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Original article

# Methodology for the evaluation of the impacts of technologies associated with the doctoral training process

## Metodología para la evaluación de impactos de tecnologías asociadas al proceso de formación doctoral

## Metodologia para a avaliação dos impactos das tecnologias associadas ao processo de formação doutoral

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**ABSTRACT**

The impact assessment of doctoral training is a systemic process that requires the participation of various stakeholders and the evaluation of short-, medium-, and long-term indicators. The objective of this work is to design a methodology for evaluating the impact of implementing technologies associated with the doctoral training process at a university, thereby continuously improving the management of this process. A mixed-methods approach was employed, combining qualitative and quantitative research methods and techniques. The result is a methodology consisting of three stages and nine steps. These logically lead to the evaluation of the impact of three technologies: the

preparatory school for admission to doctoral training, the methodological proposal for managing doctoral training with the research project as the fundamental framework, and the strategy for preparing the faculty of doctoral programs. This work is a result of the research, development, and innovation project "Management of the Doctoral Training Process and its Internationalization," associated with the Higher Education and Sustainable Development sectoral program of the Ministry of Higher Education of the Republic of Cuba.

**Keywords:** evaluation; doctoral training; impacts.

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**RESUMEN**

La evaluación del impacto de la formación doctoral es un proceso sistémico, que requiere la participación de diferentes actores y la evaluación de indicadores a corto, mediano y largo plazo. El objetivo de este trabajo es diseñar una metodología para evaluar el impacto de la implementación de tecnologías asociadas al proceso de formación doctoral en una universidad, de modo que se perfeccione continuamente la gestión de este proceso. Se empleó el enfoque mixto de la investigación combinando métodos y técnicas de la investigación cualitativa y cuantitativa. El resultado es el diseño de una metodología que consta de tres etapas y nueve pasos; estos, de forma lógica, conducen a evaluar el impacto de tres tecnologías: la escuela de preparación para el ingreso a la formación doctoral, la propuesta metodológica para la gestión de la formación doctoral con el proyecto de investigación como escenario fundamental y la estrategia para la preparación de los claustros de los programas doctorales. Este trabajo constituye un resultado del proyecto de investigación, desarrollo e innovación Gestión del proceso de formación doctoral y su internacionalización, asociado al programa sectorial Educación Superior y Desarrollo Sostenible, del Ministerio de Educación Superior de la República de Cuba.

**Palabras clave:** evaluación; formación doctoral; impactos.

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**RESUMO**

A avaliação do impacto da formação doutoral é um processo sistêmico que requer a participação de diferentes atores e a avaliação de indicadores de curto, médio e longo prazo. O objetivo deste

trabalho é desenvolver uma metodologia para avaliar o impacto da implementação de tecnologias associadas ao processo de formação doutoral em uma universidade, de modo que a gestão desse processo possa ser continuamente aprimorada. Foi utilizada uma abordagem de métodos mistos, combinando métodos e técnicas de pesquisa qualitativa e quantitativa. O resultado é o desenvolvimento de uma metodologia composta por três etapas e nove passos; estes conduzem logicamente à avaliação do impacto de três tecnologias: a escola preparatória para ingresso na formação doutoral, a proposta metodológica para a gestão da formação doutoral com o projeto de pesquisa como contexto fundamental e a estratégia para a formação de docentes em programas de doutorado. Este trabalho é resultado do projeto de pesquisa, desenvolvimento e inovação "Gestão do Processo de Formação Doutoral e sua Internacionalização", associado ao programa setorial de Ensino Superior e Desenvolvimento Sustentável do Ministério da Educação Superior da República de Cuba.

**Palavras-chave:** avaliação; formação doutoral; impactos.

## INTRODUCTION

A key element in achieving project objectives is properly defining the impact assessment methodology. According to Perissé (2019), the impact of a social project or program is the quantitative magnitude of the change in the problem faced by the target population, as a result of delivering products (goods or services) to them. Impact is then measured by comparing the initial situation, called the Baseline (LB), with a subsequent situation represented by the Comparison Line (CL).

