Intercomparison of master's degrees programs in Technologies to improve quality assurance of the careers

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Abstract – This study intends to demonstrate that the Inter comparison process can be used in master's degrees on information and communication technologies as a tool that facilitates knowing first-hand how other similar degrees work and have been accredited, in addition to know the points of improvement with respect to the career under study. The research methodology is exploratory and through the qualitative study the characteristics of the Inter comparison process are described and interpreted as a basis for initiating higher accreditation processes in a short or medium period. The results of the study show the areas of improvement that these types of programs can work to position themselves at the forefront of quality and continuous improvement. Finally, a proposal is established by phases to guide this type of processes and achieve their successful implementation. It is defined as a combined model with criteria from two accrediting entities can facilitate its approach and development of the entire process.

Keywords—Inter Comparison, Quality, Continuous Improvement, Accreditation.

I. INTRODUCTION

Intercomparison, quality assurance and accreditation are crucial pillars in the academic field. By evaluating educational processes and outcomes comparatively, it is easier to identify best practices and areas for improvement. For its part, quality assurance focuses on maintaining high standards over time, guaranteeing consistency and excellence in the offer.

In this article we will address how accreditation processes, which are external validations of study programs, promote the quality of educational institutions. In turn, the implementation of self-assessment models reinforces the culture of continuous improvement, ensuring that established standards are constantly achieved and exceeded. This rigorous approach is especially relevant in master's degrees where academic and professional excellence are essential. By providing a solid framework where these elements contribute to the comprehensive development of students, preparing them to face complex challenges in their respective fields.

The Intercomparison process provides a clearer vision of what a career has in relation to another that has an accreditation from an official entity. That is, through this tool you will be able to visualize the different perspectives you have of an accredited career and how it becomes accredited through a process of continuous improvement. As well as the activities and indicators that it defines and carries out to meet this goal.

The article is divided into five sections: I. Introduction, which shows what the study is about, II. Materials and Methods, defines the methodological process used, III. Results, shows the most relevant data of the most focused questions, IV Proposal, defines the recommendation that is proposed, V. Conclusions, finally addresses how the objectives of the study were met, and the bibliographical references.

II. MATERIALS AND METHODS

The research is an exploratory type since the area of master's accreditation is very little explored, especially the use of Intercomparison processes to be applied as an improvement tool. It is qualitative in nature since the information is interpreted from the data collection to generate a proposal that serves as a basis for universities that do not have their accredited master's degrees in information and communication technologies (ICT) and wish to use it. to explore and work in this area. Among the objectives of the research, it is proposed to carry out an Intercomparison of an accredited master's degree study plan in engineering with other non- accredited plans to identify similarities or differences between them. This is the basis to be able to take an accredited study plan as a reference and then to carry out the comparison process with one that has not been accredited yet and find the main differences and opportunities for improvement. Additionally, evaluate strategies to ensure quality in already accredited master's degrees. And finally establish the proposal of how universities

can apply these processes using a staged approach which is shown in the proposal.

An instrument with 26 questions was used to apply to a total sample of 10 universities on the different variables used by the accrediting entities of master's degrees in technologies used as a reference. 5 universities responded to the questions, that is, 50% of the total population. After this, a proposal is made with the most representative elements that could be evaluated in the Intercomparison process to guarantee that the needs described in the accreditation models of Central America and Costa Rica are covered. Additionally, provide a guide to these universities so that they can begin their accreditation processes in a simpler and more practical way.

III. THEORICAL FRAMEWORK

Higher Education Institutions (HEIs) are increasingly oriented to offering programs and careers of interest according to market trends as well as ensuring that said academic offering meets quality standards and continuous improvement as a benefit in its delivery to society.

The above allows the quality of higher education to be positioned as a topic of interest not only for institutions and their programs but also for teachers, students, graduates, employers, and society in general. With this, we seek to offer quality education that promotes research, analysis, and review of criteria on management and continuous improvement.

As mentioned, Reference [1]: "The responsibility of HEIs for quality management would be conditioned by the orientation or management profile that the institution has, although it is not necessarily decisive. There are those HEIs with a clear academic objective and strong financial support, which will seek continuous improvement through evaluation and accreditation processes".

