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**DESIGN OF AN INDICATORS SYSTEM FOR THE EVALUATION OF THE
TECHNOLOGICAL INNOVATION IN PUERTO LOPEZ - ECUADOR**

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The undersigned members of the corresponding work report committee declare that we have **APPROVED** the graduate degree work **DESIGN OF AN INDICATORS SYSTEM FOR THE EVALUATION OF TECHNOLOGICAL INNOVATION IN PUERTO LOPEZ - ECUADOR**, which has been proposed and developed by **JOSÉ RAFAEL VERA VERA**, prior to the obtention of the degree of Master in Tourism, as established by the **REGULATIONS FOR THE ELABORATION OF THE GRADUATE DEGREE WORK** by the Escuela Superior Politécnica Agropecuaria de Manabí Manuel Félix López.

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DEDICATION

I dedicate this work to my biggest inspiration in life: my family, my wife and my two girls.

JOSÉ RAFAEL VERA VERA

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ABSTRACT

Innovation in tourism is experiencing a new era in response to the changeable tourists' behavior. Therefore, this work was aimed to design an indicators system for the evaluation of the technological innovation (Ti) in the canton of Puerto Lopez. For this purpose, an analysis of the current tourist situation of the territory was carried out with the application of interviews and a survey addressing the context of Ti in the canton from the tourists' perspectives, the strategic analysis of the territory with the application of the SWOT matrix was carried out to determine the main problems affecting the Ti in the area. The design of the indicators system was exposed to experts' criteria to validate them, regarding their relativity with the issue and the current reality of the canton. The results provided a list of 19 indicators fitted in three stages evaluated within the public, business and community sectors, under the view of the four-dimension proposed by OECD (2005) in the Oslo Manual. The system of indicators was validated through the Delphy method, the result of the application of the Kendall test with Chi square method reported that the vast majority of the answers in the evaluations by the experts are located within the classification: strongly agree or agree and that the most important indicators are, certifications / recognitions on products and / or processes related to technological innovation, technological innovations with R & D, innovative tourism activities (ITA), programs / projects aimed at promoting ITA, use of ICT by tourism companies and Open data (OD) of the indicators system proposed for the evaluation of the Ti in Puerto López.

KEYWORDS

Innovation, technological innovation, innovation in tourism, tourism destination.

RESUMEN

La innovación en el turismo está experimentando una nueva era en respuesta al comportamiento cambiante de los turistas. Por lo tanto, este trabajo tuvo como objetivo diseñar indicadores para la evaluación de la innovación tecnológica (Ti) en el cantón de Puerto López. Para este propósito, se realizó un análisis de la situación actual del territorio con la aplicación de entrevistas y una encuesta que abordó el contexto del Cantón desde la perspectiva de los turistas, el análisis estratégico del territorio con la aplicación de la matriz FODA fue Realizado para determinar los principales problemas que afectan la Ti en la zona. El diseño del sistema de indicadores estuvo expuesto a los criterios de los expertos para validarlos, en relación con su relatividad con el tema y la realidad actual del cantón. Los resultados proporcionaron una lista de 19 indicadores ajustados en tres etapas evaluadas dentro de los sectores público, empresarial y comunitario, bajo la visión de las cuatro dimensiones propuesta por la OCDE (2005) en el Manual de Oslo. El sistema de indicadores se validó a través del método Delphy, el resultado de la aplicación del método de Kendall con Chi cuadrado señaló que la gran mayoría de las respuestas en las evaluaciones de los expertos están ubicadas dentro de la clasificación: muy de acuerdo o de acuerdo y Los indicadores más importantes son, certificaciones / reconocimientos de productos y / o procesos relacionados con la innovación tecnológica, innovaciones tecnológicas con I + D, actividades turísticas innovadoras (ITA), programas / proyectos destinados a promover el ITA, el uso de las TIC por parte de las empresas de turismo y Open. Datos (OD) del sistema de indicadores propuesto para la evaluación de la Ti en Puerto López.

PALABRAS CLAVE

Innovación, innovación tecnológica, innovación turística, destino turístico.

CHAPTER I. BACKGROUND

1.1. INTRODUCTION

Innovation has changed the face of the industry in all sectors of the global economy nowadays. According to Simpson, Siguaw, & Enz (2006) the positive or negative effects of innovation comes out from its orientation. In this sense, not all the “*innovative performers*” have clearly oriented innovation in the different sectors, therefore the implementation of this factor has not had the expected results. Indeed, it is an indispensable factor for the success and survival of any sort of business in terms of getting over competitors today, through the differentiation of their products and services in the market (Hernández, 2013; Rivas, 2014). For Pisano (2015) & Ponti (2013) innovating means changing ideas into products, services or strategies to later be valued by a group of target consumers. However, in many countries across the globe, innovation has not been explored in depth due to the lack of knowledge regarding its system.

Innovation differs from creativity. Creativity refers to the production of new ideas, new approaches and inventions, whereas innovation is the application of new and creative ideas and the *implementation* of inventions. From this it follows that people and organizations may be creators without being innovators (Decelle, 2004)

Innovation in tourism must be seen as a permanent, global and dynamic process (Cosma, Paun, Bota, & Fleseriu, 2014) Innovation system in tourism can be complex as the theoretical underpinning is extensive but scarce in objectivity (Hjalager, 2010). The limited theorizing and empirical investigation of innovative practices by tourism organizations is a considerable weakness (Thomas & Wood, 2014). It means that innovativeness is not only the concept but also the knowing about “what to do” and “how to do it” to transform it into business (Souto, 2015). On the other hand, most researchers have just overlapped its nature, and it comes to an entangled amount of information somewhat difficult to be synthetized. Nevertheless, it can be assumed by

empirical inference that the scope of innovation (whether sectorial, national or regional) does not exclude the technological matter.

In the entrepreneurial sector, innovativeness can improve the level of incomes, and the number of new jobs. A study run by Kogan, Papanikolaou, Seru, & Stoffman (2017) found that a growth in the amount of industry innovation increases the quantity of capital and labor services in the industry. However, for Erspective & Lusch, (2015) Ti broadly contributes to enhance the opportunities for innovating services. In other words, Ti is the golden key for the development.

Clearly, Ti is a powerful mechanism for boosting business competitiveness. Since the 90s it started to suffer several modifications, it began to stop being a lineal model to evolve into an interactive one which not only considered product and process but the importance of organization and marketing (Redes, 1996). This definition, however, has continuing evolving since then. In the view of DIACONU (2011) it comprises new or significantly modified products and processes where technological novelty emerges. For instance, the introduction of new technology generates new products or processes in the business. In respect with the aforementioned facts, Alfonso (2013, p1) asserts the following:

Technological innovation is the most important power for the change in the production of goods and services. Nowadays, this process is seen as the real and tangible result of technology, which enables innovators to combine technical, financial, commercial and administrative capacities along with the launching of new and better products or processes to the market. The process of innovating as well as its relationship with society turns out complex, since it not just implies the application of the obtained results from the research at a high level, but also it is the result of entrepreneurial, strategic, organizational and imaginative and decision-making capacities.

In this regard, (Alfonso, Rodríguez, & Blanco, 2010) asserts that the tourism industry has become interested in inserting activities of Ti as a competitive strategy for the improvements of results and quality in the service. Innovativeness in tourism is the combination of applied research (knowledge production), training levels of human capital to enable them to assimilate and

communicate that knowledge (knowledge dissemination) and the destinations and companies' capacity to absorb new technologies, therefore, Ti itself is an instrument for sustainable growing of companies and destinations, in order to boost the competitiveness in the area where tourism is implemented.

Furthermore, In Ecuador, Ti is one of the main weaknesses not just in the travel and hospitality industry but also in the majority of entrepreneurships. In the public sector, just the MIPRO (Ministry of Industry and Productivity of Ecuador) is working in this field; it has launched the initiative MIPROLab to engage university students from all over the country to present innovative proposals that affects positively the economic development.

In the PNBV 2013-2017 (in Spanish, Plan Nacional para el Buen Vivir) innovation is presented as the key mean for the transition from a primary producer- based economy to a knowledge-based economy, and introduces the idea of social and technological innovation as the fundamentals of what is called the *Productive Matrix Change* (SENPLADES, 2013). However, the capacity of innovation has not shown any signs of growing in this context as no information inventory exists. Moreover, such structural change must be supported by an easy and understandable policy framework, which leads people to direct their effort to a common goal. On the other hand, it is demanded to understand the nature of innovation by all means.