Unlike industrial projects, where the impact can be measured by the economic benefit achieved, the magnitude of the impact achieved in a social project is not necessarily a linear function of the investment made in the project, since increasing the investment does not imply a proportional increase in the project's impact. Therefore, the success of a project will be measured by its impact in relation to the objectives pursued and achieved, thus constituting the ultimate justification for its implementation.

The category of impact has been defined by Martínez, Pino, and Santacana (2022) as any outcome that generates effects with multiple manifestations at the personal, organizational, and social levels

within a specific context and timeframe, under established quality standards. These authors state that if these impacts have a marked social significance in a macro or micro context, then a social impact is present, which can be observed because it manifests itself favorably or unfavorably in the behavior of society, both individually and within different social groups. For their part, Bastida and Solé (2021) consider the concept of social impact to be very broad and to encompass anything that affects the quality of life of individuals and communities.

Impact assessment is a widely discussed topic at both national and international levels. Environmental impact assessment began in the late 1960s in developed countries as a process for analyzing and preventing environmental impacts, driven by pressure from environmental groups and the general public. Later, the social impact assessment of projects was incorporated as a broader concept, encompassing not only the environment but also the community. Currently, the concept of social impact includes not only anticipated but also unforeseen outcomes. It also considers both positive and negative effects that may arise after the implementation of a particular program or project within a social group or community (García, 2022).

In any case, it is paradoxical that legislation on impact assessment has relegated the evaluation of social impacts to a secondary role within environmental impact assessment and has not mandated an independent study specifically aimed at evaluating the social consequences of environmental intervention projects. In Cuban higher education, objectives-based planning emphasizes increasing the production of highly relevant research and development results and implementing the necessary measures to guarantee innovation and enhance the impact on the economy and society.

The Ministry of Higher Education (MES) in Cuba, in accordance with the country's scientific policy, establishes the policy for strengthening science, technology, innovation and doctoral training in the MES system, with the general objective of transforming the management of these activities in universities and science, technology and innovation entities, subordinate to this ministry (Núñez, Negrin, Rojas, González & Rivero, 2021).

Aguirre, Castrillón, and Arango (2019) group the trends in doctoral training regarding accreditation and quality at the best universities in Latin America, identified based on criteria of relevance, context, and implementation possibilities. As part of the emerging trends focused on support and guidance, these authors identify management (optimization and impact) as the increased demand for quality control of academic processes and their harmonious integration with administrative processes. This

contributes to benefiting the academic community and meeting the standards required for accreditation; supporting professional performance and monitoring impact; strengthening postgraduate governing bodies; articulating different pedagogical models for new competencies and self-evaluations; and achieving accreditation with dynamic and open approaches.

In this sense, considering the relationship that should exist between the objectives of Higher Education and the social requirements that determine its social mandate, the improvement of the management of the doctoral training process constitutes a current need (Funcia & Albuja, 2016).

As Saborido (2018) argues, doctoral training is an essential component for sustaining the country's scientific potential, especially that of its universities. A competitive number of PhDs is crucial for ensuring the quality of higher education and for producing high-level scientific results that impact the economy and contribute to meeting social and cultural needs. This even has political implications and shapes the international image of Cuban higher education, which some have unsuccessfully attempted to undermine.

According to Concepción, Rizo, and Capote (2019), research and doctoral training are fundamental to higher education. Strengthening doctoral training is an urgent national need and requires changes in its conception and organization that take into account best national and international practices.

This article takes as background the results of the R&D&I project: "Doctoral training and its contribution to development", belonging to the Sectoral Program of Higher Education "Higher education and sustainable development", whose participating institutions were the University of Pinar del Río Hermanos Saíz Montes de Oca (UPR), the University of Cienfuegos (UCF) and the University of Oriente (UO) and which was implemented in the period between January 2021 and December 2023.