From the above, quality management actions are established that promote the achievement of the objectives of the teaching model and that allow students to achieve the development of critical thinking, strengthen professional and social skills and competencies.

All the above opens the way to the search for good practices, such as criteria applied by HEI programs and careers, which have achieved at least one quality certification, either by a national or international accreditation body. According to the self-assessment model that best fits the institution, this trend is today called Inter comparison.

According to References [1], "Inter comparison is a process in which similar elements of an aspect are compared and analyzed, which allows us to identify and evaluate similarities and differences, and with this, adopt what allows us to improve the process. In academia, especially in metrology, it is used to compare measurements of instruments or measurement methods with the aim of ensuring precision and consistency [2].

Inter-comparison can also be applied to the study plans of master's degrees to identify their strengths, weaknesses, opportunities, and threats, as well as to establish quality criteria

and good practices. Furthermore, this can be carried out between study plans of the same institution, of different institutions, of the same country or of different countries, depending on the level of analysis and the purpose pursued.

Specifically, the Inter comparison of master's degree curricula in engineering involves considering a series of common aspects between existing self-assessment models, such as:

- The relevance and coherence of the study plan.
- Relationship with the context.
- Relevance of the study plan and student profile.
- The quality and updating of content and teaching resources.
- The suitability and performance of the teaching and administrative staff.
- Production, research, and social action.
- Disclosure and communication.
- Satisfaction with the program.
- Academic performance and permanence.
- Follow-up of graduates.
- The physical and technological infrastructure.
- Services and financial resources available.

On the other hand, the application of Inter comparison in master's study plans for the engineering area requires the use of appropriate sources of information and instruments, namely:

- Updated and approved study plan, curricular designs.
- Related regulations.
- Relevance and graduation or exit profile of the graduate.
- The collection instruments such as surveys, interviews, focus groups, among others, aimed at the populations of the courses, beneficiaries of the study plan, such as teachers, students, graduates, employers, and organizations.

And all those own criteria and elements are necessary for monitoring and analysis. While the benefits that stand out after the Inter comparison of master's study plans in engineering can be listed:

- Identification of best practices and areas of improvement in study plans.
- Employer market trends and challenges in the field of engineering application.
- Promote the exchange of experiences, knowledge, and resources between study plans, as well as cooperation and collaboration between institutions and programs.
- Stimulate innovation, creativity, and competitiveness in study plans, as well as adaptation and response to the demands and expectations of the environment.
- Contribute to the assurance and accreditation of the quality of the study plans, as well as their recognition and visibility.

Now, returning to the issue of quality in HEIs, quality assurance emerges, which "is focused on continuous participatory processes that must be executed in the medium

and long term, because they allow achieving sustainability over time and establishing academic organization to the members of an HEIs [3], in addition to this, it is indicated that quality assurance establishes the infrastructure to support software engineering methods, rational project management and quality control actions. , all of great importance if it comes to developing high- quality software [4].

This process requires constant review and self-evaluation, it is not occasional, once it is decided to be certified under a quality management self-evaluation model, the process has no end, since it is conceived as a "continuous process, designed and used permanently through the which evaluates the quality of a higher education system, institution or program, ensuring interested parties the continuous improvement of the quality level by meeting a set of conditions required to perform its functions, as an active organization, changing and responding to the environment, providing trust in society" [5].

In Costa Rica, the accreditation entity recognized as such is the National Higher Education Accreditation System (SINAES), which has an accreditation seal that "certifies the quality of a university degree and ensures a constant search for academic excellence". It is an external verification that includes a comprehensive evaluation of the study program, infrastructure, and teaching staff, among many other aspects. Students, administrators, professors, university authorities, graduates of the program and employers actively participate in this evaluation process" [6].

