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Architecture of a Technology Platform for sustainable tourism management under the NTS-TS 002 standard

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Abstract. The importance of the tourism sector in Colombia has focused on aspects related to competitiveness and sustainability given the impact of tourism activity in the different destinations where it is developed. In order to maintain this advantage, it is essential to strengthen the management of sustainable tourism, optimizing the benefits for users, the destination and the local economy, while minimizing impacts on the environment. In this sense, the governmental demands oriented towards the implementation of these policies in the sector, as indicated by the Sectorial Technical Norms (NTS), specifically, the NTS-TS 002, requires the support of a technological management tool that allows the controlled development of the activities and indicators established by the regulations.

Based on this need in the tourism sector, a research project was developed based on the proposal of a management model of the NTS-TS 002 standard, was articulated with a software architecture that later will be specified in a web application to support the diagnostic process, monitoring of the indicators included in the standard and which allow accommodation and lodging establishments to be subsequently certified.

1. Introduction
The concept of sustainable development has been consolidated in the Brundtland report, being that which "allows attention to the needs of present generations without compromising the possibility of future generations to satisfy their own needs" [1].

Sustainable development worldwide has become a relevant topic, oriented to activities such as the use and renewal of natural resources, analyzing the effects of the generation of waste and pollutants on the environment and the economic distribution of regions, as well as natural preservation. This concept for some authors is defined as a challenge mainly for hotel establishments, considering the multiple initiatives that must implement the process gets slow [2].

Sustainable development consists in obtaining that the human being reaches to cover his basic necessities, without the attempt deteriorates the environment in which it is developed; however, achieving both the preservation of the environment and the satisfaction of the necessities is a disjunctive for some authors since in occasions the search of an economic balance brings as consequence significant impacts in cultural, environmental and social [3].

Hotel establishments are a key link in the value chain of the tourism sector, given their impact on the strategies implemented in the framework of corporate social responsibility, seen from the environmental, socio-cultural and economic dimensions, which is why they should include between
their tourism activities strategies aimed at generating effective policies that result in the profitability of the organization in the long term and strengthen their relations with the environment with the aim of growing their business in the long term, understanding the impacts of their activity on local society or on the staff of the company. Among the potential benefits that may derive from these policies, the following should be highlighted: positive discrimination by the client, who increasingly incorporates social responsibility criteria in their purchasing decisions; greater reputation and brand image, greater competitiveness, cost savings in some cases, customer loyalty and even greater economic performance, this last point being a particularly relevant debate in the hotel sector, together with the uncertainty of whether there is a sustainable tourism sub-sector with a sufficiently attractive market to justify the creation of a specific offer[4].

The responsibility to maintain the balance between the dimensions of sustainability commits the government entities, who develop strategies aimed at motivating tourism service providers to generate strategies to implement sustainable practices in their businesses. This is how the recognition to the management granted through a certification is used as a tool to support the sustainable practices, as well as to satisfy the necessities of clients and the generation of the continuous improvement. Sustainability certification is a mechanism with which it is possible to measure qualitatively and quantitatively the performance of tourism through its operating practices[5].

In Colombia, different studies have been carried out that demonstrate the need to adopt a commitment to sustainable development: in the city of Bucaramanga, management variables were identified that influence service quality in the development of sustainable tourist destinations, through the adaptation of a measurement instrument for hotel service managers based on evaluation models identified in the literature and contrasted with the Focus Group of hotel experts in the region [6]. In the city of Bogotá, a study was conducted on the results of the hotels that implemented the NTS-TS 002 standard, and it was found that the greatest value in the sustainability requirements of the standard has been the decrease in the consumption of water and energy services and, therefore, their associated costs [7]. In Santa Marta, a study showed that the accommodation and lodging company subject to the investigation is closer to proactivity than to legal reactivity, since it begins to carry out practices of social responsibility that it is not obliged to carry out by law [8].

