

Framework for Assessing and Continuously Improving Regional Sustainability

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Abstract-- This paper proposes a methodology for assessing and continuously improving sustainability based on the concatenation of the tools Barometer of Sustainability, Multi-Criteria Analysis (AHP), and 5W2H, which make it possible to evaluate sustainability, prioritize actions, and formulate an action plan suitable to the characteristics of a region. The central problem, the object of analysis of this paper, is the lack of a methodology for sustainability that assesses, prioritizes the items evaluated, and efficiently and effectively takes initiative for increasing the level of sustainability of the object selected. The methodology proposed was analyzed by specialists, making it possible to reach conclusions about its use and reliability, who also confirmed its ability to be adapted to different scenarios. The relevance of this study is to benefit decision makers and society as a whole by providing an easy-to-use tool that contributes to increasing the effectiveness of the evaluation process and continuous improvement for sustainability.

Index Term-- Barometer of Sustainability. AHP Multi-Criteria Analysis. Action Plan. 5W2H.

1. INTRODUCTION

The definition of sustainable development means the attempt to increase the improvement of the quality of life of the inhabitants of the world while ensuring what is necessary for future generations, which includes ecosystems and human dimensions. [10-16-17-19]

The increase in the standard of consumption becomes increasingly evident in the world with warnings given by scientists, environmentalists, and researchers on the continuous consumption of natural resources, which causes incompatibility between the supply of raw materials and consumption [11- 18]. This imbalance puts into focus the issue of sustainability, which, as it takes on an important role in our society, causes its evaluation to be increasingly more important.

To do this, it is necessary to create systems that monitor and measure sustainability, ensuring the sustainable development of regions, adopting indicators in the various dimensions of sustainability [1].

Therefore, sustainability indicators make it possible to plan, monitor, and take continuous improvement actions toward the main steps of social and environmental interests [4]. To this end, some selection criteria of indicators must be followed such as relevance, validity, reliability, sensitivity, specificity, cost effectiveness, intelligibility, communicability, easy to obtain, updatable with a certain periodicity, potential

to be disaggregated, historicity, comparability, and coverage [5-8-13-19-21-27].

Thus, the assessment of the sustainability of a region in general is carried out by means of indicators that possibly could be condensed into indexes since the indicators should be seen as a means to achieving sustainable development and, when considered together, have their potential increased [12]. So, the indexes mathematically synthesize the indicators and this way assess the sustainability of a region [14]. However, such assessments do not indicate the next steps to be taken [2-3-26]. In short, the tools are a "static" assessment, providing a vision of the moment, as opposed to the concept of continuous improvement that exists in quality tools.

Tools were not identified in literature on sustainability that would help create a plan of action, maintenance, and improvement for the area under study. Besides being a tool for assessing sustainability based on indicators or indexes, it was also found to be necessary to prioritize the items of most impact to be able to act coherently. Due to the complex nature of sustainability, the transposition from the abstract to reality is extremely important to enable an assertive decision-making process [6], while monitoring and making action plans for continuous improvement should also be a part of the system indicating failures and pointing out the investments needed to achieve the goal proposed [9-24].

This paper proposes an instrument for the assessment of sustainability that through indicators or indexes determines the state of the region and puts in an order of priority the items of action from the most impacting to the least impacting, allowing the manager to have a better result at the time of taking action towards continuous improvement. To do this, we use the concatenation of three tools, which are as follows: Barometer of Sustainability, the Analytic Hierarchy Process (AHP) method, and 5W2H.

2. METHODOLOGY

In order to achieve the result of continuous improvement of sustainability, it is necessary to evaluate the level of sustainability, the analysis of what can be improved, and a specific and consistent check for providing feedback to the system.

With this as a basis, an exploratory research was carried out characterized by a literature survey designed based on material already published in articles and books.

As for the technical procedures, the research used interviews with specialists in order to validate the instrument

proposed for assessing and continuously improving sustainability.

The nature of the research is applied in order to generate knowledge for a practical application and to solve specific problems, and the approach to the problem is done in a qualitative and quantitative way.

Using this logic, after a bibliographical research, the Barometer of Sustainability tool was selected among other tools to evaluate the level of sustainability.

This tool allows a flexibility of choice with the sustainability dimensions to be evaluated and therefore can be adapted according to the reality and knowledge about the location studied [20].

An important characteristic is the ability to combine indicators connected to human welfare and environmental well-being [15], which facilitates the conclusion of the user when considering the high amount of data that can be used to evaluate the region in question. The Barometer of Sustainability does not have limits in its application and can be used at a local or global scale. Because of this, the tool can be used easily and with clarity for demonstrating results and reliability [10]. Its integrated vision awakens the need for a coherent action plan for achieving the proposal to improve the sustainability of the region assessed [24].