In Reference [7]: "Monitoring educational quality as a pillar for good Project Management in future engineering professionals" by Nidia Cruz Zúñiga, it is pointed out that every training process in engineering focused on projects, Quality must be a fundamental and transversal content, which allows the student to acquire skills to develop as a professional in the area. This training must be based on a minimum quality standard that is ensured through processes of review, measurement, and internal reflection such as self-assessment and evaluation. external. It is important to highlight that "the assurance of university quality through self-assessment and external evaluation is evidence of its excellence and sustainability, generating the emergence of pedagogical innovations, new teaching-learning models, responding to the need to raise the level of human capital formation [8]. In Reference [11] maintain that quality in higher education supposes the difference and diversities in the institutions, and from the accreditation mechanisms the change towards processes that ensure quality is inherent, making evaluations and accreditations "medium" and not "end". Fundamental changes in the field of strategic management development articulated towards quality processes can significantly raise the result towards a new horizon for universities.

What is indicated by Reference [12] those who emphasize the characteristics of Quality in Higher Education, making known the following:

The essence of quality in higher education involves institutional work, which involves achieving objectives and proposing permanent improvement activities in the academic field: research, undergraduate and graduate teaching; that is, ensuring quality in the tasks of daily practice.

A more globalized point of view is important, which maintains according to Reference [9] that the fragmentation and diversification of Costa Rican higher education presents the enormous challenge of producing a more consistent integration of public and private institutions and accreditation bodies, criteria, and instruments in the education system.

As stated, Reference [10] support these processes and certify quality, there are several accreditation agencies at the national and international level. There is the Agencia Centroamericana de Acreditación de Postgrado (ACAP) and SINAES. Regarding the accreditation agency ACAP, its relevance lies in the fact that it was created to provide public reliability of the quality of Higher Education in Central America, through the accreditation and reaccreditation of postgraduate programs.

ACAP is a regional organization, in which 41 Central American institutions participate, including: 17 Public Universities, 11 Private Universities, four Science and Technology Councils, two Science Academies and five Confederations of University Professional Entities (CEPUCA). This multisectoral formation gives an innovative character to the quality assurance of Higher Education, of which 22 programs have been accredited throughout the Central American region, and other programs are in the process of evaluation and reaccreditation. "This Central American agency was created through the signing of the framework of the III Central American Forum for accreditation of postgraduate programs, held in Tegucigalpa, Honduras, in August 2006", as "a response to the need to create an organization that can give public attestation to quality in the postgraduate programs of higher education institutions in Central America". The above allows us to guarantee the quality of this level of training in the area and provide Central American society with high-ranking professionals in their different specialties. Hence, its mission focuses on "publicly attesting to the quality of postgraduate programs of higher education institutions in the Central American region and the Dominican Republic", based on the promotion of improvement quality continuum to constantly verify the relevance of postgraduate programs in that sense. It is for this series of reasons that ACAP represents the Central American Postgraduate Accreditation Agency as a reference point.

Finally, it must be remembered that all processes entail, as indicated in Reference [13] cited in the Ibero-American Network for the Accreditation of Quality in Higher Education (RIACES), the term self-evaluation in the following way: It is an internal participatory process that seeks to improve the quality. It gives rise to a written report on the operation, processes, resources and 26 results of a higher education institution or program.

When self-assessment is carried out with a view to accreditation, it must conform to criteria and standards

established by the accrediting agency or body. That is, self-assessment is an internal assessment process that gives rise to the recognition of strengths and weaknesses, opportunities, and threats, depending or not on specific standards established for this purpose.

Another conception referred to by Reference [14] indicates that: (...) self- evaluation can be described as a periodic process of study or analysis of the situation and result of an institution as a whole or of one of its work units, programs or careers, of mandatory and thus prospective and change-oriented, which is organized and conducted by the institution itself, with the appropriate participation of relevant actors (managers, academics, officials, students). It is carried out having as references the mission and declared objectives of both the institution and the work unit, program or career and a set of external references (criteria or standards) that have been previously established. The physical product of the process is a Self-Assessment Report. From both definitions, it can be deduced that self-assessment responds to an academic activity of higher education institutions that requires an arduous research process whose product is focused on promoting continuous improvement. The above implies a series of changes necessary to amalgamate the processes and procedures that are carried out within the entity and its relationship with the specific and general environment, in coherence with the institutional objectives.

IV. ANALYSIS OF RESULTS

This analysis shows the results of 13 most representative questions that demonstrate the need for universities to know the intercomparison processes and apply them to initiate their own accreditations.