Based on the preliminary diagnosis conducted at the participating universities, a group of causes affecting the doctoral training process were identified. The project's overall objective was formulated to improve the doctoral training process, thereby enhancing institutional and regional development. To achieve this objective, a set of results, in the form of technologies, was obtained that will impact admission preparation, faculty development, process management at all stages, and its digitalization.

The project was conceived as a complete cycle, which implies that as results were achieved, they were applied in each of the universities and programs as appropriate; accompanying this process with the evaluation of their impact, so that at the end of the planned time the effectiveness of most of the solutions could be assessed.

The above leads to considering the convenience of establishing methodological instruments that allow for intentional and proactive management to obtain applicable results, with well-defined indicators for measuring impacts, which constitutes the most complex result that is managed through a project.

Hence, the objective of this work is to design a methodology to evaluate the impact of the implementation of technologies associated with the doctoral training process in a university, so that the management of this process is continuously improved.

## MATERIALS AND METHODS

The research development was based on the dialectical materialist method as the guiding principle of the entire process, employing procedures of analysis-synthesis and induction-deduction.

A mixed-methods approach was used in the research, combining qualitative and quantitative research methods and techniques. First, a literature review was conducted using the traditional method, based on document analysis, to identify the main patterns that characterize the impact assessment process of a research project in the social sciences.

Subsequently, empirical group work techniques, such as brainstorming and cause-and-effect diagramming, were used to identify and reach consensus through open discussion, the stages or steps of the impact assessment process that are common to the three technologies generated in the project, as well as a second stage to identify the specific measurement indicators that are proposed to be used.

To develop the methodology, the following were identified as main components: objectives, premises, stages, steps, methods and techniques, according to Stable and Núñez (2021), Aledo and Aznar (2021), Ortiz and González (2021) and Martínez, Pino and Santacana (2022).

The impact assessment will be a mixed-methods approach, involving both internal and external stakeholders of the doctoral program being evaluated. Instruments will be administered to various actors to gather their perspectives, including members of doctoral committees, supervisors, doctoral students, alumni, employers, and external evaluators.

## RESULTS

### Rationale for the methodology

To finalize a research process, once the proposed solutions that respond to the theoretical and empirical diagnoses carried out have been developed, it is necessary to validate them.

The process of validating the results can go through several stages:

- Expert validation, whose objective is to assess the quality of the result by specialists.
- User validation, with the aim of knowing if, when the time comes for its application, it can be viable and useful for users.
- Implementation in practice, to demonstrate its viability, given by its impacts, before proceeding to generalize in all those contexts where it is possible.

In all cases, the results of each stage should provide feedback to the initial proposal in order to improve it.

The methodology proposed in this article is located in the last step, since the previous ones have already been carried out, and is oriented towards the evaluation of the social impact of the results of the research project "Improvement of doctoral training and its contribution to development".

Social impact assessment (SIA) emerged alongside environmental impact assessment (EIA) in the early 1970s, primarily as a regulatory tool. Over time, the practice of SIA has undergone continuous evolution. As interest in SIA has grown, a community of professionals involved in its development has formed, building a consensus around it. As with any professional practice, knowledge on the subject has evolved. Social impact assessment is fundamental for understanding and communicating the real effects of projects and programs on society. It helps ensure sustainability and respect for human rights throughout the lifespan of these projects.

For the EIS it is necessary to define indicators, understanding these as reference points that provide qualitative or quantitative information, made up of one or more data, consisting of perceptions, numbers, facts, opinions or measures, which allow the development of a process and its evaluation to be followed and which must be related to it.

The methodology proposal was formed based on the previous references, recovering those regularities that were considered most appropriate for the results and project under study.

**Structure of the methodology**

Objective of the methodology: to evaluate the impact of the implementation of technologies associated with the doctoral training process at the university.