With respect to legal regulations, the Government of Colombia began a legislative process with Law 300 of 1996 - General Law of Tourism [9], which established some guidelines for the establishment of norms that regulate tourism sustainability; later work continued with the issuance of Law 1558 of 2012, which made it mandatory to implement sectorial technical norms [10]; and finally Resolution 0148 of 2015, which establishes mandatory compliance with the Sectoral Technical Quality Standards related to sustainable tourism through a self-assessment process documented and supervised by the Ministry of Industry and Commerce [11].

Taking into account the opportunity of applied research that the scenario described above entailed, support was given to the development of a project oriented towards the design of a software architecture for a technological tool that supports the process of management of indicators and activities established by the sectoral technical standard NTS-TS 002 [12], oriented to accommodation and hosting establishments at the national level. This project was articulated with the research group in Software Engineering and New Technologies - GISNET assigned to the programs of Systems Engineering and Electronic Engineering, with the institutional support of the Technological Comfenalco-Cartagena.

2. Methodology
For the development of the project objective, the following stages were planned:

Stage 1:
A. Design of the Indicator Management Model for Standard NTS-TS 002.
B. Software Architecture Design

Stage 2:
C. Design of the Indicator Management Tool for the NTS-TS 002 Standard.
D. Implementation in a real controlled environment  
E. Evolution and Improvements

The results evidenced in the article correspond to Stage No. 1.

3. Stage Results 1.

3.1 Indicator Management Model for Standard NTS-TS 002

Taking as references Standard NTS-TS 002 [12] and the Implementation Guide issued by the Ministry of Industry, Trade and Tourism [13], a proposal was designed for an indicator management model for standard NTS-TS 002, as shown in Figure 1:

![Indicator Management Model of Standard NTS-TS 002](image-url)

According to the figure, the proposed model includes the processes of:

A. Diagnosis → oriented towards the self-evaluation of the conditions of the establishment of accommodation and lodging (EAH) in relation to the fulfillment indicators of the norm NTS-TS 002.

B. Continuous improvement → the process of managing the results of tourism sustainability indicators that are below the minimum quality conditions, coming from the environmental, socio-cultural and economic aspects contemplated in the standard and which in turn provide input for improvement programmes and plans.

C. Programs → process in charge of programme management within environmental, socio-cultural and economic aspects, as shown in Figure 2 [14].
D. Activities ➔ process in charge of the management of the activities, including the tasks of assignment and description of the same, according to the indicators, aspects and programs to develop in the establishment of accommodation and lodging.

E. Aspect-Impact Matrix ➔ process oriented to the management of the traceability of the environmental aspects and impacts of the accommodation and lodging establishment. The relationship between these indicators is best shown in Figure. 3 [15]:

**Figure 2.** Aspects and programs covered by the NTS-TS 002 standard
3.2 Software Architecture for the NTS-TS 002 standard management tool

From the model proposed for the management of the indicators of the NTS-TS 002 standard, a software architecture was designed for the subsequent development of a web tool.

Figure 4 shows the proposed software architecture, which is shown as PHP programming language, which has many advantages for the development of web solutions, such as a large community of developers, several frameworks at both front-end and back-end level; as far as data management is concerned, MySQL has been selected, which is also an open and free product that has a trajectory and recognition in the software development industry.

![Diagram of software architecture](image)

**Figure 4.** Proposed software architecture for the NTS-TS 002 indicator management tool.
As part of the design exercise, an estimation was made of the expected functionality flowchart for the web application to be developed, based on the previously proposed software architecture, as shown in Figure 5:

![Proposed flow chart for the NTS-TS 002 indicator management tool.](image_url)

4. Conclusions

The obligatory adoption of the sectoral technical standard NTS-TS 002 for accommodation and lodging establishments (EAH), promulgated by national government regulations, is a challenge for companies in this sector, especially the smaller ones, which require technological support, proposed by a tool that allows them to manage in a suitable and productive way, the different indicators that must be adopted to achieve tourism quality certification, allowing them to compete in the same conditions as major tourism service companies. As future challenges of this research work, is to implement the proposed architecture in a web application that can be installed in a controlled manner in accommodation establishments and lodging, allowing it to submit to validation and verification in relation to the requirements of the standard NTS-TS 002.

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