The first 5 questions show what they answered regarding knowledge of terms used in the research.

2. As understood by the term Inter comparison, indicate the level of importance for the accreditation of your degree:

Very Important 60%
Important 40%

3. Which of the following accrediting entities do you know?

the 100% know SINAES and the 20% ACAP

4. Do you know the term quality assurance?
Yes   100%
No   0

5. Based on the previous term, please indicate the level of importance of ensuring quality for your career:

Important 60%
Very important 40%

6. Respect to the improvement plans that must be generated to ensure quality, how likely is it that you and your team will commit to complying with the defined actions:

Very likely 100%

The next 7 questions focus in the intercomparison and the perception of the people.

7. Based on the inter-comparison carried out between self-assessment models, classify the following criteria according to level of importance: Relationship with the context

Satisfactory 40%
Acceptable 60%

8. Based on the inter-comparison carried out between self-assessment models, classify the following criteria according to level of importance:

Various resources
Study plan: 60% Satisfactory 40% Acceptable
Infrastructure: 60% Satisfactory 40% Acceptable

Training, resources, equipment, and materials:
60% Satisfactory
20% Acceptable
20% Unsatisfactory

Personal: 80% Satisfactory 20% Acceptable

9. Based on the intercomparison carried out between self-assessment models, classify the following criteria according to level of importance: Academic and administrative management

Students: 20% Satisfactory 80% Acceptable
Processes: 60% Satisfactory 20% Acceptable 20% Insufficient.
Teaching development: 80% Satisfactory 20% Insufficient
The training processes and teaching development stand out as insufficient.

10. Teaching-learning methodology:

The answer is 80% Satisfactory 20% Acceptable
Program management: 60% satisfactory 40% Acceptable.

11. Based on the intercomparison carried out between self-assessment models, classify the following criteria according to level of importance: Career projection.

Research is generating or analyzing themes in an area of study:
Satisfactory 20%, Acceptable 40%, 40% insufficient.

Innovation, generating ideas, strategies, tools, products, or services:
Satisfactory 40%, Acceptable 20% and Insufficient 40%.

Internationalization, expansion of activities outside borders:
Acceptable 40%, Insufficient 40%, Poor 20%.

Extension, bringing knowledge and services to the community:
20% Satisfactory, 40% Acceptable, 20% Insufficient, 20% Deficient.

It is notable with 40% Insufficient in the Research, Innovation and Internationalization processes which need to be strengthened to guarantee continuous improvement. And the Extension with 20% of Insufficient, but 20% as a Deficient process that must establish changes for its progress.

12.Based on the inter-comparison carried out between self-assessment models, classify the following criteria according to level of importance: Results and monitoring

Student Performance: Satisfactory 40%, 60% Acceptable

Graduates: Satisfactory 40%, 60% Acceptable

Career projection: 20% Satisfactory, 60% Acceptable, 20% Insufficient

In this section, the Insufficient 20% in the Career Projection stands out, which must entail strategic actions to reverse it. Finally.

13. Based on the inter-comparison carried out between self-assessment models, classify the following criteria according to level of importance:

Sustainability. 60% Satisfactory and 40% Acceptable.

V. SOLUTION PROPOSAL

In the Accreditation processes, an external verification is carried out that includes a comprehensive evaluation of the study program, infrastructure, and teaching staff, among many other aspects. Students, administrators, professors, university authorities, degree graduates and employers actively participate in this evaluation process.

The objective of this proposal is to combine what is required by both accrediting entities and form a guide so that universities that are not accredited have a frame of reference to know that it can work in each area and category in a process prior to the official process established by each accrediting entity.

To begin, we will define the SINAES accreditation process with a breakdown of its dimensions (see Fig. 1).

