

# Key Success Factors for Public Higher Education: Structural Analysis

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## Summary

Higher education (institutes, universities and other institutions) seeks, above all, to fulfill its three substantive functions: teaching, research, and linkage with society; the control bodies are always auditing their work. State budgets also depend a lot on compliance with standards at the country level, and on the quality of higher education centers. For this reason, it is of utmost importance to determine the most important key success factors, at the system level. The objective of this research is to analyze from the theoretical-empirical point of view the key success factors of public higher education in the province of Pichincha, through the structural analysis of one of its most representative universities: the University of the Armed Forces ESPE. This task will be achieved by analysing the conceptual framework of the prospective method known as structural analysis or MIC MAC. The results of the application of such a prospective tool will allow the design of strategies, as an input to the decision-making of the directors of the same, to improve its competitiveness, educational quality and social impact.

**Keywords:** Strategic foresight, structural analysis, MIC-MAC, Public higher education.

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## 1 Introduction

The University of the Armed Forces ESPE of Ecuador (UCE), recognized as one of the most prestigious institutions of higher education in Quito, has an important trajectory and a solid position in the national academic field. However, it faces a dynamic complex environment of high volatility, where multiple factors related to changing and breakdown organizational environments are reflected, especially in the post-pandemic era. The institution must update its interrelationships with students, faculty, administrative staff, local communities, government entities, and businesses. The challenge of continuous improvement, and search for better positioning, leads its planning departments to the search for new strategies and plans in the short and medium term; It increasingly highlights the importance of better international visibility and an improvement in its academic reputation.

In this context, it is essential to carry out a structural analysis of the University system – the object of study – in order to determine, through this prospective technique, the most important factors in its work, and

based on them propose strategies to achieve the goals determined in its planning. The results can serve as a basis for strategic decision-making aimed at promoting the sustainable development and institutional strengthening of the University of the Armed Forces ESPE

To address this challenge, the present study adopts the prospective structural analysis model (Mojica 2006); which organizes seeks to determine the variables of the systems, and their qualification (assessment through the interaction of them in influence and dependence). After running the software, a matrix of four quadrants will be obtained, with whose classification the variables to be searched can be grouped: as the most important variables or key variables. This research is part of the research project called "Stakeholders and actors as decision-makers in the higher education institutions of Pichincha; a multi-case analysis, and a proposal to optimize the planning systems in them." Therefore, for this purpose, field information has been collected for some months, as well as successful experiences of application of this and other models in other educational institutions.

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The article analyzes how the application of structural analysis (prospective) allows to better evidence the system studied through the use of panels of experts, and the use of prospective tools. To achieve this purpose, a mixed methodology will be implemented, combining documentary analysis, consultations with expert groups and the practical application of the MICMAC method (structural analysis). This will provide a compact vision of the internal and external dynamics that affect the university system and will allow concrete recommendations to be formulated to optimize the multi-year strategic planning of this higher education center. of their strategic relationships.

It is expected that the results obtained will serve as a relevant contribution to research in university management, promoting the development of a novel diagnostic and planning system, as well as support for the planning system and design of effective strategies, for the achievement of objectives and institutional sustainability.

### 2 Theoretical Framework

Gaston Berger, French philosopher and father of foresight, laid the conceptual foundations of the method between 1955 and 1960 and created the International Center for Foresight, promoting its expansion in Europe, especially in France. In Asia and Latin America it began to be applied in the 70s in countries such as Argentina, Brazil, Colombia, Cuba and Mexico. Its background comes from military studies in the US after World War II, later adopted in the social sciences. (Pérez, 2019).

Foresight constructs multiple futures of a phenomenon, analyzes its actions, likely scenarios, and influential actors. When combined with strategy, it is called strategic foresight. Its use in strategic processes is common, since it allows actions to be anticipated and alternatives to be proposed. (Pérez, 2019).

According to Cid and Warnecke (2016), the main purpose of foresight is to anticipate possible future scenarios in order to reduce uncertainty and support strategic decision-making. This discipline allows us to

illuminate the changes that could occur and evaluate the available alternatives for action. In this sense, foresight and strategy are closely linked: while the former offers a framework for understanding potential transformations, the latter is responsible for choosing, in the opinion of decision-makers, the most appropriate path to achieve the objectives set. For this reason, both approaches are integrated into what is called "strategic foresight".