This methodology establishes the aspects to be taken into account during the implementation of different technologies associated with the doctoral training process, namely:

- School for preparing students for doctoral studies.
- Methodological proposal for the management of doctoral training with the research project as a fundamental scenario.
- Strategy for preparing the faculty of doctoral programs.

The following are established as premises of the methodology:

- Willingness and commitment of the actors linked to the doctoral training process, with the implementation of the methodology.
- Have the technologies to be implemented approved by the Scientific Degrees Commission (CGC) of the University.
- Be implementing the technologies for at least six months before conducting the impact assessment.

**Stages of the impact assessment methodology**

Stage I. Establishing the initial conditions for the evaluation.
Stage II. Application of the evaluation.
Stage III. Analysis of results - feedback.

The objectives and steps for each stage are shown below:

**Stage I.** Establishing the initial conditions for the evaluation.

**Objective:** to create the necessary conditions for impact assessment.

**Step 1:** Evaluation of compliance with the premises.

Compliance with the previously defined premises is evaluated. If any of them are not met, the methodology implementation process cannot continue, as these are essential requirements.

**Step 2:** Formation of the impact assessment team.

In this step, the working group that will lead the impact assessment process at the University will be formed. This group will consist of a member of the Comptroller General's Office, a member of the Vice-Rector's Office that coordinates postgraduate studies, and a member of the Doctoral Committee.

**Step 3:** preparing the impact assessment team.

The members of the impact assessment team will receive training (awareness training) on topics primarily related to the doctoral training management process, the technologies that will be implemented, and other related topics, so that they have the necessary tools for carrying out the assessment.

**Stage II.** Application of the evaluation.

**Objective:** to carry out the evaluation of the impact of the implementation of the technologies, using specific indicators for each one.

**Step 4:** Determination of the variables, dimensions and evaluation indicators, as well as the methods and techniques for collecting user information.

This methodology is based on variables and indicators specific to each technology to be implemented. These are:

***School for preparing students for doctoral studies***

*a. Determination of the study variable*

The study variable is assumed to be: Impact of the School of Preparation for Entry into Doctoral Training, defined as the transformations in the intellectual and professional order achieved in the students of the school, as a result of their participation in the preparation activities and in response to their needs and interests, for the improvement of their preparation to enter a doctoral training program.

*b. Determination of the dimensions and indicators of the study variable*

Based on the definition of the study variable, its dimensions and indicators are determined, in order to facilitate the evaluation process and the identification of the main impacts.

I. Dimension of intellectual growth

Indicators:

- Knowledge of the country's science policy.
- Knowledge of the regulatory documents related to obtaining a scientific degree in the Republic of Cuba.
- Development of skills related to accessing and processing scientific information, through the use of technological resources.
- Development of basic research skills in the doctoral training process.
- Development of skills related to the writing of scientific texts.

II. Professional growth dimension

Indicators:

- Participation in academic and/or scientific networks.
- Participation in a research project.
- Production of scientific publications in medium and high impact databases.
- Participation in scientific events.

- Entry into an academic training program, as part of his doctoral training.
- Admission to a doctoral training program.

III. Dimension: Level of satisfaction

Indicators:

- Relevance of the topics that made up the school's teaching work scheme.
- Adapting the school's content to the needs of the participants.
- Updating the knowledge that was taught at the school.
- Use of the experience of participating students in the development of school activities.
- Level of satisfaction with the evaluation system used.
- Levels of motivation in students for admission to a doctoral program.