- Admissibility
- Relationship with context
- Resources
- Program
- Educational process
- Results
- Sustainability
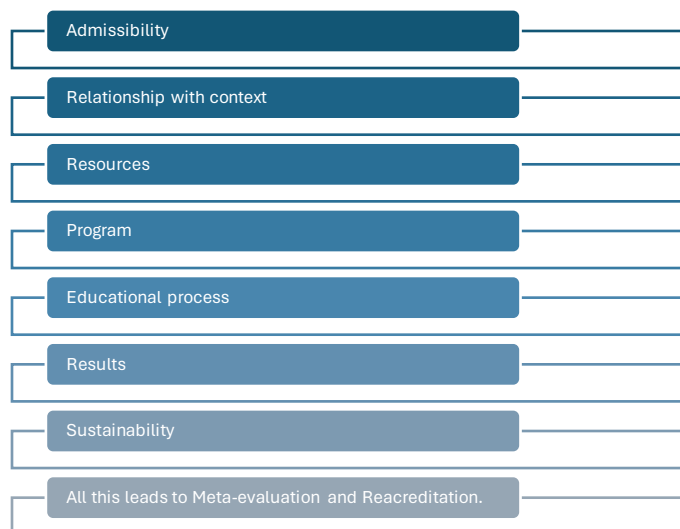- All this leads to Meta-evaluation and Reacredition.

Fig. 1 the SINAES accreditation process with a breakdown of its dimensions

The process of the Self-Assessment Guide of the Central American Postgraduate Accreditation Agency (ACAP) is detailed below:

Categories
1. Students
2. Graduates
3. Teachers
4. Training Processes
5. Research and Innovation
6. Academic and Administrative Management
7. Linking through extension and social projection
8. Internationalization

Fig. 2 The process of the Self-Assessment ACAP

When looking for areas of intersection in both accreditation entities, common elements are determined where work can be done for the continuous improvement of careers through their accreditation models. But there are also areas that must be established to be worked on and achieve growth in them.

Firstly, some guidelines are established for the master's degrees and their contents, so that all the possible variations they may have been considered.

The foundation area is aimed at complementing and deepening the students' basic theoretical and methodological foundation. The elective area is aimed at offering specific theoretical and methodological elements in the line of research chosen by the student. Its design is flexible and personalized so that it meets training needs with a view to carrying out his research work.

The research area constitutes the central area of the curricular structure of the master's Program and has as its main component the formulation, development, monitoring, and publication of a research work and is made up of the following curricular components.

The complementation area is aimed at providing additional elements to promote a more comprehensive training of students. These areas are suggested, and it is important to consider them in your study plans.

As a result of this exploratory study, we propose the following Proposal for Inter comparison (see Fig. 3):
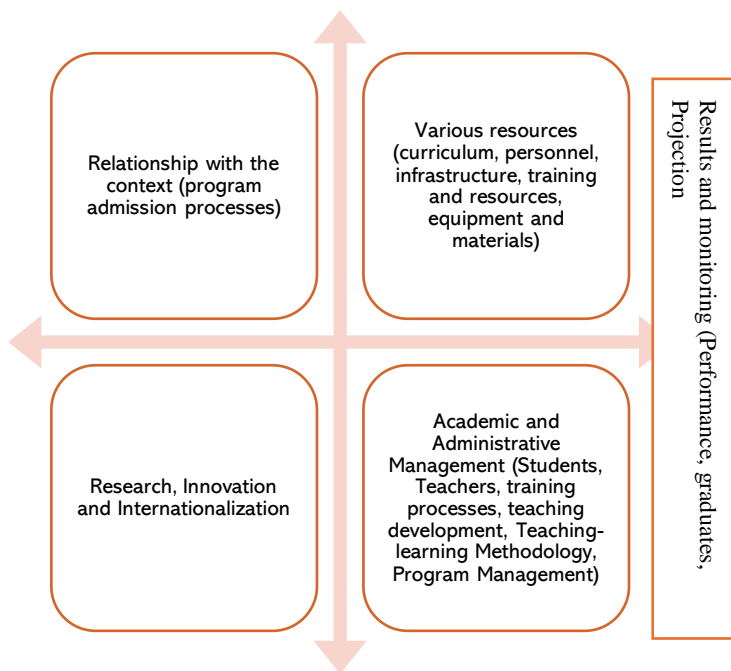

Fig. 3 Results and monitoring (Performance, graduates, Projection)

1. Relationship with the context (program admission processes). These are all those activities that the program carries out as part of its admission to the program, which guarantees a clear and transparent procedure.
2. Various resources (curriculum, personnel, infrastructure, training and resources, equipment, and materials). The training and resource processes are what the master's program requires to function properly. It also contemplates the infrastructure available, and the equipment and materials used by the program during its execution.