Innovation today is one of the priorities in the tourism agenda at all institutional levels, the World Tourism Organization (UNWTO) says that it is an indispensable tool for management of the tourist activity (OMT, 2018). Ecuador, however, considerably bet on innovation during the past government in order to achieve the goal of changing the productive matrix, for this purpose, the current Government Secretariat for Higher Education, Science and Technology ([SENESCYT; for its Spanish acronyms] Government Secretariat of Science and Technology [SENACYT] by then) in 2015 promoted great support for innovative ventures and promoted proposals for innovation in various fronts of the economy and invested in the global training of human talent. This year marked important advances for this phenomenon, such as the appearance of Innopolis (Fair of innovation projects) managed by the university YACHAY

TECH, the same that has led to innovations, which have been more linked to the development of technologies and robotics, with a low impact on tourism activity. Currently, SENESCYT continues to support innovation projects through its web portal “Banco de Ideas” that promotes calls for proposals. However, so far there have been no emblematic innovative projects directly linked to tourism activity.

Further, it seems that the importance of innovative decisions in businesses or public planning is still underestimated. In some tourist SMEs (Small and Medium Sized Enterprises) – the predominant number of establishments in Ecuador in this sector- incremental innovation is being seen as a tool of growth, in contrast, radical innovation is a quasi-non-explored field.

On the contrary, when it comes to the reality in tourism, the lack of innovative ideas in the academic, social, political, organizational, technological, cultural, entrepreneurial, environmental, and infrastructural dimensions, within the local, regional, national or sectorial area is easily visible. Nonetheless, it has been widely and wrongly assumed that innovation is strictly connected to ICT (Information and Communication Technology) because of its versatility to be implemented in any of those dimensions.

In this regard, the underestimated importance given to Ti, particularly from the governmental policy, is negatively affecting the province of Manabí. Despite the fact that innovation can revolutionize the form of managing tourism to succeed the development of this sector, when it is implemented and evaluated. Today no cantons have implemented an innovative strategy to attract visitors, conversely, in their rural localities, tourism is not seen as a tool of local development, sometimes, as the result of the difficult implementation of ICT. Thus, it is of striking importance to evaluate the current and potential application of innovative ideas to foster the activity in those areas.

Nonetheless, in cantons with high demand of tourists such as the Canton of Manta, big companies like the hotels Howard Johnson, and Oro Verde, which are located on the sea border, are leading the process of innovation, despite the fact that it is just incremental and that international chains own most of them. In addition, in the province of Manabí, the process of Ti is not observed under the

lens of systematization, and it is necessary to implement procedures, tools, and existing methodologies that facilitate its evaluation.

Tourism activity in Manabí after the earthquake of April 16, 2016, must be reformulated, so it requires the new reality, it is necessary to analyse the (...) problems and their causes that motivate the stagnation in tourism management, learn the needs and the requirements of tourism service providers, redesigning new products aimed at motivating demand and implementing strategies that motivate the reactivation of tourist activity through the improvement of tourist offers, and communication (marketing) of the destination (Garcia, Carreño, & Doumet, 2016)

Added to this issue, this province is now experiencing an infrastructural, social and economic recovery from the devastating earthquake occurred on April 16th 2016, which weakened the tourism growth for the next two years. On the other hand, Puerto López – as potential tourism important site- must take care of innovation in order to boost the activity and avoid losing interest by tourists to be visited. With this in mind, it is time to start planning from a renewable perspective that greatly affect in the face of tourism in a middle and long term. For this reason, it is viable to state the idea that the evaluation of the technological innovation will allow planners to establish better conditions to improve the tourist supply in the territory. The evaluation must be performed by the application of an indicators system. According to Alfaro & Gómez (2016) for the building of any indicators system, the need to establish the characteristics of the incoming information is key so that the data provided by the different official information sources are related to the dimensions of the previously selected evaluation.

As a way of result of all the problematic situations previously stated, it is evident that Ti is still an emerging issue, likewise instruments for its evaluation in the destination were not found. For these reasons the following scientific problem is stated:

- How may the technological innovation be evaluated in Puerto Lopez?

HYPOTHESIS

If an indicators system for the evaluation of Ti in Puerto Lopez is built, it will be possible to improve the technological management in the territory.

STUDY OBJECTIVES

For the realization of the present study the following general objective was proposed:

- Design an indicators system for the evaluation of the technological innovation in Puerto López.

For the end of reaching the main goal, below are the specific ones which guided the process:

- Analyze the tourism sector regarding the technological innovation in Puerto López.
- Define the indicators for the evaluation of the technological innovation in Puerto López
- Validate the indicators system for the evaluation of the technological innovation in Puerto Lopez

CHAPTER II. METHODOLOGY DEVELOPMENT

2.1. RESEARCH METHODOLOGY

This qualitative study with an analytic-synthetic approach was developed in three main phases described ahead which were obtained from the analysis of different methodologies applied in previous studies regarding the construction of an indicators system as it is steered in this work. Below is the theoretical basis for the definition of the procedure, the design of it and the detail of the steps considered for each of the investigative activity run.

2.1.1. METHODOLOGICAL ARGUMENTATION FROM THE THEORY

Prior to the construction of the indicators system for the evaluation of the Ti the following procedures for this end were taken as references in order to integrate the aspects they consider for this purpose. Below is a short account on their corresponding main approach:

Methodology I: “Workshop on indicators in tourism for the countries of South America- Villa Gesell, Argentina”. (UNWTO, 2000)

The workshop was aimed to establish indicators for tourism. It consisted of three stages, the first was preparatory and involved the raising of information for the analysis of the study object, its determination and characterization, data collection and analysis contrasted to the local reality. the second phase gather key information to avoid risks in order to validate the indicators with the participation of key actors; finally, the third stage comprises the writing of the final report.

Methodology II: “Indicators of sustainable development for tourist destinations - Practical guide” (UNWTO, 2005)

This work was framed in three phases. The first stage aims at the obtention of information of the destination as well as its current tourist situation, it also identifies the stakeholders and previous studies on the area. In the second stage, indicators are built with the consideration of the most striking problems

which must be prioritized to solve the main situations. The last phase embodies the application of the indicators with all the mechanisms for monitoring.

Methodology III. “Indicators system to promote sustainable tourism in the province of Manabí” (Rodriguez, 2018)

This thesis presents a similar procedure compared to the previous methodologies analyzed. It integrates three stages, the first one is aimed to raise information on the destination such as the strategic analysis of its current tourist situation, collection and analysis of data and characterization of the main problems. The second stage is the identification of indicators by the revision of literature and adaptation to the destination tourist reality. The third stage embraces the validation and writing of the indicators system.

For a better visual interpretation, the stages applied in the aforementioned methodologies are shown in table 2.1.

Table 2.1. Methodologies for the design of an indicators system

	(UNWTO, 2000)	(UNWTO, 2005)	(Rodriguez, 2018)
Stage 1	Preparatory: raising of information for the analysis of the study object	Analysis of the destination and its current tourist situation	Analysis of the destination and its current tourist situation
Stage 2	Gathering of information about risks and validation of indicators with the participation of key actors	Construction of indicators	Identification of indicators
Stage 3	Writing of the final report	Implementation of indicators	Writing of indicators

Source: self-reported information

As shown in the table above, the stages proposed by the authors cited implies similar activities which can be summarized for this work as follows:

- Analysis of the current situation,
- Identification of the indicators
- Writing of the indicators for the system

- Validation of the indicators

2.2. METHODOLOGICAL DESCRIPTION FOR THE STUDY

In order to better understand the methodology for this study, the stages, activities and techniques are shown in figure 2.1.

