaza province

Based on the SWOT strategic diagnosis, the Delphi technique and the relative operability index, the indicators were chosen to measure the sustainability of tourism. For which the criteria on the relevance, specificity and feasibility of each indicator were considered. The proposal was based on the territorial development approach that is based on two strategies: local economic development and tourism development.

To evaluate the protection and conservation of the environment, 19 indicators related to water, energy, the preservation and recovery of natural resources, and the environment. To eliminate the heterogeneity of the measurement units, it was necessary to normalize each of the indicators on a common scale. Regardless of the unit of measurement in which an indicator is expressed, a value can be obtained for each of them that is relative to the total number of indicators. These values range from 0 to 1; and its meaning varies according to the type of relationship, positive or negative (Table 3)

Table 3: Selected indicators to measure the environmental sustainability of tourism in Pastaza

No	Indicators	Zscore *
1	There are training initiatives for local resident officials.	0.476
2	There are local resident officials with tourism training.	0.593
3	The amount of water consumed by tourists does not affect local consumption.	0.652
4	There are programs to reduce the consumption and reuse of water.	0.471
5	There is monitoring of water quality.	0.462
6	The amount of solid waste generated by tourism is high.	0.486
7	There are programs to reduce the amount of solid waste.	0.491
8	There is selective collection of solid waste and a recycling process.	0.488
9	The energy consumed by a tourist in a period does not affect local consumption.	0.590
10	There are programs to reduce energy consumption.	0.465
eleven	There is a wastewater treatment process.	0.501
12	There are areas preserved, recovered or in the process of recovery.	0.468
13	There are programs or facilities to improve air quality.	0.439
14	There is a prgram oriented to environmental education.	0.572
fifteen	There are associations of environmental groups in the town.	0.598
16	There is an environmental or tourism certification process.	0.547
17	There is a good amount of typical local products (crafts, souvenirs, etc.).	0.505
18	There are acts of vandalism practiced by tourists to the heritage	-0.441
19	There is satisfaction of the local population with tourism .	0.415

* Zscore (normalized indicator)

Consultation with third parties on the proposal of indicators

The proposal of indicators in the Delphi study was consulted with a third group of experts who had no information on the previous ratings. The experts who would participate in these analyzes were chosen for their professional experience at the regional and national levels:

- University professors linked to research and tourism planning of natural spaces, or the relationships between tourism, territory and the environment;
- Qualified professionals from the Ecuadorian, tourism and environmental public administrations;
- Members of institutions and / or organizations, public and private, related to the planning and management of natural spaces;
- Professionals from private companies with experience in tourism planning and management of natural spaces.

In any case, the existence of a close link between the professional, institutional and / or research activity of the experts invited to collaborate and the subjects under study was established as a requirement. The average experience of the experts was 25 years, 36% are doctors in different areas of science and 50% work as professionals, managers and entrepreneurs in the tourism sector

The interpretation of the results was carried out by means of the statistical analysis of Measures of Central Tendency or of Position and Measure of Dispersion to obtain a qualitative evaluation on the answers of the experts. Wang (2016) The validation of Sustainability Indicators for areas with tourist use in the Pastaza Province, consulting third parties presented a Cronbach's Alpha 0.877.

By consensus, selection was considered a very useful instrument to measure the sustainability of natural areas with tourist use in the region. (Table 4).

Table 4: Consultation with third parties on the proposal of indicators to measure sustainability.

No	Query about indicators	Dev. typical	% agree
1	It is conceptual and coherent	0.422	96
2	They are of practical use	0.789	84
3	There is no duplication	0.316	98
4	All are relevant	0.483	74
5	Are enough	0.483	94

Basic and strategic dimension of the indicators

The indicators are classified, according to Coll-Serrano (2012), in two levels according to their relevance, specificity and feasibility of application (Table 5)

- Basic level: made up of operational indicators that allow knowing, based on planning, all the actions of the different strategic lines. This dimension is made up of short-term indicators of resources, processes and products.

- Strategic level: formed by the indicators linked to the strategy and the results to be achieved in medium and long term; relating to the effects and impacts.

Table 5: Dimension of the system of indicators to measure environmental sustainability in the province of Pastaza.

System level	Indicator number *
Basic	1,2,3,5,6,8,9,11,12,13,15,16,17,18,
Strategic	4,7,10,14,19

* (Identify in Table 3)

Strategic indicators should guide actions and the application of policies aimed at the conservation, restoration, preservation and revaluation of heritage assets. The triangulation of the information provided by all the actors who participated in the selection process and guarantees the objectivity of each of the indicators.

Evaluation of the tourism environmental sustainability index

The ISAT was calculated according to the Methodological Guide recommended by the Economic Commission for Latin America and the Caribbean (Quiroga 2009). As a criterion for evaluating sustainability, the methodology to measure sustainability in tourist areas characterized by their high biodiversity recommended by the IUCN was adopted; according to which, to establish the level of sustainability, the following criteria must be included:

0 to 0.2 = collapse
Any number greater than 0.2 to 0.4 = critical
Any number greater than 0.4 to 0.6 = unstable
Any number greater than 0.6 to 0.8 = stable
Any number greater than 0.8 to 1.0 = optimal

Formula of the environmental tourism sustainability index (IST)
ZSi = value of indicator "j" normalized in the field
p = number of simple indicators used

The application of the proposal of sustainability indicators was able to reveal the current problem of tourism management in the Pastaza province regarding environmental sustainability, presenting an index of 0.485; which qualifies biodiversity as an unstable system.

Among the causes that determined the sustainability index in the environmental dimension are:

- Most of the province's territory is covered with natural forest, but only 38% of these areas are under some mechanism of conservation or legal protection. (Zambrano et al., 2019)
- Inadequate solid waste management is exacerbated in Pastaza. These wastes are emitters of gases, fumes and dust that promote pollution.

The Autonomous Decentralized Government of the province has proposed the strengthening of the provincial environmental unit. As well as the execution of projects focused on solving environmental management problems and compliance with regulations that affect the sustainability index of areas with tourist use.

CONCLUSIONS

The integration of various techniques and methodologies used in the framework of natural spaces of great biodiver-

sity, allowed to identify the behavior of the environmental sustainability of tourism in the Pastaza province. The analysis allowed the system to be classified as unstable by registering an index of environmental sustainability of tourism of 0.485.

The main contribution of the research is the establishment of a useful tool for determining the environmental sustainability of tourism in the Pastaza province. Which can serve as a reference for other Amazon regions and tourist destinations recognized for their biodiversity.

THANKS

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