Foresight is understood as an analysis that is carried out in the future, which seeks to identify what will be the impact that certain variables will have on a given phenomenon. Future analysis allows planning to be carried out as a strategy to achieve objectives and foresee possible problems. (Arango Morales & Cuevas Pérez)

To carry out prospective analysis, it is necessary not only to establish a question supported by a firm theoretical basis, but also to generate the correct question based on consensus and rationality; consensus can be based on conformism and contaminate what the majority establishes, which is not necessarily correct; We must also look for alternative questions that can lead us to possible answers. (Arango Morales & Cuevas Pérez,)

#### *MICMAC (Cross-Impact Matrix)*

What is MICMAC?

According to Bustamante Marquez, et al (2023) The MICMAC method stands out as one of the best-known tools in structural analysis. Its fundamental purpose is to determine the importance of the relationships, both direct and indirect, between the variables that make up a system. Through this technique, it is possible to identify variables that, although at first may seem uninfluential, actually have a more significant effect than others that appear to be more relevant.

Structural analysis is a structuring design tool, where a set of variables is collectively analyzed, reflected and interpreted, the same as described, with the help of a matrix that relates all the elements constituted in the study; This methodology helps to identify the influential and dependent variables and then make the appropriate decisions. (Quintana Córdova & Pérez Espinoza)

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It is important to note that the MicMac method "Matrix of cross-impacts and multiplication applied for a classification" is a tool designed by Godet (2000), whose main function is to facilitate the structuring of ideas. In general, it makes it possible to describe a system/model, based on the completion of a matrix; vertically oriented to the description of the degree of influence and horizontally to the description of the degree of dependence on each of the variables arranged for the effect. (Rafael Pérez & Hugo Vargas)

The MIC-MAC METHOD (Cross-Impact Matrix – Multiplication Applied to a Classification) aims to support structural analysis of a system: company, sector, institution, territory. (Niño Lievano et al)

The MIC-MAC Method makes it easier to find and identify the key variables of the problem studied, with the help of tables and graphs that allow the modeling of the problem to be addressed, based on a list of structural variables and a matrix that represents the direct influences between the variables. (Niño Lievano et al)

According to Perez (2019), the structural analysis known as MICMAC serves as a foundation for building future scenarios and studying the actors involved. Its purpose is to identify the most influential variables (motor) and those that depend on others, which are fundamental to understanding how the analyzed system could evolve. This method is developed in three phases: the preparation of a list of variables, the definition of the relationships between them and, finally, the identification of those that are key. For its application, the training includes three group sessions after the analysis of the problem, in which each of the stages of the process are addressed in detail.

### Features of the MIC MAC method

Structural analysis is a tool for structuring a collective reflection. It offers the possibility of describing a system with the help of a matrix that relates all its constituent elements (Bustamante Márquez et al)

Within the Structural Analysis technique using the MICMAC Method, the objectives are to describe a

system with the help of a matrix that connects the components of the

system, also seeks to identify the influential and dependent variables of the study, at the same time seeks to carry out a collective reflection of the study group and also reduces the complexity of the system to specific points. (Arango Morales & Cuevas Pérez)

- Description of the model: The participants to whom the structural matrix is applied are experts, actors who, based on their knowledge, analyze the impact that the different variables generate on each other. The analysis is carried out through three phases, in each phase an example will be given, which will be marked in a table in order to facilitate its understanding. (Arango Morales & Cuevas Pérez)

The structural analysis is carried out by a working group composed of actors and experts with proven experience, but this does not exclude the intervention of

"advisors" or external experts. For example, the work group formed within an organization can be reinforced with the collaboration of external experts, customers of the organization, suppliers of the organization. (Bustamante Márquez et al)

- Selection of experts: The efficient choice of participants is essential to favor structural analysis. To this end, a multidisciplinary group must be formed, thus avoiding the tendency of opinions. It is pertinent to establish that structural analysis is complex, since it requires human resources, that is, availability of experts. Godet and the experts mention that the period of analysis takes about three to six months, considering an acceptable pace for meetings with experts. It is recommended that no more than 12 people be included in the analysis of the relationship between variables. (Arango Morales & Cuevas Pérez)