3. Academic and Administrative Management (Students, Teachers, training processes, teaching development, Teaching- learning Methodology, Program Management). Everything concerning the teachers and the training processes used it. The teaching development that must have to be trained and meet the objectives of the program and finally the methodologies that developed and applied.

4. Research, Innovation, and Internationalization. Of the most sensitive areas in master's programs, Research focuses on the production of scientific knowledge and its dissemination using innovative mechanisms that guarantee appropriate use of necessary technical resources. With respect to Internationalization, project students with their peers in other latitudes and ensure a comprehensive education that takes into consideration cutting-edge technologies and modern work methods.

5. Results and monitoring (Performance, graduates, Program Projection): in this last section, measure performance with effective indicators and monitor graduates so that linked to the program, which guarantees an adequate and functional projection of it.

Regarding how to develop these Inter comparison processes, it is necessary to establish a series of phases that contribute to the distribution of work but that guarantee success in their implementation. For this, the following are detailed (see Fig 4).
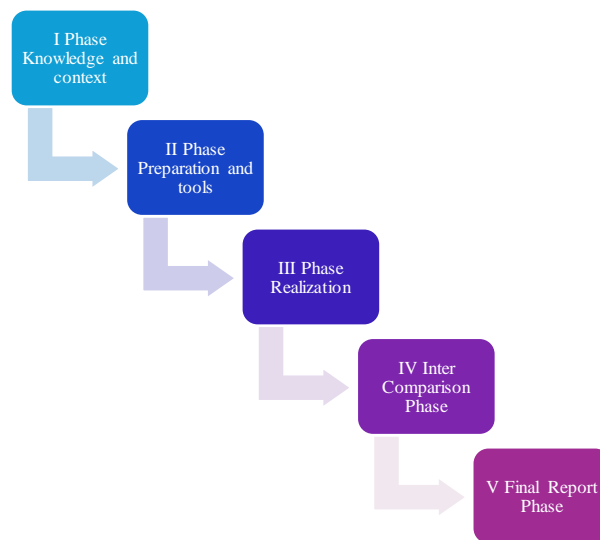

Fig. 4 Phases for the implementation of Intercomparison

1. Phase Knowledge and context

In this phase, an exploration of the environment is carried out and the goals that we will achieve with the Inter Comparison

are established, in addition to looking for a university that is accredited at the Central American level, including Latin America, that has an area of action and specialties like the one being studied. study subject.

And finally, the objectives of the Inter comparison process are defined, taking as a reference that our degree has not been accredited before.

2. Phase Preparation and tools

In this phase, the scope of applying the Intercomparison is established and what materials and documentation will be worked on during this process, as well as preparing the self-assessment guide and the accrediting entity that will be followed.

3. Phase Realization

It begins with the self-assessment process that provides input to all members of the ecosystem of the master's degree under study.

4. Inter Comparison Phase

The visit of the peer evaluators who will carry out the process and verify the evidence and completed documents is carried out.

5. Final Report Phase

The visitors present their final report, and it is discussed in a special session with representatives of the master's degree, university authorities and peers. The process is considered closed when the report is received in accordance respectively.

Subsequently, the university uses the final report of the Inter comparison that indicates all the recommendations and possible actions to improve and works with it so that when the Accreditation process begins it has all the documentation and tools necessary for it to be successful.

It is important to monitor with previously established indicators so that the fulfillment of the objectives set in the first phases can be autonomously visualized and, above all, to ensure the quality of the process and the accreditation process when it is carried out completed.

The first thing is to define through the phases how the entire process will be worked and what will be done in each one, this will define a work plan to which a schedule of established dates will be associated. Subsequently, an interdisciplinary work team will be convened to work on all the respective activities and get involved in the experience that this entails.

It is important to consider that intercomparison processes are carried out when the programs are not accredited and help the acquired experience drive the necessary actions to initiate the formal accreditation processes.

The documentation used must be transversal to the entire process and distributed and communicated among all those interested in the master's degree under study.