*c. Determination of research methods for obtaining information*

- Survey of graduates of the school. This survey aims to ascertain the short-term impact of the School of Preparation for Doctoral Training, based on the partial implementation of a diploma program, one of its most significant activities. Respondents are asked to rate different criteria on a scale of 0 to 5, where 0 represents the lowest value and 5 the highest. The criteria to be evaluated include: knowledge of the country's science policy; development of skills related to accessing and processing scientific information through the use of technological resources; knowledge of the regulations related to obtaining a scientific degree in the Republic of Cuba; development of basic research skills during the doctoral training process; development of skills related to writing scientific texts; participation in academic and/or scientific networks; participation in research projects; publication of scientific articles in medium- and high-impact databases; and participation in scientific events. the relevance of the topics that made up the school's teaching work scheme; among others.
- Survey of school faculty members. This instrument asks faculty members about the main impacts of the university entrance preparation course. They are also asked about the aspects of the school that gave them the most satisfaction and those elements they believe should be included in future editions.
- Group interviews with graduates. The purpose of this instrument is to ascertain the impact of the school's actions related to the partial implementation of a diploma program, based on

interactions with the program's direct beneficiaries. Graduates are asked about their prospects for entering an academic training program as part of their doctoral studies; the status of their application to a doctoral program and the resources they have to apply; the suitability of the school's content to the participants' needs; and other related topics.

*d. Determination of the study group*

The study group is made up of a representative sample, stratified by area of knowledge, of students and teachers who participated in the school.

***Methodological proposal for the management of doctoral training with the research project as a fundamental scenario***

*a. Determination of the study variable*

The study variable is assumed to be: the impact of the methodological proposal for the management of doctoral training with the research project as a fundamental scenario, defined as the transformations achieved in the doctoral training developed by a doctoral program, from its stages and components, from the implementation of the methodological proposal.

*b. Determination of the dimensions, sub-dimensions and indicators of the study variable*

Based on the definition of the study variable, its dimensions, sub-dimensions and indicators are determined, in order to facilitate the evaluation process and the identification of the main impacts.

I. Academic dimension (components of doctoral training)

*I.1 From scientific research*

Indicators:

- Publication management (partnerships and support).
- Presentations at events (alliances and support).
- Organization into research groups and projects.
- Presence of guiding standards for doctoral training in projects.

- Forms of evaluation (workshops, seminars, others).
- Skills training within the project (seminars, scientific sessions).

*I.2 With theoretical and methodological training*

Indicators:

- Forms established by the program.
- Offers of options for granting mandatory and optional credits (achievable according to the diversity of doctoral students).
- Flexibility in activities and credits.
- Partnerships with examination boards for Social Problems of Science and Technology and Languages.

*I.3 For thesis writing, pre-defense and defense*

Indicators:

- Mechanisms for the systematic review of written documents and media.
- Presence of guiding standards for the writing of the thesis.
- Monitoring and corrections to theses between pre-defense and defense.

II. Procedural dimension (stages of doctoral training)

*II.1 Admission to a doctoral program*

Indicators:

- Exchange and familiarization with the program.
- Presentation by the applicant of the ideas to be investigated.
- Topic assignment, linking to a project, joining a group and assigning tutor(s).
- Applicant's admission to the doctoral program.

*II.2 Doctoral training*

Indicators:

- Development of the doctoral candidate's individual training plan.
- Presentation of the research design in the project and/or research group.
- Development of the activities conceived in the theoretical-methodological training.
- Development of the activities conceived in the research training.
- Development of the activities conceived in the preparation for the writing of the thesis, pre-defense and defense.
- Systematic evaluation of compliance with investigative actions.

*II.3 Postdoctoral training*

Indicators:

- Generalization of the scientific results obtained in the research process.
- Presentation of the fundamental result of the research and its generalization to awards from the Cuban Academy of Sciences and Technological Innovation.
- Dissemination of the results of the thesis implementation in high-impact journals and scientific events.
- Integration of doctoral program faculty, performing the roles corresponding to doctoral training, with emphasis on guiding doctoral students, as co-tutor and tutor.
- Project management, research groups and lines of research.
- Advising and directing processes and institutions in the area of knowledge of your doctorate.

