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Quality indicators system: Evaluation of research training in higher education in Nicaragua, 2021–2023

Sistema de indicadores de calidad: Evaluación de la formación investigativa en la Educación Superior de Nicaragua, 2021-2023

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Abstract

Indicators have become key instruments to improve decision-making in the research management of institutions and for better definition, development, and evaluation of policies, reforms, and programs. Under this reality, the present research is developed, which arises from the doctoral thesis in Gestión de la Calidad de Investigación Científica. The methodology was characterized by a constructivist paradigm, a mixed approach, and an explanatory type of study. methods, techniques, tools, and instruments were used to collect and process data. The objective of the research is: to develop a quality indicators system for the evaluation of research in the university context, based on efficacy, effectiveness, and efficiency.

Keywords: Quality, Indicators, Research, System, University.

Resumen

Los indicadores se han convertido en instrumentos claves para mejorar la toma de decisiones en la gestión investigativa de las instituciones y para una mejor definición, desarrollo y evaluación de políticas, reformas y programas; bajo esta realidad se elabora la presente investigación que surge de la tesis doctoral en Gestión de la calidad de investigación científica. La metodología se caracterizó por un paradigma constructivista, enfoque mixto, tipo de estudio explicativo, se utilizaron métodos, técnicas, herramientas e instrumentos para recolectar y procesar datos. La objetividad de la investigación es: elaborar un sistema de indicadores de calidad para la evaluación de la investigación en el ámbito universitario, desde la eficacia, efectividad y eficiencia.

Palabras clave: Calidad, Indicadores, Investigación, Sistema, Universidad.

Introducción

This scientific article is linked to the research area: University Research. Research line: Impact of research results on the productivity of Central American countries. Research line of UNAN Managua: Knowledge area: Educational Sciences. CED1.-16: Management and quality in education. It is linked to the Institutional Project of Universidad Nacional Autónoma de Nicaragua (UNAN-Managua). Likewise, it is related to Sustainable Development Goal (SDG) number 4: Education and to the National Plan to Fight Poverty, in the development of human talent for national development from within the education system.

The system of proprietary quality indicators for the evaluation of research at UNAN-Managua is a set of indicators that will serve to measure the quality of performance in the institution's research process; the aim is that those involved in continuous improvement projects of processes and products in the Quality Management Systems not only have sufficient tools, but also know how to develop them. This is the central purpose of this research: to be prepared for what lies ahead — to measure and improve quality through indicators day by day.



The research has far-reaching implications by developing a system of proprietary quality indicators for the evaluation of research in education at UNAN, based on efficacy, effectiveness and efficiency; it can be implemented in any higher education university or in organizations carrying out quality and continuous improvement systems, showing the relationship between criterion, indicator and standard with their respective examples, as well as the different types of indicators.

This research identifies the specific problems that affect the research process and proposes alternative solutions to promote the development of continuous improvement processes that contribute to strengthening the current research quality management system at the university level.

The quality and impact of research must be measured because educational institutions are and must be permanent generators of intellectual property, knowledge and human resources, which impact the educational, scientific, economic and social sectors. National development priorities must be clearly established and based on this definition, fund or support the research that addresses these priorities.

Given this reality, the following question arises: How is the quality, efficiency, efficacy and effectiveness of the research component evaluated? Among the forms of completion of undergraduate and postgraduate studies is the monographic work for obtaining the professional degree. Therefore, it is necessary to evaluate the relevance and contribution of the impact of the research carried out. Measuring quality in the research process and in the training of careers with a research profile in higher education is essential.

The direct beneficiaries are the next professionals to be trained in careers with a research profile and teachers who have not yet achieved the category of research professors. The indirect beneficiaries are the Nicaraguan community. Given the importance of the research component in responding to phenomena and problems demanded by society, at UNAN it has always been a topic of interest to evaluate the relevance and contribution of the quality and impact of the research carried out.