### What is the MAC MIC for?

It applies a systemic approach, allowing the elements of the system to be broken down and the relationships between them to be analyzed. It seeks to be applied by a working group composed of actors and experts of the system under study. The factors of change that impact the system can be sociodemographic, environmental, macroeconomic, technological, political, legal and

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belonging to different scales. (Ministry of Economy et al)

Importance in foresight

The MIC-MAC Method is crucial in foresight because it allows planners to understand the complex dynamics of interrelated variables. This facilitates the creation of more accurate and realistic future scenarios, supporting strategic decision-making in uncertain environments, thanks to this capability, the MIC-MAC method allows to build more coherent, accurate and realistic future scenarios, as it helps to prioritize the key variables those that have the greatest influence and dependence to guide strategic decision-making. In this way, it becomes an essential tool for anticipating changes, assessing risks and opportunities, and designing adaptive strategies for possible futures. (Ministry of Economy).

### 3 Methodology

The methodology is mixed, including documentary analysis, work with panels of experts and the application of the MIC-MAC method. The review of the state of the art was done through high-impact articles in recent years. The application of the MIC-MAC method to the university under study was carried out, following the methodological recommendations that include some steps that are detailed below:

#### *Phases of the method*

According to Anrango Morales & Cuevas Perez (2014) In order to carry out a prospective analysis study, it is essential that the theoretical framework supports the variables included in the structural analysis matrix. The three stages that make up the research using the MICMAC method are presented below, along with an example corresponding to each of them.

According to Godet (2006), the different phases of the MIC MAC method are as follows:

Phase 1: List of system variables

Godet mentions that they should not exceed the number of 70-80 variables, since the application of the analysis through the structural matrix becomes tiresome, however, in the experience of the writer of this chapter, studies can be carried out with around 10 variables. It is advisable that, if the variables listed are more than 20 variables, the analysis matrix is applied in several sessions as appropriate, as it can cause confusion among experts. These variables must be validated by a group of experts who help verify the meaning of the variables, as well as the elimination of some of them, all through the consensus of the experts with the aim of eliminating risks. (Arango Morales & Cuevas Pérez)

Using foresight workshops or other methods, it is advisable to feed the list of variables through free conversations with people who are considered to be representatives of actors in the system studied, with experts or with external agents, and to prepare lists with the contributions of each of them. (Bustamante Márquez et al)

Phase 2: Description of relationships between the variables of the system

To carry out this phase, the variables are first listed in a box named "structural matrix of variables," using a short name for each of the variables due to the space used; Each of the variables must be at a junction with each remaining variable, as shown in Table 1. After the preparation of the table, it is completed, after identification of the experts and request to participate in the study; The filling of the matrix (table) is qualitative, and for each pair of variables the following question is asked: Is there a direct relationship of influence between variable i and variable j? If we do not write down 0, otherwise we ask ourselves whether this direct influence relationship is weak (1), medium (2), strong (3) or potential (P) (Godet, 11). (Arango Morales & Cuevas Pérez).

Once the final list of variables is available, several data must be supplied by the researcher to the program's software, such as the list of actors, list of variables, short name of the variables, in case it represents more than two words. (Arango Morales & Cuevas Pérez)

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Structural analysis is carried out by relating the variables in a double-entry board or direct impact matrix (MID). For each pair of variables, it is questioned, for example, whether there is a direct relationship of influence between variable *i* and *j*. If not, 0 is scored; otherwise, it is analyzed whether the relationship is weak (1), medium (2), strong (3) or potential (P) and if it does not influence the present, but does influence the future. (Pérez, 2019).

Phase 3: Identification of key variables

"In this phase, the key variable of the system is differentiated by means of a direct classification based on the motor skills-dependence established according to the relationships and then by an indirect classification called MICMAC" (LA Armijos, DJ Ortega, JA Simbaña, IS Santillán, 2019)

This phase consists of the identification of key variables, i.e. essential to the evolution of the system, firstly, by means of a direct classification (easy to do, by means of simple sums of motricity/influence and dependence values for each of the variables), and then by an indirect classification (called MICMAC' for matrices of cross-impacts Applied Multiplication for a Classification). This indirect classification is obtained after the elevation in power of the matrix. (Bustamante Márquez et al)