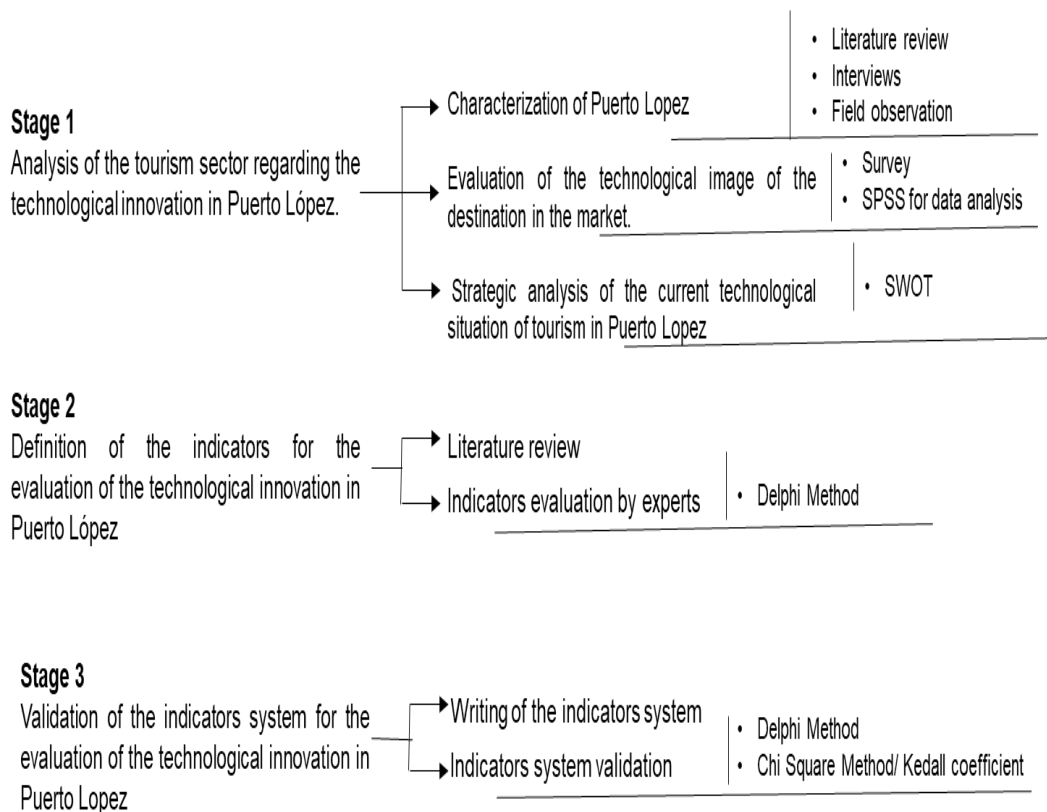


Figure 2.1. Methodological Procedure for the construction of an indicators system.

2.2.1. ANALYSIS OF THE TOURISM SECTOR REGARDING THE TECHNOLOGICAL INNOVATION IN PUERTO LÓPEZ.

This stage comprises three main activities: the characterization of Puerto Lopez, the evaluation of the technological image of the destination in the market and the strategic analysis of the current tourist situation; all of them are described below.

2.2.1.1. CHARACTERIZATION OF PUERTO LÓPEZ

For the characterization of the study area from the tourism perspective, literature review on the available information of the territory was analyzed in

official documents, web pages, and through interviews applied to officials of the tourism sector in Puerto López. The analysis is developed on the three axes of sustainability (economic, social and environmental), and due to the characteristics of the study, the technological management was addressed as the superstructure to overview the handling of the institutions which intervene in the territory; for this purpose the PDOT (Spanish acronyms for Territorial Development Plan) was revised (GAD Puerto López, 2015), the statistical information of the canton was revised in official pages and the technique of direct observation was applied to raise information about the tourist and basic infrastructure through visits to the territory.

2.2.1.2. EVALUATION OF THE TECHNOLOGICAL IMAGE OF THE DESTINATION IN THE MARKET: PROCEDURE FOR THE STATISTICAL SAMPLE.

For the collection of data, the sampling procedure was defined, information collection instruments were designed, quantitative techniques were applied and the statistical package SPSS version 29 was used. To determine the sample size, the methodology proposed by Alatorre & Pérez (2011) was used but following a statistical criterion and assuming an infinite population. The variability of the population is estimated at 50% ($p = q = 0.5$), a widely used value in social research (Meiriño, Fraiz, Vila, & Lopez, 2016) For the information gathering, 191 valid surveys were applied, representing a sampling error of 7.2% with a confidence level of 95%.

The questionnaire for the survey is shown in annex 1.

2.2.1.3. STRATEGIC ANALYSIS OF THE CURRENT TECHNOLOGICAL SITUATION OF TOURISM IN PUERTO LOPEZ

Through the analysis of the results of the interviews, the search for scientific information and direct observation, it was proceeded to analyze the internal characteristics (weaknesses and strengths) and its external situation (threats and opportunities) that the Puerto López has. Through the identification of the

main problems in the SWOT matrix, it allowed to generate the problematic and solution of the same ones by means of the rating of the variables considered.

2.2.2. IDENTIFICATION OF THE INDICATORS SYSTEM FOR THE EVALUATION OF THE Ti IN PUERTO LOPEZ.

In this phase, the most important indicators related to technological innovation and adapted to tourist destinations are defined, which at the same time can respond to the most important problems and best fit the needs of the territory.

First, for the identification., indicators were considered in relation with the context of the potential and existing technological reality. Technological management is one of the main pillars of innovation in this field, which according to the White Paper on Smart Tourism Destinations (STD) (Blanco, 2015) must be framed in three substantial phases: before, during, and after the visit of the tourists.

On the other hand, the Bogota Manual (MB) (Hernan Jaramillo, Gustavo Lugones, 2001) was considered as a key tool for the identification of innovation indicators in relation to the measurement dimension and the types of indicators. This manual is an adaptation of the Oslo Manual (RICyT, 1997) to the Latin American context, assuming the complexity in the comparability of these indicators in our (developing) countries against the reality of the developed countries. However, none of these manuals presents an approach - albeit partially - touristy but fully entrepreneurial. This constitutes a complex framework in the adaptation of the indicators to the field of tourism framed in the management from all its sectors (public, private and community), taking into account the difficulty of the term innovation as an evolving concept.

For the adaptation of the indicators for the measurement of technological innovation in tourism, the merger of the indicators proposed in the Operational Manual for the Configuration of STD (Agencia Valenciana del Turisme (Invat.Tur), 2015) of which those that are directly related to technological innovation are extracted. Through the guide of the MB and Oslo Manual proposed by the OECD (2005), the dimensions on which to measure (product, process, organization and marketing) are established, finally considering the

White Paper of the STD (Blanco, 2015) for the stages (before, during and after the visit) that will make up the phases of the measurement.

In this section, a preliminary list of possible and / or potential indicators is prepared to address each of the adjacent problems and policy issues of the destination. The indicators were chosen from the aforementioned documents, they were selected based on their potential implementation in relation with the reality of the destination. For the achievement of it, a matrix with the indicators proposed matched with the sectors and dimensions to evaluate was designed so that experts find the correlation easier to understand (see annex 2).

2.2.3. VALIDATION OF THE INDICATORS SYSTEM FOR THE EVALUATION OF THE Ti IN PUERTO LÓPEZ

For the indicator system design, it was necessary to have the list of indicators evaluated and classified according to the needs identified.

2.2.3.1. EVALUATION OF THE INDICATORS FOR THE EVALUATION OF THE Ti IN PUERTO LÓPEZ - DELPHY METHOD.

Based on the risks and problems identified, a consultation procedure or a group of experts designated for this purpose can be used to draw up a list of possible indicators that could be useful to understand the problems and risks and contribute to managing or influencing them.

The methodology used for the evaluation of sustainability indicators by expert criteria was considered as follows:

- As an initial phase, a matrix of personal information of the profession of each expert was drawn up:

EXPERTS' PROFESSIONAL INFORMATION			
Nº	RESPONSSABILITY	ACADEMIC TRAINING	YEARS OF EXPERIENCE
1			
2			
3			
4			
5			
6			
7			

Once the list of possible experts who participated in the evaluation process has been determined, an assessment was made regarding the level of experience that they have, evaluating the levels of knowledge they have about the object of study. The evaluation consisted of marking with an X on a scale of 1-10, in which they indicate the degree of knowledge they have about the research and from that the coefficient of knowledge or information (Kc) is calculated with the following formula: $Kc = \frac{n}{10}$

Sources of argumentation or rationale	High	Medium	Low
Theoretical analyzes done by you			
Your experience obtained			
Works by national authors			
Works by foreign authors			
Your knowledge about indicators on Ti			
Your intuition			

- Once the corresponding assessment was made, this result allowed calculating the coefficient (Ka) of each expert: $Ka = \frac{a_i}{n_i} = \frac{(n_1 + n_2 + n_3 + n_4 + n_5 + n_6)}{n_i}$.
- After that, obtained the values of the knowledge coefficient (Kc) and the argumentation coefficient (Ka), we proceed to obtain the value of the coefficient of competence (K), which is calculated using the formula $K = 0,5(Kc + Ka)$.

It should be noted that this coefficient will allow to determine the experts that will be taken into account to work on the proposed investigation.