To achieve the objective of this research, it is necessary to define impact and quality research indicators that allow their effectiveness to be evaluated. Thus, quality indicators are those associated with the results and operation of an organization's key processes and are determined based on critical success factors and components, i.e., the development of concrete actions and final process results that guarantee the achievement of objectives. Quality indicators measure whether the most relevant actions carried out by the organization contribute to achieving results (García et al., 2003).

Regarding the concept of *quality*, it has evolved from prehistory to the present day, but it reaches its greatest relevance in business activity and in the last half of the previous century. Several internationally recognized authors stand out, who emphasize certain aspects as cited by Becerra et al. (2018, n.p.):

quality as value (Feigenbaum, 1951; Abbot, 1955), quality as conformity to specifications (Levitt, 1972; Gilmore, 1974), quality as meeting requirements (Crosby, 1979), quality as fitness for use (Juran and Gryna, 1988), uniformity and reliability (Deming, 1989).



According to [Horruitiner \(2007\)](#), the concept of quality is used to define a set of qualities of the object of study — in this case, the training process — previously established, which becomes a standard against which periodic evaluations of said process are carried out.

Quality indicators are measurement instruments, tangible and quantifiable in nature, that make it possible to assess the quality of processes, products, and services to ensure customer satisfaction. In other words, they measure the level of compliance with the specifications established for a given activity or business process.

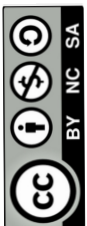
In education, indicators serve informative, evaluative, and knowledge-production functions. What can be measured can be better understood, and what is better understood can be improved. The most competitive educational institutions are those capable of innovating at the technical and organizational level, maintaining their entrepreneurial vision, in the constant quest to improve their processes, with increasing standardization, which is achieved through good administrative management. All this stems from the search for solutions to the critical situation they face, which arises from the lack of innovation in products and processes, merely managing to remain in the market by being defensive, but without significant progress or growth.

At the international level, the university of the new century must face important challenges given the continuous changes and growing paradigm shifts that occur constantly in all areas of knowledge, science, and technology. In other words, the aim is to guarantee and substantially increase the current and potential resources of knowledge, establishing a relationship between higher education and society as a whole.

At the national level, there is general consensus on the need to evaluate and accredit higher education institutions and programs, particularly regarding the type, scope, and characteristics of teaching as an effective way to ensure quality and safeguard public trust ([Consejo Superior de las Universidades Privadas. 2000, p. 2](#)). In this case, UNAN-Managua, as an institution committed to the quality of higher education and the relevant training of its students, has been involved in various processes, including: Institutional Self-Assessment for improvement purposes, the Institutional Improvement Plan, the Minimum Quality Standards Verification Process, and the international accreditation process of the International Evaluation and Accreditation Council (CEAI) of the Union of Universities of Latin America and the Caribbean (UDUAL). This body is responsible for evaluating based on the following dimensions: Governance, University Management and Infrastructure, Training, Research, Artistic, Cultural and Innovation Creation, Community Engagement, and Internationalization.

Methodology

The research paradigm was socio-constructivist. According to [Berger and Luckman \(2003\)](#), it is based on the principle that knowledge of the real world is constructed through processes of social interaction and mobilization of persuasive and representational resources.



This research, having a mixed approach, employed both qualitative and quantitative methods and techniques, such as: documentary research, ethnographic method, data analysis, closed-question surveys, semi-structured interviews, participant observation, triangulation, and focus group.

The type of study was explanatory, aiming to solve problems or intervene in history. It includes technical, artisanal, and industrial as well as scientific innovation. According to the timing of the events and the recording of information, the study was retrospective, and according to the period and sequence of the study, cross-sectional.

The study was also ex post facto, meaning it was based on available information about events that had already occurred, from which data was obtained at two levels (employers and graduates). This method allowed the collection of information on the go and of the products generated, to make decisions regarding adjustments and corrections to the study plan.

The study population consisted of UNAN degree programs with a research profile (Social Anthropologists, Historians, and Geographers); a total of 256. Simple random sampling and convenience sampling were used, with 60 participants considered.