The results announced above in terms of influence and dependence of each variable can be represented on a plane (the axis of abscissas corresponds to the dependence and the axis of ordinates to the influence). Thus, another point of reference of the most influential variables of the system studied, gives interest to the different functions of the variables in the system, where a typology is presented in the next plane. (Bustamante Márquez et al)

- Input variables: Any transformation in these will have repercussions throughout the system. As they are the ones that have the greatest effects on the others, it is advisable to take into account whether there are instruments available to act on them, as they constitute a key field of action.
- Link Variables: They are both very influential and very dependent. This means that their changes produce strong impacts but

at the same time they are very receptive to changes in the other variables. Their strategic importance is evident, then, since the conflicts that have arisen between them develop.

- Outcome variables: They depend strongly on the influencing variables, and on the contrary, their effects on the other variables are minimal. In this group of variables, the result of the structure and functioning of the system is manifested.
- Excluded variables: Their effects, both received and driven, are of little relevance to the evolution of the system.
- Platoon variables: Corresponds to the moderately influential and moderately dependent variables. (Bustamante Márquez et al)
- How the Direct Relationship Matrix is completed

It allows us to evaluate the degree of influence that one variable exerts on another within a system. This matrix is filled in by means of an expert analysis, assigning values that indicate the intensity of the direct influence between pairs of variables. This evaluation is carried out through the construction of a Direct Impact Matrix, which is completed by an expert analysis, in which the participants assign values that represent the intensity of the direct influence between each pair of selected variables. This process is essential to understand the causal relationships that structure the analyzed system and, therefore, to identify which variables are strategic in the design of future scenarios. (Ministry of Economy).

The scale used is usually:

- 0 = zero direct influence
- 1 = weak direct influence
- 2 = moderate direct influence
- 3 = strong direct influence
- P = potential (future) influence

The last step will always be a reflection with the experts on the results when applying the method described here: It involves analyzing the results and the implications of its application in the specific context of the project, the organization. After having followed the previous steps and applied the model to the concrete reality, it is important to reflect on how

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the results reflect the institutional reality and what lessons can be drawn for future planning and projects.

### 4 Results and discussion

#### *Step 1: Inputs for structural analysis*

In this case, a SWOT of the organization is used:

**Table 1:** SWOT of the ESPE

<b>STRENGTHS</b>	<b>OPPORTUNITIES</b>
<ol style="list-style-type: none"><li>1. Accreditation and recognition in the national and regional context.</li><li>2. Quality assurance model that includes the participation of students and teachers.</li><li>3. Particular connotation due to its military nature (ethos).</li><li>4. Capacity for action in different geographical areas of influence in the national territory.</li><li>5. Respect for inclusion and equality, through the implementation of the institutional plan for equality and institutional values.</li><li>6. There is a consolidated research and linkage system.</li><li>7. The physical infrastructure is suitable for the development of its substantive functions.</li><li>8. The student retention rate is above the average of the system, which indicates that the monitoring of student performance is effective.</li></ol>	<ol style="list-style-type: none"><li>1. The State finances public higher education.</li><li>2. Information technologies have developed exponentially to the point that they allow the massification of education and teleworking.</li><li>3. Definition of important goals in the public policy of higher education that add value to the substantive functions of the University.</li><li>4. Dynamic environments that foster continuous academic innovation.</li><li>5. Technological development in the area of security and defence has been the basis for proposing solutions to problems in the civilian sphere.</li><li>6. The educational offer in security and defense in the country is limited.</li><li>7. Funds for investment in research at a global level privilege the</li></ol>