- Once the results are obtained, they are evaluated as follows:
 - o $0.8 < K < 1.0$ High Competition Coefficient
 - o $0.5 < K < 0.8$ Average Competition Coefficient
 - o $K < 0.5$ Low Competition Coefficient

Experts	High Competition	Medium Competition	Low Competition
---------	------------------	--------------------	-----------------

	Coefficient	Coefficient	Coefficient
Expert 1			
Expert 2			
Expert 3			
Expert 4			
Expert 5			
Expert 6			
Expert 7			

2.2.3.2. WRITING OF THE INDICATORS SYSTEM FOR THE EVALUATION OF THE Ti IN PUERTO LÓPEZ

In this section, each of the selected indicators is written and described, using the indicator description table, the same that was use for the validation of the indicators.

2.2.3.3. VALIDATION OF THE INDICATORS SYSTEM FOR THE EVALUATION OF THE Ti IN PUERTO LÓPEZ – CHI SQUARE METHOD.

The opinion of the experts was analyzed by means of a Chi-Square statistical test, to verify if there is a coincidental coincidence in the criteria issued by the experts. Within this, a value of the Kendall concordance coefficient was obtained. Kendall's concordance coefficient (W) is useful in reliability studies among judges (experts). The mathematical expression for its calculation is:

$$W = \frac{s}{\frac{1}{12}k^2(N^3 - N)}$$

Where:

- The denominator of the expression is the maximum possible sum of squared deviations; that is, the sums that will occur when there is a perfect agreement between the "k" ordinations.
- s is the sum of the squares of the deviations observed from the average of the judgments issued and is obtained through the following expression:

$$s = \sum \left(R_j - \frac{\sum R_j}{N} \right)^2$$

Where, in turn:

R_j is the sum of all the criteria of the expert j on the problem i in relation to the weighting.

N is the number of entities (objects, indicators, problems) ordered.

K is the number of experts.

In the case of "linked" observations (T), each of the observations is assigned the average of the ranges that would have been assigned if no leagues had occurred. The effect of the linked ranges is to reduce the value of W , given by the expression 15.

$$W = \frac{s}{\frac{1}{12}k^2(N^3 - N) - k \sum_T T}$$

For large samples ($n > 7$) the χ^2 statistic is used, which is distributed according to the distribution χ^2 with $N-1$ degrees of freedom.

So that:

$$\chi^2 = k(N-1)W.$$

The null hypothesis would then be:

H_0 : There is agreement between the judgment of the experts.

H_1 : There is no agreement between the judgment of the experts.

Critical region (CR):

RC: if $\chi^2 > \chi^2_{\alpha; N-1}$ the null hypothesis is rejected, because the judgment of the experts is consistent and they agree in the weighting of the calculated indicators.

CHAPTER III. RESULTS AND DISCUSSION

3.1. ANALYSIS OF THE TOURISM SECTOR REGARDING THE TECHNOLOGICAL INNOVATION IN PUERTO LÓPEZ.

The results were obtained from the implementation of the phases stated in the methodological development as it follows:

3.1.1. CHARACTERIZATION OF PUERTO LÓPEZ

According to the Plan for Development and Land Use of the Puerto López canton (PDOT) prepared by the GAD Puerto López (2015a), this is one of the 22 cantons of the province of Manabí, located in the southwestern part of the province, strategically crossed by the Spondylus Route (road artery E-15), in the Machalilla National Park (a protected area), which covers 60% of its territory, the canton has an area of 429.36 km², it borders on the north and east with the canton of Jipijapa, to the south with the province of Santa Elena and to the west with the Pacific Ocean, it is between the coordinates 01°10' and 01°40' of south latitude and between the 80°25' and 80°52' of western longitude. Its population is 20,451 inhabitants of whom the predominant number reaches a secondary level, followed by elementary level of schooling (INEC, 2010).

Puerto López is politically made up of three parishes (Machalilla, Salango and Puerto López). Within these three parishes there are 31 villages of which 4 are communes (Agua Blanca, El Pital, Las Tunas and Ayampe) the latter is integrated by 4 communities that have their own organizations.

In the northern part of the canton the climate oscillates between 26 and 24°C, in the southern part between 22 and 24°C; with an annual precipitation between 0 and 1500 mm. It has several rivers that flow into the sea, excelling as the main basin, the Ayampe River, which shares its route with the canton Jipijapa. As its

territory is widely occupied by the Machalilla National Park, environmental management is strictly regulated by the Environmental Ministry of Ecuador (MAE), however, other ministerial posts which intervene directly or indirectly in the management of the territory such as the Ministry of Tourism (MINTUR) and the Ministry of Agriculture, Livestock (MAG), Aquaculture and Fishing (MAP) among others, this due to its various forms of production. According to the GAD Puerto López (2015b) there are natural resources that have been degraded by the intervention of the human being and its causes such as: deforestation and pollution, among them the deterioration of the flora and fauna as well as those of the rivers' basins.

Fishing represents the most important source of income for the canton in general and the parishes of Machalilla and Salango - with the exception of the urban parish of Puerto López. The Machalilla parish, is the least benefited by tourism. This reality contrasts with the statistics of the economically active population (PEA) which represents 46.53% of the population of the canton (INEC, 2010a) where the majority of them are work in the tourism field. In addition to these activities, there are other sources of income such as agriculture, livestock, forestry and poultry farming, especially in the rural area, however, their low level of production plays down their importance in the local economy (GAD Puerto López, 2015c).

Based on the population census of 2010, 45.74% of the gross population in the canton represented predominantly a primary level of education, followed by the secondary level with 22.70% and only 6.45% had higher education level, most of them are involved in the tertiary sector, but not directly linked to tourism but to the administrative and teaching functions.

The strategic location of Puerto López facilitates the access to and from it. Its roads are of second order. The road infrastructure inside the town is deteriorated, which makes transportation and internal mobilization difficult. One of the most important streets is the waterfront one, which was rebuilt in the last five years and now represents a nice urban landscape unlike the rest of the city. On the other hand, access to rural areas is limited. The canton has 44 educational establishments (primary and secondary level), none of them at the third level, has three health centers (two sub-centers and one community clinic). The majority of the population does not have access to basic services.

Within the framework of the tourist superstructure, the MAE is the institution that regulates any type of activity, including tourism. MINTUR currently does not have a tourism office in the canton, so the task of promotion and dissemination is carried out by the tourism department of the GAD of the canton, while the community sector assumes its touristic role. There is an association of hoteliers, and also restaurants and operators, however, their objective is to enhance the achievement of operating permits, so currently they do not lead any project that promotes tourism from the private sector. In addition, there is a lack of interest of these key actors for inter-institutional and intersectoral cooperation and coordinated work for the management of tourism in the territory.

Tourism dynamics in the canton of Puerto López is consistent, with a greater influx of visitors between the months of June to September, largely due to the observation season of humpback whales. Among its most positioned natural attractions are: Los Frailes beach, Agua Blanca commune and Isla de la Plata, all located within the Machalilla National Park. "The tourism specialist of the tourist office in Puerto López, Ángel Pincay, stated that the fact that this canton

is inside the park has greatly benefited them for tourism development" (A. Pincay, Personal communication, January 9, 2019). Despite the precarious situation of the infrastructure of basic and complementary services, Puerto López is one of the most visited cantons by the sun and beach tourism segment in the province of Manabí. The tourist facility consists of 71 accommodation establishments, 25 food and beverage establishments, 32 travel agencies and a tourist transport agency. According to statistics from the tourism office of the canton, according to the department of tourism in Puerto López, in 2017 it received a total of 299,535 visitors, between nationals and foreigners, despite the economic impact suffered by the earthquake that occurred the previous year.

One of the most outstanding weaknesses that tourism in Puerto Lopez currently faces today is the lack of a strategic plan to direct the processes of tourism management in the territory, followed by administrative instability as department directors are normally changed when a new major is elected. This has caused the lack of firm projects, which promote constant development; due to this, the shift managers have directed the management of this activity, mostly to the promotion especially in national and international fairs, with little presence in social networks. The results of this management approach affect tourism activity, as conflicts in the management of the various public institutions responsible for tourism in the territory and basic infrastructure, make the image of the canton, a reality different from that of promote. According to "Cedeño, MAE officer for Puerto Lopez, another of the serious problems affecting tourism development, especially at the business level, is the activity of" hooking "which

leaves little profit margin to operators, preventing them from improving their services "(Y. Cedeño, personal communication, January 9, 2019).

3.1.2. EVALUATION OF THE TECHNOLOGICAL IMAGE OF THE DESTINATION IN THE MARKET

Important information concerning to innovation was analyzed to construct the questionnaire for the survey. In this regard, the criteria stated in the White Paper for STD were considered to build the questions. Relying on the manual revised, the technological interaction between the tourists and the destination must be present in the three stages that make up the process of a visit, they are:

- Before the visit: the raising of awareness of what the destination has regarding its products and services, and the way to provide the right and quick response to the potential tourists' questions for them to make the right decisions on time.
- During the visit: technological facilities to enhance the access to information for visitors while in the destination, is an indispensable feature of a STD.
- After the visit: Public departments must be interested in the tourists' perceptions of the destination, so that it is easy for the tourism managers to learn about the customer's satisfaction and therefore improve the products and services as they correct the mistakes.