While striving for a continuous search for improvement, the efforts needed to be concentrated on should be pointed out to thereby achieve the desired evolution.

Therefore, the Multi-criteria Analysis tool AHP was chosen to prioritize the indicators used in the Barometer of Sustainability, from which the actions taken based on the order of priority given by the tool will allow for a better result in increasing the level of sustainability in the region chosen for the analysis.

This prioritization of indicators shows a decision-making process for reaching the most appropriate alternative according to the objective outlined, thus aiding in the decisions in the strategic plan. [22] The multi-criteria analysis tool AHP is well-known and accepted in the academic environment and used in most applications involving decision making [25].

When a decision is made to solve a problem, a plan of action should be put in place in order not to deviate from the main focus of the problem, which is done by using the 5W2H Tool that establishes an action plan for each indicator given a priority.

This way the sustainability assessment ceases to be "static" and becomes "dynamic" with a more concise, direct, and precise operation on the main unsustainable causes that prevent development.

Once the instrument proposed was formulated, a need arose to check its design and ease of use. To do this, five specialists were interviewed: three from the public sphere with managerial positions related to sustainability and two consultants who work both in the private and public sectors.

The instrument proposed was initially presented to these evaluators and after this each one answered a questionnaire with open and closed questions about the 3

stages that make up the proposed concatenation of tools, thus evaluating them not only separately, but also as a whole.

3. RESULTS

3.1 Proposals of an framework for assessing and continuously improving regional sustainability

The framework for assessing and continuously improving regional sustainability begins with the manager's decision to assess the sustainability of a certain area on specific dimensions of his interest. It begins with the Barometer of Sustainability tool. The indicators used are submitted to the Multi-criteria Analysis Tool AHP in order to prioritize them. An action plan for each indicator is set up in its order of priority using the 5W2H Tool. Figure 1 shows the operation of the Framework for Assessing and Continuously Improving Regional Sustainability.

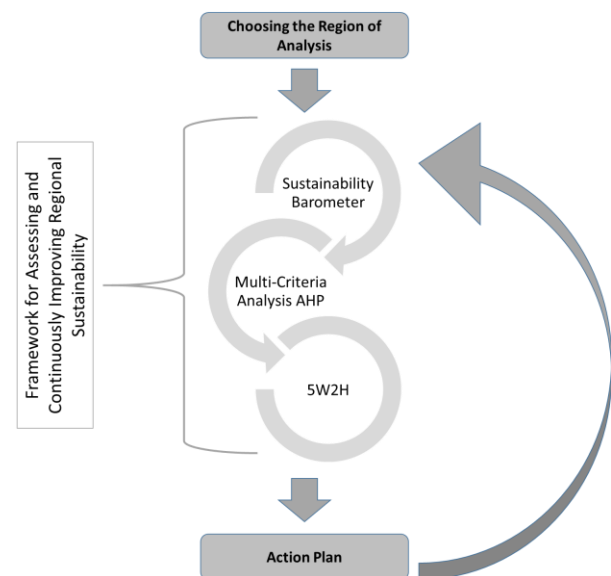


Fig. 1. Framework for assessing and continuously improving sustainability
Source: Prepared by the author

As shown, the instrument is divided into 3 phases:

Phase 1: Understand the problem by applying the Barometer of Sustainability Tool.

Phase 2: Analyze the problem by prioritizing the indicators using the Multi-criteria analysis tool AHP.

Phase 3: Draw up an action plan by using the 5W2H Tool.

In order to facilitate the understanding of the framework, a set of steps is presented during each stage to reach its successful application.

3.1.1 Phase 1: Application of the Barometer of Sustainability

Stage A

When starting to use the tool, the purpose of the assessment should be indicated along with a justification given, objectives, and study area. To do this, the opening

statement can be used, which is a well-established form to start any project management methodology.

Stage B

Soon after the initial definitions, the dimensions and systems to be evaluated should be defined.

Stage C

With the dimensions and systems defined, the indicators that best represent the study area chosen should be selected. The maximum and minimum limits (performance criteria) are attributed for each indicator. These maximum and minimum limits will make up the performance scale of the Barometer of Sustainability.

Stage D

Once the indicators selection stage has been finalized with their performance criteria, they should be transposed to the Barometer of Sustainability performance scale and this way make it possible to analyze the systems and dimensions chosen. The scale should be built correlating the data of the indicators selected with this scale.

Stage E

Once the correlation between the scales has been done, then a value is reached for each indicator on the Barometer of Sustainability scale to then merge the indicators into a single index representing the dimensions for assessing the sustainability of the region under study.