In the documentary phase, the following sub-phases were carried out: (a) Project planning: Review of secondary sources and existing documentary sources related to the object of study (the quality of education). According to the research objectives, the variables to be investigated were defined, operationalized, and quality indicators were constructed. (b) Instrument development: Design and validation of research instruments that allowed data collection with their respective output tables, representing the studied variables, through information exchange, questionnaires, and interviews. For the quantitative analysis, the process started with a research idea based on formulated hypotheses. Once the numerical data were collected, they were transferred to a matrix, which was analyzed using statistical procedures.

Based on the collected data, the corresponding database was designed using SPSS statistical software, v. 20 for Windows. Once the quality control of the recorded data was completed, the relevant statistical analyses were conducted, according to the nature of each variable (quantitative or qualitative) and guided by the commitment defined in each specific objective; descriptive analyses were considered for nominal and/or numerical variables.

Results

The quality of a product is always complex to assess. The reason is simple: the measurement of quality can be approached from different perspectives and has a multitude of possible solutions. Therefore, to speak of quality as objectively as possible, one must first define what is meant by that quality, second specify how that quality will be evaluated, and third clarify the desired level of quality and whether it can be achieved.



The simplest way to approach these steps is to identify the objectives pursued in terms of quality (quality criteria), establish a way to know if these objectives are achieved (a numerical index known as an indicator), and finally establish a range within which the level of quality is acceptable and must remain (quality standard).

It has been argued that working on quality requires an essential condition: evaluation, that is, the ability to measure. Data, not impressions, are needed; one must know what, how, who, when, why, and for what purpose measurement is done. This is where quality criteria, indicators, and standards come into play, which, as will be seen, are closely linked and help achieve the expected learning outcomes. A good quality information and evaluation system in an educational system should include, in addition to performance tests, indicators derived from traditional educational statistics and other studies on specific aspects, such as school resources and internal processes.

Interest in performance tests should not lead to abandoning traditional indicators but to improving and managing them alongside the most recent ones, while continuing to explore the development of those still insufficiently addressed, especially those of relevance, impact, and equity.

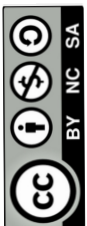
Management indicators become a simple and powerful idea for measuring how well something is being done; because resources invested in education are expected to be managed efficiently and produce the best results. For example, they make it possible to know: what is the level of satisfaction of employers with graduates of research-profile programs due to their prestige derived from their competencies?

Indicators refer to a specific object of analysis (program, degree, etc.); there is always an evaluation factor on which the importance of the indicators depends. Therefore, in this research, the following evaluation factors were selected: (a) evaluation of the quality, efficiency, and effectiveness of social research. Thus arose the general research question: what is the quality indicator system required to evaluate research training in Nicaraguan universities?

Currently, UNAN -Managua has a Research Directorate and an Institutional Quality Management Directorate, which have succeeded in consolidating the main theoretical and conceptual elements of process management, quality management, and information management systems, securing the participation of central-level units in driving the achievement of established goals. The research culture is not exempt from this strategic purpose of accreditation for academic excellence.

At UNAN, quality management is understood as the set of policies, strategies, actions, and procedures aimed at maintaining and sustaining continuous improvement at each level of management, academic and administrative instances, strategic, key, and support functions and processes we develop to meet the demands of Nicaraguan society.

The Vice-Rector of UNAN - Managua, Luis Alfredo Lobato, in an interview with [Mora and Hernández \(2024\)](#), states that:



We are making progress in Research, and above all in Innovation. Nowadays, the Innovation Conferences are already seen from the technological, social, and process perspectives (...) they are no longer a surprise; they are a continuous dynamic. There are 4, 5, even 6 Conferences a year in terms of competitions and the pursuit of progress in Innovation and Research. The University Conferences on Scientific Development continue to be a regular feature at our Universities, and we keep growing despite the fact that it is always an unfinished task — how we grow, how we advance in Research. (n.p.)