Set forth below are the results:

The frequency of people who had informed on the web before the visit showed that from the 191 visitors surveyed, 68.9% of them did it (see table 1), this indicates that most of the tourists search information on web pages before making their decision about the trip.

Table 3.2. Tourists informed on the web

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	131	68.6	68.9	68.9
	No	59	30.9	31.1	100.0
	Total	190	99.5	100.0	

Missing	System	1	.5		
Total		191	100.0		

Source: self-reported information.

In the second question 63.4% of the 191 respondents reported that there are no official virtual tourist information channels where they can ask questions about tourism products and services and get answers in a short time, this shows the lack of management for permanent communication with real and potential visitors. 33.5% did not answer the question (see table 2).

Table 3. 3. Awareness of official virtual channels on the web to ask for information

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	6	3.1	4.7
	No	121	63.4	95.3
	Total	127	66.5	100.0
Missing	System	64	33.5	
Total		191	100.0	

Source: self-reported information.

With regard to the third question, 74.3% of the 191 respondents stated that there are private virtual channels that resolve the concerns of tourists before the trip. In contrast to the public sector, Puerto Lopez companies are interested in providing quick and timely information to both real and potential tourists through virtual channels. 20.9% did not answer the question (see table 3).

Table 3.4. Awareness of private virtual channels on the web to ask for information.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	142	74.3	94.0
	No	9	4.7	100.0
	Total	151	79.1	100.0
Missing	System	40	20.9	
Total		191	100.0	

Source: self-reported information.

As shown below in table 4; 86.9% of the 191 visitors reported that there are no technological applications aimed to facilitate the access to information and services in the destination, so that it gets easier for visitors to better interact with

the destination, this percentage in turn represents the total of the questions answered. On the other hand, 13.1% did not answer the question.

Table 3.5. Apps to provide the visitors with virtual interaction while in the destination.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid No	166	86.9	100.0	100.0
Missing System	25	13.1		
Total	191	100.0		

Source: self-reported information.

The total of the questions answered in question five shows 86.4% of the 191 tourists who reported that in Puerto López there are no QR modules that contain information on sites. 13.6% did not answer the question (see table 5).

Table 3.6. Existence of QR modules with tourist information on sites.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid No	165	86.4	100.0	100.0
Missing System	26	13.6		
Total	191	100.0		

Source: self-reported information.

59.7% of the 191 tourists surveyed determined that there are no rental technology devices in the tourist kiosk in Puerto López. However, a significant percentage of the respondents (40.3%) did not answer the question (see table 6).

Table 3.7. Intelligent electronic devices for rent at the tourist kiosk.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid No	114	59.7	100.0	100.0
Missing System	77	40.3		
Total	191	100.0		

Source: self-reported information.

74.3% of the 191 respondents reported no public areas with free Wi-Fi points installed and managed by the official institutions responsible for managing the territory. 23% did not answer the question (table 7).

Table 3.8. Free use of Wi-Fi in public places and attractions.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	5	2.6	3.4	3.4
Valid No	142	74.3	96.6	100.0
Total	147	77.0	100.0	
Missing System	44	23.0		
Total	191	100.0		

Source: self-reported information.

As shown below in table 8; 66.5% of the 191 visitors reported that they have not received any promotional information about Puerto López after their visit, this shows a weak tracking of the tourist for their loyalty to the destination. 5% did not answer the question.

Table 3.9. Information provided for tourists through any technological channel after their visits

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	63	33.0	33.2	33.2
Valid No	127	66.5	66.8	100.0
Total	190	99.5	100.0	
Missing System	1	.5		
Total	191	100.0		

Source: self-reported information.

The following table (table 9) shows the qualified quantitative criteria, regarding the technological management in Puerto López. The questions analyzed through descriptive statistics were weighted on a rating scale of 1 (very bad); 2 (bad); 3 (fair); 4 (good); 5 (very good) and 6 (unknown).

Table 3.10. Analysis of the current technological management and infrastructural situation of Puerto López

		N	Minimum	Maximum	Mean	Std. Deviation
1	How would you rate the information about Puerto López available on the Web?	190	1.00	6.00	3.8316	1.67555

2	How would you rate the official use of social networks for tourism promotion and dissemination (relevant information, photographs of sites of interest, etc.) of Puerto López?	190	1.00	6.00	3.0316	1.79330
3	How would you rate the use of ICT (Information and Communication Technologies) for the management of tourism products in Puerto López?	190	1.00	6.00	2.5526	1.36272
4	How would you rate the technological infrastructure in Puerto López?	190	1.00	6.00	2.0263	1.16580
5	How would you rate the use of ICT by tourism managers of Puerto López, for information on tourists' visits (account of experiences, opinions, complaints and / or suggestions)?	190	1.00	4.00	2.0000	.98131
	Valid N (listwise)	190				

Source: self-reported information.

As shown in table 9, the survey applied to 191 visitors showed that the rating of the information about Puerto Lopez available on the web is at an average of 3.83 (± 1.67) under the regular parameter. The official use of social networks for tourism promotion and dissemination has a similar average of 3.03 (± 1.79); the use of ICT for the management of products in the territory shows an average of 2.55 (± 1.36) under the bad parameter, in a similar way, the technological infrastructure of Puerto López is at an average of 2.02 (± 1.16) followed of the use of the TIC for the information of the experiences of the tourists after the visit, with an average of 2.0 (± 0.98).

The result of the surveys shows an incipient technological management on the part of the public institutions in charge of the tourist activity. The current perception of the visitor of Puerto López, shows the urgent need to implement a technological infrastructure to boost the interaction of the visitor with the destination, before, during and after his visit, through technological tools and web channels such as social networks.

3.1.3. STRATEGIC ANALYSIS OF THE CURRENT TECHNOLOGICAL SITUATION OF TOURISM IN PUERTO LOPEZ

This part of the study was participative. It contributed to the analysis of the current situation of the technological innovation in Puerto López, and provided guidelines for the design of the indicators as the main problems related to this

field are stated. For the achievement of this step, experts of the different institutions (MAE- GAD cantonal), academics (ESPAM MFL School of Tourism) and entrepreneurs (travel agents, restaurants, transportation and hotels) involved in tourism in the territory took part in the preparation of the analysis. All of the information stated and selected by the participants were compare to the information available in the PDOT of Puerto López and by means of other sources like interviews and direct observation before analyzing and rating them in the SWOT matrix (table 3.11).

Table 3.11. SWOT Matrix for the strategic analysis of the current technological situation of tourism in Puerto Lopez

	Strengths	Weaknesses
Internal Analysis	<p>S1- Potentiality of the territory for the implementation of technological infrastructure.</p> <p>S2- Destination of tourist interest positioned in the domestic and international market.</p> <p>S3- Strategic location (on the Spondylus route, near two international airports [Manta and Guayaquil])</p> <p>S4- Priority area located within the Machalilla National Park (protected area)</p> <p>S5- Territory with a wide variety of natural and cultural resources of national heritage value.</p>	<p>W1- Lack of a tourism strategic plan (lack of planning related to technological innovation).</p> <p>W2- Deficient use of ICT for tourism management in the territory.</p> <p>W3- Deficient technological infrastructure.</p> <p>W4- Scarce investment in R & D + i.</p> <p>W5- Limited cantonal budget for tourism management.</p>
	Opportunities	Threats
External analysis	<p>O1- Global access to technology transfer.</p> <p>O2- Economic capacity of the central government to develop technological investment projects.</p> <p>O3- Presence of institutions for advice in the development of projects (universities, SENPLADES, MAE, MINTUR, etc.)</p> <p>O4- World tourism trend towards the STD.</p> <p>O5- Public policies to boost innovation</p>	<p>T1- Eventual appearance of tourist destinations with similar natural and / or cultural characteristics that may reduce the importance of Puerto López.</p> <p>T2- Eventual difficulty of the inhabitants of Puerto López for technological changes.</p> <p>T3- Administrative instability for tourism management in the territory.</p> <p>T4- Eventual policies of economic austerity due to crisis in the country.</p> <p>T5- Environmental degradation (affectation to natural resources)</p>

Source: self-reported information

The rating of the criteria considered for the SWOT variables were run according to the following scale (table 3.12)

Table 3.12. Weighting key for the SWOT

0	1	2	3
Nothing	Low	Médium	High

Source: self-reported information.