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<p>9. Extensive trajectory and experience in teaching practice.</p> <p>10. Various academic cooperation agreements with world-renowned universities.</p> <p>11. Laboratories that guarantee the development of academic activities.</p> <p>12. Research and postgraduate centre under construction that will facilitate the development of research activities.</p> <p>13. There is no political interference in institutional management.</p> <p>14. The university community strengthens an integrated safety culture that includes the environmental management component.</p> <p>15. Institutional strategic guide and defined management policies with a medium and long-term vision</p>	<p>participation of universities from developing countries.</p> <p>8. Opportunity for scholarships, exchanges and national and international academic events that promote the mobility of teachers, students and administrators.</p> <p>9. Increase in the entrepreneurial culture and regulations at the national level that include the participation of universities.</p> <p>10. Predisposition of alumni professionals to the continuous updating of knowledge.</p> <p>11. The industry is embracing new innovation models where research developed in academia is required.</p>
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<b>WEAKNESSES</b>	<b>THREATS</b>
<p>1. There are no internationally accredited careers or programs.</p> <p>2. Low positioning in the rankings worldwide.</p> <p>3. Decreasing academic mobility.</p> <p>4. Educational practice is not based on research.</p> <p>5. Scarce postgraduate and continuing education offerings, which respond to the needs of the Armed Forces and society.</p> <p>6. Deficiencies in the learning assessment process.</p> <p>7. Low job placement of graduates.</p> <p>8. The management of university welfare and follow-up of graduates is not consolidated.</p> <p>9. Production is not consolidated high-impact scientific research in the lines of research associated with the Security and Defense lines.</p> <p>10. The University's management is not based on data science and emerging information and communication technologies.</p>	<p>1. Investment policies in the country tend to free import prices, which harms the development of local industry.</p> <p>2. Lack of government policies focused on the internationalization of higher education institutions.</p> <p>3. Catastrophic events that put the normal operation of higher education at risk.</p> <p>4. Business sector with a low level of execution and financing of R+D+i activities.</p> <p>5. The number of applicants to higher education is increasing, while the physical and technological capacity of HEIs is not in line with this growth.</p> <p>6. The level of knowledge acquired in high school is insufficient to access higher education.</p> <p>7. Insufficient public financing for investment activities.</p> <p>8. Increased competition from private universities.</p> <p>9. Constant changes in the regulations</p>

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<p>11. Scarce self-management resources for the financing of the University (technology transfer, graduate programs, continuing education, services).</p> <p>12. The scientific production of the University is focused on a few professors and does not reach the expected levels of global impact.</p> <p>13. Lack of monitoring, control and improvement of institutional processes and academic management.</p> <p>14. Incipient technology transfer in the different academic domains of the University, especially Security and Defence.</p> <p>15. There is no development and innovation model articulated to the research system.</p> <p>16. Lack of an effective internal and external communication and socialization system.</p> <p>17. Lack of a state-of-the-art technological platform that supports the educational activities.</p>	<p>governing the higher education system.</p>
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**Source:** Strategic Plan for Institutional Development (PEDI) 2021–2025, University of the Armed Forces – ESPE, Res. ESPE-HCU-RES, p 29

It was also considered appropriate to present the University's competence tree:

**Table 2:** SWOT of the ESPE ESPE Competence Tree

Dimension	Historical Stage (Past)	Current Status (Present)	Strategic Projection (Future)
<b>Fundamentals (Roots)</b>	<p>-An institutional identity based on discipline was consolidated, patriotic commitment and an ethic of service. - The mission focuses on the rigorous training of professionals with a military-technical profile. - Principles were established institutional oriented to delivery to the country.</p>	<p>- Guiding principles are updated towards a Inclusive, ethical culture, and committed to excellence. - Institutional identity is affirmed from a solid civic-military. - Technical talent is trained with a social conscience and collective responsibility.</p>	<p>- An organizational culture is strengthened that It values equity, sustainability and innovation as axes of transformation. - The university projects a vision with global reach without losing your national essence.</p>