For a linear evaluation where all the indicators have the same importance, then the simple average is the most recommended. If some indicator or dimension is diagnosed as having a greater weight in the evaluation, a weight is attributed to them and a weighted average is run.

Stage F

Once calculated, the indexes should be represented graphically by determining the level of sustainability on the Barometer of Sustainability graph that will indicate if the study area is poor, fair, average, good, or excellent in relation to sustainability.

3.1.2 Phase 2: Prioritization of Indicators by the Multi-criteria Analysis AHP

With the level of sustainability for the study area established by the Sustainability Barometer, the indicators for an effective action on increasing sustainability should be prioritized.

The prioritization of the indicators is done by the Multi-criteria Analysis Tool AHP. To do this, the indicators will be the alternatives and the prioritization criteria should be set by the manager.

Stage G

Phase 2 begins with defining the indicators selected as prioritization alternatives for decision making.

Stage H

The team, which has already defined the strategic objectives, should establish the criteria for prioritizing the alternatives.

Stage I

After defining criteria and alternatives, they should be judged according to the fundamental scale suggested by Saaty where the criteria are judged between each other and the alternatives are judged in pairs in light of the criteria established [23].

The result of this analysis will be the ordering of the indicators initially listed indicating which alternative will have a greater impact on increasing sustainability if its Barometer of Sustainability index is high.

3.1.3 Phase 3: Drawing up an Action Plan by using the 5W2H Tool

With the indicators prioritized, the 5W2H tool is used in order to put together the action plan.

Stage J

To do this, 7 questions from the tool should be answered for each indicator in order to set up its action plan. Here are the questions: What? Who? Why? Where? When? How? How much does it cost? [7].

After the execution of the action plan, we have the strategy in hands for the current situation in the given region.

To keep the Action Plan up-to-date, it is necessary to redo the entire process, thus forming a continuous improvement cycle. In short, this improvement will be achieved through the constant evaluation of the region by the Framework in question by measuring the efficiency and effectiveness of the actions proposed.

3.2 Using the assessment and continuous improvement framework of the regional sustainability proposed from the perspective of the professionals interviewed

To check the feasibility of the framework, interviews were conducted with specialists in the field through questionnaires for judging the Framework's proposal and each phase that is part of it. The questions formulated to evaluate each phase were: Did you already have knowledge of what was presented? How difficult is this phase? Does the procedure lead to satisfactory / adequate results? To evaluate the framework the following questions were asked: What skills and abilities are required by the framework? What are the advantages (if any) of developing an action plan using the framework presented? What are the disadvantages (if any) of developing an action plan using the framework presented? Is the framework presented feasible to be implemented?

It was noticed that none of the respondents had prior knowledge of the Barometer of Sustainability methodology even though this tool is in third place among the twenty-four

main tools used in the area of sustainability [2]. But even with the prior lack of knowledge, the difficulty was considered moderate or low by the participants. For them, the tool leads to satisfactory results.

As for the Multi-criteria Analysis AHP, 80% of the respondents already had a knowledge of the tool and classified it in relation to the degree of difficulty as low or moderate. 100% of the respondents agree that the results presented by this tool are satisfactory.

As for the 5W2H tool, 80% of the respondents already knew it and classified it in relation to the degree of difficulty as very low or low and that it leads to satisfactory results.

As for the advantages and disadvantages of the Framework as a whole, the following advantages were listed: objectivity, quick assessment, prioritization of actions that will have the greatest impact on the issues considered and a better view of the area selected. The disadvantages pointed out were the need of a team with good data analysis skills.

On the other hand, all participating specialists agree that the Framework for Assessing and Continuously Improving Regional Sustainability proposed is feasible to be implemented. Since it is a critical analysis, one can realize that the results reached are highly dependent on the input data. Furthermore, the application needs a multidisciplinary team due to the scope of the subject that is intended.

4. CONCLUSIONS

The Framework proposed is shown to be feasible and useful for professionals who deal with sustainability assessment. The proposal is strong in the issue of its structure of thought and the speed with which the evaluation can be performed.

The link established between the three tools used was also adequate and the proposal of joining these tools can be considered an instrument for assessing sustainability.

Reworking the plan and its constant development contribute to the region's continuous improvement and to reaching sustainability targets. However, despite being well-known and accepted in the academic environment, the use of the tools require care on the part of the professional who deals with it in order to avoid errors in treating the data.

Getting to know the problem is of great importance for obtaining satisfactory results. Inconsistent or inadequate input of data will directly contribute to the proposal's failure. Therefore, it is recommended that the indicators be selected in a technical way and that they effectively portray the region selected for the study.

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