Subsequently, the strategic analysis of the SWOT matrix was carried out, as shown in table 3.13.

Table 3.13. Strategic analysis of the SWOT matrix.

		Opportunities						Threats						TS
		O1	O2	O3	O4	O5	T	T1	T2	T3	T4	T5	T	
Strengths	S1	3	3	3	3	3	15	3	2	3	3	3	14	29
	S2	2	1	2	2	3	10	3	1	2	3	2	11	21
	S3	0	2	3	0	1	6	3	0	1	2	1	7	13
	S4	0	3	3	1	3	10	3	0	3	2	3	11	21
	S5	0	3	3	1	3	10	3	0	3	3	2	11	21
	T	5	12	14	7	13	51	15	3	12	13	11	54	TW
Weaknesses	W1	3	3	3	3	3	15	3	1	3	2	3	12	27
	W2	3	1	1	3	2	10	3	2	0	2	1	8	18
	W3	3	2	2	3	3	13	3	3	1	1	3	11	24
	W4	3	3	2	3	3	14	3	3	3	2	3	14	28
	W5	2	0	3	0	3	8	3	0	1	2	2	8	16
	T	14	9	11	12	14	60	15	9	8	9	12	53	
	TO	19	21	25	19	27	TT	30	12	20	22	23		

* The relationship of importance between the variables of each quadrant is identified. With the total sum of each of them, the most important variables are identified.

Source: self-reported information.

The variables identified in each SWOT dimension are summarized below in Table 3.14.

Table 3.14. Main synthesized variables of the SWOT

Strengths S1.- Potentiality of the territory for the implementation of technological infrastructure.

Opportunities O5.- Public policies to boost innovation

Weaknesses W4.- Scarce investment in R & D + i.

Threats	T1.- Eventual appearance of tourist destinations with similar natural and / or cultural characteristics that may reduce the importance of Puerto López
----------------	---

Source: self-reported information.

Based on the analysis developed in the assessment table, it was possible to determine which quadrant in which the highest incidence of factors is found is the crossing between opportunities and weaknesses, which results in a mini-maxi quadrant (see table 3.15). This indicates that actions or strategies of reorientation must be proposed to counteract the weaknesses by taking advantage of the opportunities. The strategies obtained will integrate the system of indicators for the evaluation of technological innovation in Puerto López.

Table 3.15. Quadrants for the strategic analysis.

	Opportunity	Threat
Strength	Offensive Strategy	Defensive Strategy
Weakness	Reorientation strategy	Survival strategy

Source: self-reported information.

– **Strategic Problem**

If the eventual appearance of tourist destinations with similar natural and / or cultural characteristics that may reduce the importance of Puerto López is prevented, in consideration of the scarce investment in R & D + i, although the territory has potentiality for the implementation of technological infrastructure, the public policies to boost innovation may not be effectively used.

– **Strategic Solution**

If the potentiality of the territory for the implementation of technological infrastructure is effectively used by taking into account the public policies to boost innovation, proposals aimed to prevent the appearance of tourist destinations with similar natural and / or cultural characteristics that may reduce the importance of Puerto López must be done to overcome the scarce investment in R & D + i.

On account of the aforementioned strategic problem and solutions, the following strategies and actions are proposed:

1. Implementation of Wi-Fi points in public areas for free internet access in order to ensure the permanent interaction between visitors and the rest of the world. This action will permit to disseminate the destination via online.
2. Implementation of QR modules with stored information about the sites to facilitate the interaction between the tourists and the destination.
3. Development of R+D+i projects to enhance the technological system in Puerto López. This important action will lead the canton into a STD and make the inhabitants more adaptable to technological changes as they will be constantly exposed to it.
4. Supply of electronic devices in the tourist kiosk for visitors' use. This strategy will boost the tourist dissemination of Puerto López as the visitors will share information of the places they visit in the destination while having a better interaction with the information available in the QR modules on sites.

3.2. IDENTIFICATION OF THE INDICATORS SYSTEM FOR THE EVALUATION OF THE Ti IN PUERTO LOPEZ.

This section corresponds to the construction of indicators for the evaluation of technological innovation in Puerto López, the proposal of this list of indicators, which were submitted to experts for analysis and subsequent validation.

In order to facilitate its interpretation and reduce the visual impact, a model for the management of technological innovation was designed with the integration of all the sectors, stages and dimensions which affect it (figure 3.2).

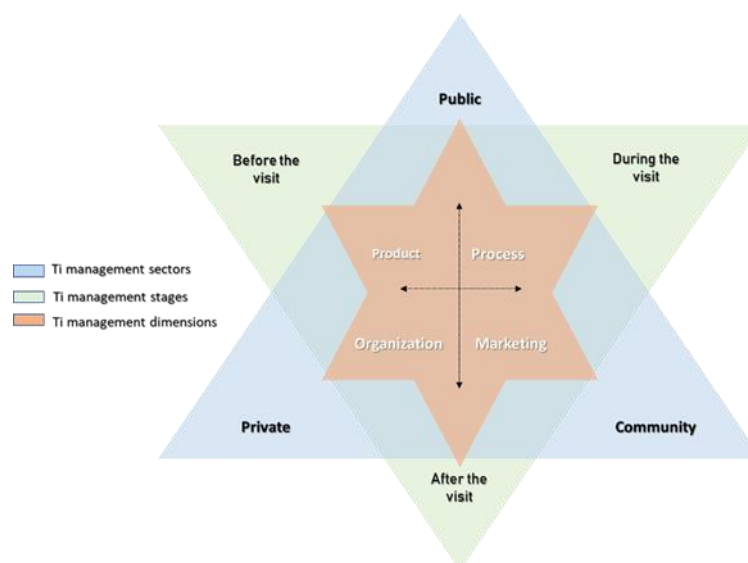


Figure 3.2. Star-model for the management of Ti
Source: self-reported information

The types of indicators are established according to the classification established in the MB:

- impact (I)
- expense (E)
- dissemination (D)

In the Indicators Validation Matrix (table 3.16), it is marked on two important axes (sector and dimension) on which technological innovation intervenes or positively impacts. However, it is important to clarify that by indicating in the quadrant responsibility for the execution of this activity does not completely exclude the other sectors when it is applicable. It is suggested through the relationship with the indicators to establish the minimum requirements for a positive result in the evaluation of technological innovation.

Table 3.16. Indicators Validation Matrix

STAGES	INDICATOR	CODE	CRITERION	SECTOR			DIMENSION			
				G	P	C	p	pp	o	m
Before the visit	Certifications / recognitions on products and / or processes related to technological innovation	IN001	Recognitions and / or certifications that reflect the adequate management of technological innovation in the territory	x	x	x	x	x	x	x
	External R & D investment	EN002	Investment of external organizations or institutions, as well as the academy in general for R & D				x	x	x	x
	Technological innovations with R & D	IN003	Technological innovations with registration of investment in R & D	x	x	x	x	x	x	x
	Technological innovations without R & D	IN004	Technological innovations	x	x	x	x	x	x	x

			without registration of investment in R & D									
	Installed panoramic cameras showing state of the beaches and weather in real time	DN005	Number of panoramic cameras installed for live transmission	x			x	x			x	
	Programs of control and assurance of quality through technology	EP007	Expenditures of public, private or community companies in quality control and assurance programs	x	x	x	x	x	x	x		
	Innovative tourism activities (ITA)	IP008	Percentage of innovative tourism activities	x	x	x	x	x	x	x	x	
	Updating of social networks	DF009	Frequency of updating information in social networks of official use	x	x	x	x	x	x	x	X	
	Programs / projects aimed at promoting ITA	GN010	Number of registered programs or projects linked to technological innovation	x	x	x	x	x	x	x	x	
	Collaborative innovation processes	DP011	Existence of platforms, forums or debate spaces to promote tourism knowledge oriented towards innovation - technological.	x				x	x			
	Virtual tourist information	DP012	Tourist chat Virtual call center: Skype, example. Virtual tourist office: Facebook, example	x	x	x		x	x	x		
	Tourist website	DN013	Existence of an attractive, simple and fast web page, adapted to all devices that encourage interaction and co-creation processes with the possibility of booking	x				x			x	
	Technological training associated with new processes and products	EN014	Investment of companies in human capital training for the incorporation of new technologies	x	x	x		x	x			
	Use of ICT by tourism companies	IP015	Percentage of companies or organizations that manage their tourism products through ICT	x	x	x	x	x	x	x	x	
	Positioning and SEO actions (Search Engine Optimization)	DP016	Participation in debates, post on blogs and SEM management (Search Engine Marketing), blogs, etc.	x				x			x	
During the visit	Mobile applications developed	EN017	Designed to facilitate the interaction of the tourist with the destination for decision making within it.	x	x	x	x	x				
	Quality connectivity to the network of tourist companies of the destination with latency	EG018	Sufficient bandwidth and limited latency to offer agility in the service		x	x	x	x				
	Wi-free network with QoS guaranteed in public places of tourist affluence (parks, museums, piers, etc.)	EN019	100 KBPS of available flow per terminal when the area is at 20% of its capacity of regular users	x			x					
	Wi-free network with guaranteed QoS in tourist companies (hotels, restaurants, shops, etc.)	EN020	100 KBPS of available flow per terminal when the area is at 20% of its capacity of regular users		x	x						
	Sensorization applied to tourism management	EG021	Sensors of various types, such as traffic management, which have	x				x	x			