In Cuban higher education, this concept of quality is understood as the result of the conjunction of academic excellence and comprehensive relevance. The degree of social relevance of a program or institution is measured by the social impact it generates, by the flow of repercussions and meaningful transformations that objectively occur in the surrounding society, presumably as a result of the set of contributions made by such program (Águila, 2012).

Según Martín et al. (2015) existen indicadores claves en la evaluación:

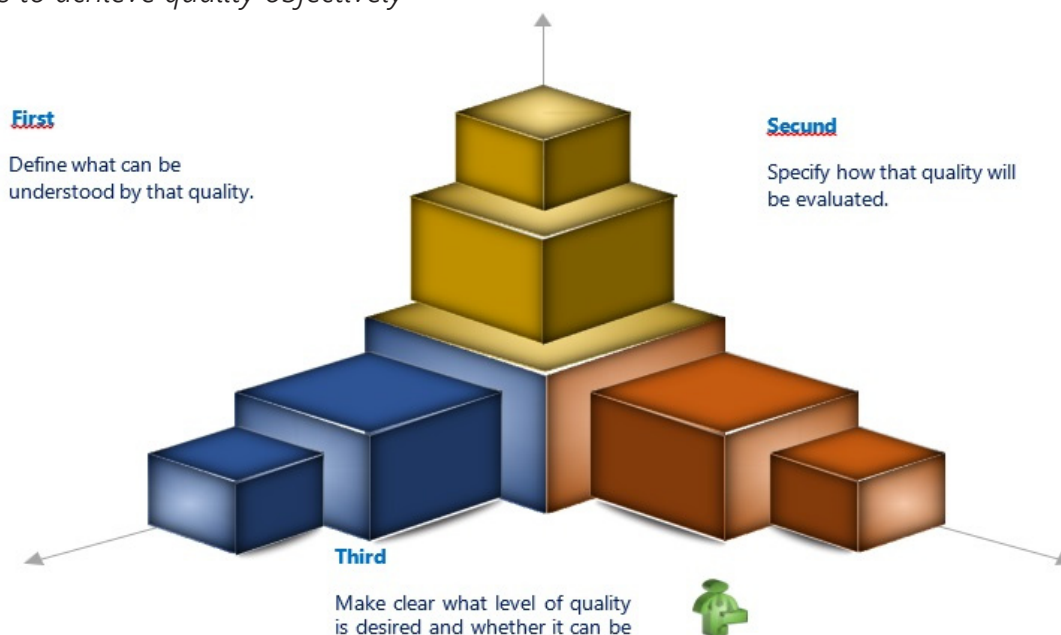
1. Relevance and social impact: The response provided by the degree program to achieve the sustainable development of the country and the region, the strengthening of the cultural identity of Cuban society, the comprehensive development of professionals, and the attention to ideals of justice and equity that characterize our social system.
2. Students, teachers, specialists, graduates, and employers are satisfied with the research training achieved in the program.
3. Graduates fully take on the research challenges of the profession in accordance with the accelerated dynamics of science and technology in the country's economic and social development.
4. Teachers and specialists demonstrate, through their scientific production and especially in their way of acting, a culture of research.
5. Teachers and specialists must stand out for their investigative qualities as educators, based on solid political-ideological, scientific-technological, and professional preparation.
6. Faculty members of the degree program possess a high capacity for professional and scientific research work, accredited by the university community and society, with a significant number holding the scientific degree of Doctor and the academic title of Master or Specialist.
7. The supervision of research work, courses, and diplomas is also carried out by highly qualified teachers and specialists. In this research, the following criteria were taken into account:



Given this reality, and with the aim that higher education research achieves efficiency, efficacy, and effectiveness, the Quality Indicators System: Evaluation of Research Training at the Higher Education Level was developed, comprising 140 indicators for the dimensions of research: (a) Research project, Research training programs; (b) Human resources in research and Research infrastructure, evaluated in terms of research efficiency, efficacy, and effectiveness; (c) Capacity to investigate socio-cultural realities, with the aim of comprehensively analyzing the human being and their culture (indicators applied in anthropology, history, and geography programs); (d) Capacity to formulate social projects with cultural relevance, contributing to sustainable human development; (d) Capacity to promote intercultural dialogue, in order to foster local coexistence and strengthen identities, among other key elements; (e) Use and relevance of scientific research based on bibliometrics, among others. Figure 1 summarizes in three steps how to achieve good quality.