*c. Determination of research methods for obtaining information*

- Survey of Doctoral Committee members and faculty. This survey aims to determine the current state of doctoral training management within the Doctoral Program. Among the questions posed in the survey are: the existence of an admissions procedure for the doctoral program; the frequency with which the call for applications to the doctoral program is issued, how it is disseminated, and what information it contains; whether the program facilitates exchange with applicants regarding their dissertation topics; who assigns the topic and

advisor and whether it is linked to a research project; who participates in the development of the individual doctoral training plan; what activities are outlined in the program regarding the components of theoretical-methodological training, scientific research, and dissertation writing, pre-defense, and defense; what specific actions must be taken in the research project; what essential difficulties the programs face in this regard; among other elements.

- Survey of doctoral students. This instrument contains questions regarding: how they learned about the call for applications to the doctoral program; whether they had any exchange with the program about their proposed topic; how they became involved in a research project and how the tutor was assigned; what requirements they needed to be accepted into the doctoral program; who participated in the development of the individual doctoral training plan; what specific actions they must carry out in the research project, what they suggest for the improvement of this process; among other aspects.

*d. Determination of the study group*

The study group is made up of a representative sample of doctoral students and professors from the university's doctoral programs, stratified by lines of research and research projects.

***Strategy for preparing the faculty of doctoral programs***

*a. Determination of the study variable*

The study begins with the determination of the variable of tutor preparation for doctoral training, conceived as a pedagogical process of a systemic and integrative nature of the instructional and educational activities, in which the tutors of the faculty of the doctoral training programs participate, in order to improve their professional performance.

*b. Determination of the dimensions and indicators of the study variable*

The process of operationalizing the study variable This allowed us to arrive at three dimensions with their respective indicators, as can be seen below:

I. Management dimension of the tutor preparation process in doctoral training

Indicators:

- Relevance of the content developed, in accordance with the needs of the participating tutors.
- The preparation activities used are tailored to the characteristics of the participating tutors.

II. Instructional-educational preparation dimension of the tutor in doctoral training

Indicators:

- Update on the normative documents that govern the doctoral training process in Cuba following the improvement.
- Updating content related to the science area of the doctoral training program to which the tutor belongs.

III. Dimension of professional performance of the tutor in doctoral training

Indicators:

- Improvements in the fulfillment of the tutor's functions (diagnosis, planning, guidance, support, communication and control).
- Increases in scientific production, participation in events, national and international academic and scientific networks.
- Levels of satisfaction achieved in the preparation received for the development of the tutoring work.

*c. Determination of research methods for obtaining information*

- Survey of tutors. The objective of this instrument is to ascertain the short-term impact of the strategy for preparing tutors in doctoral training, based on its partial implementation. Respondents are asked to rate the impact of the tutor preparation activities on doctoral training, using a scale of 0 to 5, where 0 represents the lowest value and 5 the highest. The evaluation criteria include: relevance of the content to the needs of the participating tutors; suitability of the training activities to the characteristics of the participating tutors; updates

on the regulatory documents governing the doctoral training process in Cuba following the program's improvement; updated content related to the tutor's area of study within their doctoral training program; improvements in the tutor's performance; increases in scientific output, participation in events, and academic and scientific networks; and levels of satisfaction with the training received for tutoring, among other aspects.

- Survey of doctoral students. Doctoral students are also included in the evaluation, as they can provide feedback on the preparation of their supervisors based on their participation in the activities designed as part of the strategy. Accordingly, the survey asks them about the main impacts the supervisor preparation strategy has had on doctoral training, as well as the most relevant aspects, both positive and negative, related to supervisor preparation activities in doctoral training, and aspects they believe could enrich the strategy for supervisor preparation in doctoral training.

*d. Determination of the study group*

The study group is made up of a representative sample of tutors from the university's doctoral programs, stratified by lines of research and research projects.

**Step 5:** Application of the instruments to collect the information.

The instruments defined in the previous phase are applied to the actors involved in the doctoral training process, in order to determine their current situation.

**Stage III.** Analysis of results – feedback.

**Objective:** to analyze the results obtained from the implementation of the impact assessment instruments.

**Step 6:** Analysis and processing of information.

Once the information derived from the application of the instruments has been collected, it is necessary to analyze it in order to obtain the trend of each of the impact assessment indicators.