			applications for tourism management								
	Automation of information for data collection	EN022	Acquisition of software for the automation of visitor information	x					x	x	
	Technological solutions in the destination	EN023	Technological solutions center for visitors with problems in technological connectivity and with the destination	x				x	x		
	Existence of NFC, QR, RFID, etc..	EN024	Interpretive panels and promotional material with NFC, QR, RFID or others	x				x	x	x	
	Technological tools available for tourists	EN025	Devices such as tablets, audio guides and others that are available to visitors for their loan or rental..	x	x				x	x	x
After the visit	Characterization of the tourist demand satisfaction.	IG026	Online surveys, account of experiences, opinions, complaints and / or suggestions	x	x	x			x	x	
	Open data (OD)	DN027	Information sharing platform for companies, organizations and institutions to facilitate R & D processes	x	x	x		x	x	x	x
	Brand and media monitoring	IG028	Analyze what is said of the destination in social networks, frequency of use, what is the profile of our digital visitor	x	x	x			x		x
	CRM (Customer Relationship Management) and E-mail marketing strategies	DN029	Promotions, last minute offers with the profile of the visitor, aimed at inspiring and loyalty			x			x		x

* **Legend:** In the code column the first letter shows the type of indicator (*I* = impact, *E* = expenditure, *D* = Dissemination), the second letter indicates the proposed measure of the indicator (*N* = number; *G* = degree, *F* = frequency and *P* = percentage). In the quadrants corresponding to the sector, they are classified as follows: *G* = public sector, *P* = private sector, and *C* = community sector. In relation to the evaluation of dimension, we consider: *p* = product, *pp* = process, *o* = organization, and *m* = marketing.

Source: Self-reported information

3.3. VALIDATION OF THE INDICATORS SYSTEM FOR THE EVALUATION OF THE Ti IN PUERTO LÓPEZ

Based on the validation of the indicators, by the experts, 19 indicators were determined with their code and measurement criteria. It also indicates the sectors in which the indicators intervene in the different stages, as well as their respective dimensions (table 16). At the suggestion of experts, another indicator was added to the system, which was the IN002 indicator, which is based on the importance of the measurement of technology management for our research in the Triple Helix model (government- business-university) addressed by (Castillo Hernández, Lavín Verástegui, & Pedraza Melo, 2014). Several of the indicators

identified in the previous section were separated from this study due to their scarce relationship with the reality observed in the study area.

The indicators which integrate the system were finally framed within the three stages of the visit each in each table for a better interpretation.

Table 3.17. Indicators system for the evaluation of the Ti in Puerto López before the visit.

STAGES	INDICATOR	CODE	CRITERION	SECTOR			DIMENSION			
				G	P	C	p	pp	o	m
Before the visit	Certifications and/or recognitions on products and / or processes related to technological innovation	IN001	Number of recognitions and / or certifications achieved in the last 5 years that reflect the adequate management of technological innovation in the territory	x	x	x	x	x	x	x
	Agreements Government-Company-University for the development of technological innovation for tourism	IN002	Number of agreements for the evaluation of the cooperation between these key actors for the promotion of innovation	x	x		x	x	x	x
	External investment in R+D	EN003	Number of R & D incoming projects managed by NGOs, universities or government agencies which are not directly linked to the tourism innovation management in the territory				x	x	x	x
	Technological innovations	IN004	Number of technological innovations run in the territory in the last 5 years	x	x	x	x	x	x	x
	Programs of control and assurance of quality through technology	EN005	Number of programs led by public, private or community companies on quality control and assurance programs	x	x	x	x	x	x	
	Updating of social networks	DF006	Frequency of updating information in social networks of official use	x	x	x	x	x	x	X
	Programs / projects aimed at promoting ITA	EN007	Number of registered programs or projects linked to technological innovation	x	x	x	x	x	x	x
	Tourist website	DN008	Number of attractive, simple and fast web page/s, adapted to all devices that encourage interaction and co-creation processes with the possibility of booking Tourist chat. Virtual call center: Skype, example. Virtual tourist office: Facebook, example	x	x	x		x	x	x
	Technological training associated with new and improved processes and products	EP009	Percentage of investment by companies in human capital training for the incorporation of new technologies	x	x	x		x	x	
	Use of ICT by tourism companies	IP010	Percentage of companies that manage their tourism products through ICT		x			x		x

Source: self-reported information

The indicators stated in the matrix above show an overall view of what the canton Puerto Lopez must consider to start planning to improve the innovation in technology oriented to improve the processes of getting in touch with the destination before the visit. Indeed, the indicators selected by experts are in coherence with the current situation of the territory and do not represent excessive costs.

Table 3.18. Indicators system for the evaluation of the Ti in Puerto López during the visit.

TAGES	INDICATOR	CODE	CRITERION	SECTOR			DIMENSION			
				G	P	C	p	pp	o	m
During the visit	Mobile applications developed	IN011	Number of mobile Apps designed to facilitate the interaction of the tourist with the destination for decision making within it.	x	x	x	x	x		
	Quality connectivity to the network of tourist companies of the destination with latency	IG012	Degree of sufficient bandwidth and limited latency to offer agility in the service		x	x	x	x		
	Wi-free network with QoS guaranteed in public places of tourist affluence (parks, museums, piers, etc.) as well as in tourist companies (hotels, restaurants, shops, etc.)	IN013	Number of KBPS of available flow per terminal when the area is at 20% of its capacity of regular users	x			x			
	Software created and licensed for the tourist and hotel sector	DG014	Degree of the automation of visitor information	x				x	x	
	Existence of NFC, QR, RFID, etc..	DN015	Number of interpretive panels and promotional material with NFC, QR, RFID or others	x			x	x	x	

Source: self-reported information

The indicators written in table 3.18, clearly stated the criteria of experts on the strategic technological things to improve the experience of the tourists while in the destination, it shows the importance of the private and community sectors participation for the implementation of a better technological infrastructure in the canton.

Table 3.19. Indicators system for the evaluation of the Ti in Puerto López after the visit.

STAGES	INDICATOR	CODE	CRITERION	SECTOR			DIMENTION			
				G	P	C	p	pp	o	m
After the visit	Characterization of the tourist demand satisfaction.	IF016	Frequency of online surveys, account of experiences, opinions, complaints and / or suggestions	x	x	x		x	x	
	Open data (OD)	DG017	Degree of Information on the platform shared by companies, organizations and institutions to facilitate R & D processes	x	x	x	x	x	x	x
	Brand and media monitoring	IG018	Degree of technological surveillance to analyze what is said of the destination in social networks, frequency of use, what is the profile of our digital visitor & the study of competitors	x	x	x		x		x
	CRM (Customer Relationship Management) and E-mail marketing strategies	DN019	Number of promotions, last minute offers with the profile of the visitor, aimed at inspiring and loyalty		x			x		x

Source: self-reported information

Table 3.19 shows the indicators that must be considered to enhance the *keeping-in-touch* with the visitors, start working on technological intelligence to virtually know them and keep them loyal to the destination.

3.3.1. VALIDATION OF THE INDICATORS SYSTEM FOR THE EVALUATION OF THE Ti IN PUERTO LÓPEZ – CHI SQUARE METHOD.

The experts' opinions were analyzed by means of a Chi-Square statistical test, to verify if there is a coincidental coincidence in the criteria issued by the experts. Within this, a value of the coefficient of agreement of Kendall was obtained ($W = 0.991$) and this test was carried out in the same way as that described in table 3.20.