Figure 1

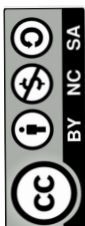
Process to achieve quality objectively



Note: Own elaboration (2025).

The simplest way to approach these steps was to identify the objectives pursued in terms of quality (quality criteria), establish a way to know if we are achieving those objectives (numerical index that shows where we are and which is called an indicator), and finally, establish a range within which the level of quality is acceptable and within which it should remain (quality standard).

As a result, each criterion was assigned a score from zero to five, such that indicators that scored between 13 and 15 were classified as priority 1, those that scored between 10 and 12 were classified as priority 2, and those that scored below 10 were classified as priority 3. Why were these



indicators selected? They were considered because the research project constitutes the unit from which information is retrieved from state universities regarding inputs and outputs.

Discussion of results

The concepts of *effectiveness*, *efficiency*, and *efficacy* are fundamental in quality assessment and can be used as key *criteria and indicators in a Quality Indicator System, especially when evaluating research training*.

The quality indicator system is the set of indicators associated with the results and operation of an organization's key processes, determined based on critical success factors and components; that is, the development of concrete actions and the final results of the processes that ensure the achievement of objectives.

The quality of research training is always complex to evaluate. The reason is simple: the measurement of quality can be approached from different perspectives and has a multitude of possible solutions. For this reason, it is necessary to speak of quality as objectively as possible.

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To work on quality, an indispensable condition is evaluation—that is, the ability to measure. What does *efficacy* measure? The degree of fulfillment of the proposed objectives. *Efficiency* measures the relationship between the resources used and the results obtained. It implies achieving objectives with the least possible use of resources (time, money, effort). *Effectiveness* is the system's capacity to generate real positive impacts in its environment. Data are needed, not impressions. It is necessary to know what, how, who, when, why, and for what purpose the measurement is done. This is where criteria, indicators, and quality standards come into play, which are closely linked.

Similarly, it was observed that the participation of teachers in research processes is a key element for knowledge production and educational improvement. Analyzing their role in terms of efficiency, efficacy, and effectiveness allowed us to understand how their involvement impacts the results of the research process and the transformation of the educational environment.

In this sense, teachers' participation in research can be evaluated positively or negatively based on efficacy (achievement of objectives), efficiency (resource management), and effectiveness (real impact, understood as a lasting change in the condition of people and their environment, brought about by a chain of events or a change in the functioning of a system to which research, innovations, and related activities have contributed, provided there is adequate articulation between their teaching and research roles. To maximize these aspects, it was considered essential that educational institutions provide training, time, and recognition for teachers' research work.



Conclusions

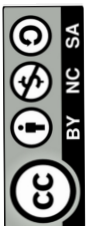
Research has become synonymous with quality. A university that does not produce research does not contribute to the development of knowledge and therefore becomes relegated in the academic context; a teacher who does not conduct research cannot develop professionally or academically. Understood in this context, research training constitutes a pathway to a new society.

It is concluded that research effectiveness means doing things well to achieve the expected result. It focuses on a person's ability to carry out research tasks. It can be measured with indicators that reflect the level of productivity achieved. Thus, it is concluded that research efficiency means focusing on the use of resources and the required time, doing the right things to obtain the result, and optimizing the necessary resources to achieve the objective. It can be measured with indicators that reflect the advanced level of quality.

Finally, it is concluded that effectiveness is the combination of effectiveness and efficiency to achieve the expected result. It focuses on how to achieve an objective in the best possible way. It is the highest quality that can be achieved to fulfill the stipulated objective. It can be measured with result indicators that reflect data on the levels of productivity and quality achieved.

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