At this stage, it is important to compare the final results with those initially planned for the purpose of improving the technologies.

**Step 7:** Preparation of the final report.

The purpose of preparing the final report is to provide stakeholders with a tangible product that summarizes the results of the impact assessment. The final report formally documents the assessment findings, enabling decision-makers to take action for continuous improvement.

That report must have the following general characteristics:

- Technical quality: it must be understandable, logically sequenced, and highlight the most important aspects.
- Current context: description of the political, legal and administrative framework that contains it.
- Actions that can modify the environment at different stages.
- Factors susceptible to impact.
- Improvement plan.

**Step 8:** Communication of results.

The report must be analyzed by the Vice-Rector's Office responsible for postgraduate studies at each university and by the Scientific Degrees Committee. Communication strategies will be implemented through official channels to share the results with all parties involved in the doctoral training management process.

**Step 9:** Feedback.

Feedback will lay the foundation for the development of improvement plans, based on the doctoral training management process at the university, so that each actor involved in this process acts in accordance with their continuous improvement.

## DISCUSSION

Research project management involves knowledge and application of different methodologies that guide the work to solve diverse needs with practical solutions to the problems raised, through a path to design clear and realistic objectives. with an internal logic that reflects causal relationships

between the different parts of the project, enabling monitoring and evaluation (Mejía & Aguilar, 2022).

According to García (2022), the impact of science and technology itself presents significant challenges and complexities. Multidimensionality and multicausality are variables to consider in any potential impact measurement. The proposed methodology demonstrates the analysis of several indicators and dimensions for each technology whose impact must be evaluated.

Impact assessment of a project is a fundamental process for measuring its effectiveness and determining whether it has achieved the desired results; as it allows for improved decision-making by providing objective and reliable information about the project in question. The most important change that has occurred is the greater awareness that addressing social impacts requires the active management of social aspects from the very beginning of a project, long before regulatory approval is required (Falcón, Escalante, Nordelo & Campal, 2018).

The social impact assessment is based on the proposal by Vanclay (2003), which was later accepted by the International Association for Impact Assessment (IAIA), which defines it as the process of analyzing (predicting, evaluating and reflecting) and managing the intended and unintended consequences on the human environment of planned interventions (programs, plans, projects) and any process of social change that is initiated by such activities with the aim of building a fairer and more sustainable human and biophysical environment.

The impact assessment methodology, structured in three stages and each containing: objective, steps, methods and techniques corresponds to the proposals made by Stable and Núñez (2021), Aledo and Aznar (2021), Ortiz and González (2021) and Martínez, Pino and Santacana (2022).

The study of the theoretical and methodological references on the evaluation of the social impact of technologies, resulting from the research project on doctoral training at a university, made it possible to establish the elements that served as the basis for the design of the methodology for the evaluation of the impact of the implementation of said technologies.

The methodology guarantees the achievement of essential characteristics such as: contextualization, understanding of its elements, active participation of those involved, and the use of tools and varied techniques that can provide desired information.

The proposed methodology, consisting of three stages: establishing the initial conditions for the evaluation, applying the evaluation, and analyzing the results, allows for evaluating the impact of implementing technologies associated with the doctoral training process at a university and outlining strategies for those aspects that are considered deficient, based on the set of indicators designed for this purpose, thus satisfying the objective of this study.

Without a doubt, among the evaluation methods, impact assessment is the most comprehensive, as it incorporates the other methods in its steps and evaluation stages: The diagnostic, formative, summative, transfer and final impact, which demonstrates the interdependence between these modalities and the logic that the impact assessment follows as it goes through the different evaluation moments, where each result will be closely related to the previous ones (Díaz & Marrero, 2021).

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**Conflict of interest**

Authors declare no conflict of interests.

**Authors' contribution**

The authors participated in the design and writing of the article, in the search and analysis of the information contained in the consulted bibliography.