Table 3.20. Application of Kendall test with Chi-square method

Group of Indicators	Experts							R_j	$R_j - R_i$	S^2
	E1	E2	E3	E4	E5	E6	E7			
IN001	6	7	8	6	6	6	7	46	-24.11	581.06
IN002	4	4	5	4	5	4	4	30	-40.11	1608.43
EN003	8	8	7	8	7	8	8	54	-16.11	259.38
IN004	9	9	10	9	10	9	9	65	-5.11	26.06
EN005	10	10	9	10	9	10	10	68	-2.11	4.43
DF006	12	12	11	12	12	12	12	83	12.89	166.27
EN007	15	13	13	13	15	13	11	93	22.89	524.17
DN008	3	3	4	3	4	3	3	23	-47.11	2218.91
EP009	1	1	1	1	1	2	1	8	-62.11	3857.06
IP010	2	2	2	2	2	1	2	13	-57.11	3261.01
IN011	7	6	6	7	8	7	6	47	-23.11	533.85
IG012	14	14	14	14	14	14	13	97	26.89	723.33
IN013	11	11	12	11	11	11	14	81	10.89	118.70
DG014	5	5	3	5	3	5	5	31	-39.11	1529.22
DN015	18	17	17	18	18	18	18	124	53.89	2904.64
IF016	13	15	15	15	13	15	15	101	30.89	954.48
DG017	16	16	16	17	17	17	16	115	44.89	2015.54
IG018	19	18	18	19	19	18	19	130	59.89	3587.38
DN019	17	19	19	16	16	19	17	123	52.89	2797.85
E	7						Mean R_j	70.11	Σ	27671.79
N	19									
ΣS^2	27671.79									
$N^3 - N$	6840									
E^2	49									
$E^2 * (N^3 - N)$	335160									
$12 * S^2$	332061.48									
W	0.991									
X^2	124.84									

Source: self-reported information

So that:

$$\chi^2 = k (N-1) W.$$

The null hypothesis would then be:

H₀: There is casual coincidence in the experts' criterion.

H₁: There is no chance coincidence between the experts' judgment.

Critical region (RC):

RC: Si $\chi^2 > \chi^2_{\alpha; N-1}$ the null hypothesis is rejected, so the judgment of the experts it is consistent and they agree on the weighting of the calculated indicators.

Substituting according to the data of the experts (Table 3.20).

$$\chi^2 = k * (N-1) * W = 124.84$$

$$\chi^2 > \chi^2_{\alpha; N-1}$$

$$\chi^2_{0.05; 18} = 3.94$$

124.84 > 3.94 → Therefore, it was obtained as a result that there is no accidental coincidence among the experts, which leads to the conclusion that there is strong consistency among the experts.

The result of the application of the evaluation instrument (Kendall test with Chi-square method) indicates that the vast majority of the answers in the evaluations by the experts are located within the classification: strongly agree or agree and that of the proposed indicators system which stand out for the evaluation of the Ti in Puerto Lopez are, Certifications / recognitions on products and / or processes related to technological innovation, Technological innovations with R & D, Innovative tourism activities (ITA), Programs / projects aimed at promoting ITA, Use of ICT by tourism companies and Open data (OD).

From the application of the Kendall Test (see table 3.20), it is verified that there is no accidental coincidence among the experts, by which it is concluded that the consistency between their opinions is strong, in relation to the system of indicators proposed for the evaluation of the Ti in Puerto López. For this reason, from the application of the validation instrument that is confirmed in the model, it shows as main indicators the following:

- ✓ Certifications / recognitions on products and / or processes related to technological innovation,
- ✓ Technological innovations with R & D,

- ✓ Innovative tourism activities (ITA),
- ✓ Programs / projects aimed at promoting ITA,
- ✓ Use of ICT by tourism companies
- ✓ Open data (OD)

CHAPTER IV. CONCLUSIONS AND STUDY LIMITATIONS

4.1. CONCLUSIONS

The analysis of the tourist sector of the canton of Puerto Lopez determined that it has a weak technological infrastructure, without strategic planning in the medium or long term, with no incentives for technological development and management of tourism intelligence.

In addition, the characterization reported it has an important image in the market due to its strategic location within the Machalilla National Park. Too, tourism represents the second most important economic activity in the territory. The survey carried out, showed the negative perception of the tourist regarding technological management given in three stages (before, during and after the visit). The SWOT determined that the main problem the canton has is the scarce investment in R&D+i.

The identification of indicators for the Ti in Puerto Lopez was based on the revision of important manuals for the measurement of the Ti as the manuals (Bogotá 1997, Oslo 2005) Manual for the configuration of the STD and the White Paper of the STD. Initially, 28 indicators were identified that were submitted to experts' criteria to validate their relationship with the topic and relevance to the tourism reality of the study area, 19 suitable indicators for the evaluation of the Ti in Puerto López in the three stages proposed in the White Paper of the STD to measure the management of the Ti from the different sectors in the dimensions of product, process, organization and marketing were identified and validated through experts' methods.

A new model was obtained for the management of the Ti in the destination as a result of the integration of the management sectors (public, private and community) on the dimensions proposed in the Oslo Manual (product, price, organization and marketing) in the stages proposed in the STD white paper.

The application of the Kendall test, shows that there is no accidental coincidence among experts, so it is concluded that the consistency between their opinions is strong, in relation to the proposed system for the evaluation of

the Ti in Puerto López. For this reason, based on the application of the validation instrument used, it is confirmed that the Model shows the following main indicators: Certifications / recognitions on products and / or processes related to technological innovation; Technological innovations with R & D; Innovative tourism activities (ITA), Programs / projects aimed at promoting ITA, Use of ICT by tourism companies and Open data (OD).

4.2. STUDY LIMITATIONS

Due to the complexity of the topic and the limited theoretical support regarding the evaluation of the Ti in the TD as well as the absence of indicators that consider the different sectors of the economy within the management of Ti, the present work might have important limitations for the evaluation, however, it may be used as a beginning work to guide future researches.

It was found that officials' awareness of technological innovation is low, so some of the questions asked were not accurately responded.

The lack of references to measure Ti in TD did not permit to establish a framework of reference towards the quantitative criteria each indicator should have for an effective evaluation.

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ANNEXES

Annex 1. Questionnaire for the survey on Ti in Puerto Lopez



ESCUELA SUPERIOR POLITÉCNICA AGROPECUARIA
DE MANABÍ MANUEL FÉLIX LÓPEZ



SURVEY AIMED AT VISITORS TO PUERTO LÓPEZ

As part of the development of the Degree research work: "SYSTEM OF INDICATORS FOR THE EVALUATION OF TECHNOLOGICAL INNOVATION IN PUERTO LÓPEZ", at the university ESPAM- MFL

Goal: Characterize the technological management for tourism in Puerto López from the perspective of the demand.

Important: The information you provide is confidential, we thank you in advance for your cooperation

Before your visit:

1. Did you inform yourself of Puerto López through information channels on the web?
 Yes No
2. How would you rate the Puerto López information available on the Web? *Where 1: very bad; 2: bad; 3: fair; 4: good; 5: very good*
 1 2 3 4 5
3. Are there official virtual information channels where you can ask questions about tourism products and services in Puerto Lopez and get answers in a short time?
 Yes No
4. Are there any business virtual information channels where you can ask questions about tourism products and services in Puerto Lopez and get answers in a short time?
 Yes No
5. How would you rate the official use of social networks for tourism promotion and dissemination (relevant information, photographs of sites of interest, etc.) of Puerto López? *Where 1: very bad; 2: bad; 3: fair; 4: good; 5: very good*
 1 2 3 4 5

During your visit:

6. Are there any Apps created to facilitate mobility, access to information in the various resources and tourist attractions in Puerto López?
 Yes No
7. How would you rate the use of ICT (Information and Communication Technologies) for the management of tourism products in Puerto López? *Where 1: very bad; 2: bad; 3: fair; 4: good; 5: very good*
 1 2 3 4 5
8. Is there information stored in QR modules for free access in any of the tourist sites to visit in Puerto López?
 Yes No
9. Are there smart devices for rent in the tourist office of Puerto López?
 Yes No
10. Are there any public venues (parks, piers, lookouts, etc.) with free access to WIFI?
 Yes No
11. How would you rate the technological infrastructure of Puerto López? *Where 1: very bad; 2: bad; 3: fair; 4: good; 5: very good*
 1 2 3 4 5

***Answer the following questions only if you have visited Puerto Lopez more than once.**

After your visit:

12. Have you received promotional information from Puerto López through any technological information channel after your visit?
 Yes No
13. How would you rate the use of ICT by tourism managers of Puerto López, for getting information about your visit (account of experiences, opinions, complaints and / or suggestions)? *Where 1: very bad; 2: bad; 3: fair; 4: good; 5: very good*
 1 2 3 4 5

***Thank you for your collaboration!**