Regarding the methodological and technical part of the process, it is necessary to establish the actions to be carried out regarding the traceability of the progress of the students and their tutors in their research projects generated during all the studies.

Use references from other master's programs with a scientific or research focus where the academic load of the subjects taken is lower and that focus on subjects or academic credits that allow progress in their research projects.

It is necessary to consider the methodological reference used to build the program or curricular framework. Incorporate research work in all semesters to advance research, extension, and innovation as catalysts for master's programs.

It is recommended to organize the respective information and evidence in each of the established categories. It is about establishing evaluation and improvement processes of academic training and evaluation processes, considering that these are inclusive and equitable.

It is important to review the teaching strategies of the courses and align them with the purposes of the program and the training processes. Consider the use of teaching strategies that include equitable and equal treatment of students. It is necessary to consider the application of strategies for the evaluation of learning.

In terms of Research and innovation, it is necessary to define policies and strategic lines of research and innovation of local, national, and international scope. In addition to organizing the information. Encouraging strategies for students and teachers to participate in projects of this type are essential.

Carrying out impact evaluations of the linkage projects developed in the program, once the projects are completed, guarantees their success with indicators on the achievement, incidence or impact of social projection and the degree of satisfaction of the beneficiaries with the actions or linkage projects generated by the program.

Regarding Internationalization, it is necessary to carry out regulatory actions for internationalization. As well as establishing an improvement action plan to record and integrate the processes.

Create a roadmap document to consult on the disclosure mechanisms of agreements or collaboration agreements. In addition to establishing a mechanism for the functioning of collaboration, exchange, and academic networks, it is one of the basic elements to consider.

Finally, define a procedure to follow up on collaboration agreements or agreements and disseminate the results. With evidence related to the efforts of national and international contributing organizations.

V. CONCLUSIONS

It is important to highlight that quality management improvement processes are broad and require concrete actions. This is why it is necessary to carry out a series of actions before starting an Intercomparison process.

The use of Intercomparison makes it easier for careers to explore Accreditation activities with confidence and with the certainty that they will be able to generate evidence over time that guarantees success in their performance.

It explored how these processes can establish the differences between accredited careers and those that are not, find existing gaps and determine the concrete actions required to initiate and develop successful accreditation processes.

In future lines, it is expected to be able to develop case studies in national and international universities and establish empirical cases that help with the topic under study and allow expanding the use of this tool, intercomparison, as a basis for initiating accreditation processes and guaranteeing quality in the development of its final products (see Fig. 5).
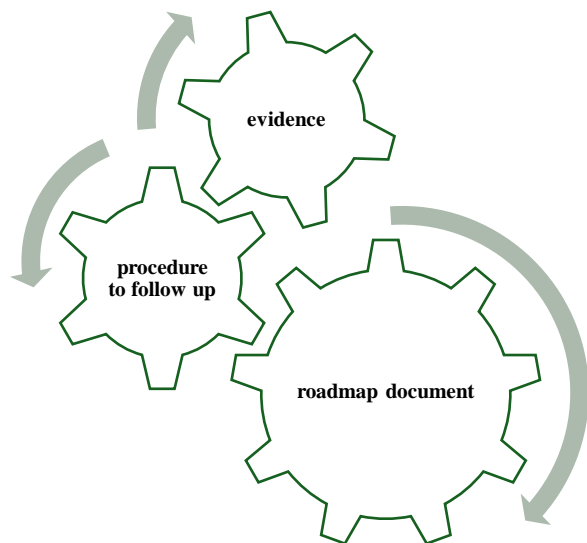

Fig. 5 The instruments to successfully Inter Comparison processes.

The figure shows the instruments to successfully Inter Comparison processes for establishing mechanisms for the evaluation and dissemination of the results of research and innovation projects is essential to guarantee their incorporation into the process.

All plans, processes, and results of connection through extension and social projection are essential to serve as evidence with the respective regulations for compliance. In addition to the contracts made. Additionally, evidence of the execution of actions, extension projects and social projection.

We can carry out exhaustive evaluations of the accreditation processes in master's programs to define a common route and a starting point for universities to invest and work in the processes to ensure the quality and continuous improvement of these educational offers high level.

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