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<p><b>Structure (Trunk)</b></p>	<p>- They were developed physical facilities with a military and academic vocation. - Institutional management responded to a hierarchical model with a technical orientation. - The training offer was limited to traditional fields in engineering and defense.</p>	<p>- A results-oriented planning system is implemented (PEDI 2022–2025). - The Physical and digital infrastructure has reached remarkable levels of consolidation. - Achievements in teaching, knowledge production and active engagement with the environment are highlighted.</p>	<p>- The institution is transitioning towards a University 4.0 model, incorporating automation, AI and data analysis to your processes. - The learning environment is becomes a flexible, cooperative and global system. - Distributed, adaptable and visionary organizational leadership is promoted.</p>
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<p><b>Results and Public Value (Fruits)</b></p>	<ul style="list-style-type: none"> <li>- Technicians, officers and engineers graduated prepared to respond to the strategic needs of the country.</li> <li>- Operational support was provided to entities linked to national security and defense.</li> <li>- It contributed technically to works and initiatives of infrastructure of national interest.</li> </ul>	<ul style="list-style-type: none"> <li>- Professionals with solid training are trained technique and ethical principles.</li> <li>- Scientific research is strengthened with publications in indexed media.</li> <li>- Continuing education has more than 180 annual programs.</li> <li>- University projection services with social impact are expanded.</li> <li>- Solutions are developed in health, environment, education, and more.</li> </ul>	<ul style="list-style-type: none"> <li>- Graduates will access doubles International qualifications.</li> <li>- It is will consolidate the transfer technological towards key productive sectors.</li> <li>- Will be offered advanced technology surveillance and academic intelligence services.</li> <li>- They will be executed High-level consultancies on strategic for the country.</li> <li>- The generation of intellectual property with commercial impact will be promoted.</li> <li>- They will be exported training products such as MOOCs, virtual platforms and specialized content.</li> <li>- The university will lend Scientific Services strategic to the State in key areas such as defense, simulation and applied innovation.</li> </ul>
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**Note:** University of the Armed Forces – ESPE. (2021). Strategic Plan for Institutional Development (PEDI) 2021–2025. Adaptation: the authors

### *Determination of key variables*

Once the SWOT of the institution -object of study- and its tree of competencies were prepared, based on the experts of the Faculty of Sciences, it was possible to determine the list of variables, as an input for the MIC-MAC. They are presented below:

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VARIABLES, ESPE SYSTEM			
Long label	Short label	Description	Theme
LEVEL OF EMPLOYABILITY OF GRADUATES	EMPL GRAD	Rate of graduates who manage to enter the labor market in their area of training	Economical
STUDENT RETENTION RATE	IND STUDIO	Proportion of students who continue their studies at the university without dropping out during the evaluation period.	Social
INDEX OF INNOVATION IN TEACHING AND PEDAGOGICAL METHODS	INNO. TEACH	It evaluates the implementation of new teaching methodologies, such as project-based learning, the use of technologies and hybrid teaching.	Technological
LEVEL OF TEACHER TRAINING	FORM DOCEN	It determines the proportion of professors with advanced graduate degrees in relation to the total academic staff.	Institutional
NUMBER OF NEW AND REFORMED ACADEMIC PROGRAMS	PROG ACADE	Number of updated or new programs created to respond to the needs of the environment and advances in knowledge.	Academic
RESEARCH INVESTMENT INDEX	INVR INVES	Percentage of the institutional budget allocated to scientific research and technological development.	Institutional
SUSTAINABILITY INDEX OF POSTGRADUATE PROGRAMS	SUSTAINABLE	It measures the financial and academic viability of master's and doctoral programs over time.	Academic
AGREEMENTS WITH COMPANIES AND PRODUCTIVE SECTORS	AGREEMENTS	Number of agreements signed with private and public entities for professional practices, internships and knowledge transfer.	Economical
PARTICIPATION OF TEACHERS AND STUDENTS IN SOCIAL PROJECTS	PROY PARTY	It measures the level of involvement of the university community in social development initiatives.	Social
LEVEL OF BUREAUCRACY IN ADMINISTRATIVE PROCESSES	BUREAUCRACY	It evaluates the efficiency of internal processes in terms of time, number of procedures and digitalization of services.	Institutional
TECHNOLOGICAL INFRASTRUCTURE AVAILABLE FOR ACADEMIC MANAGEMENT	INFRA TECN	Quality and availability of technology platforms to support teaching, research, and academic administration.	Technological
AGREEMENTS WITH FOREIGN UNIVERSITIES	CONVE EXTR	Total academic and research agreements with international institutions.	Institutional
ACADEMIC MOBILITY OF STUDENTS AND TEACHERS	MOVI ACADE	Number of exchanges of teachers and students in international training and research programs.	Social

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LANGUAGE PROFICIENCY IN STUDENTS	LANGUAGES	Percentage of students with second language certifications that meet international standards.	Academic
NUMBER OF ENTREPRENEURSHIP INCUBATORS AT THE UNIVERSITY	INCUBA EMP	Number of spaces designed to promote startups and business projects among students and teachers.	Economical
INTERNATIONAL VISIBILITY AND ACCREDITATION	INTER VISION	Recognition and prestige of the university in the international arena, as well as obtaining quality accreditations from recognised bodies.	Institutional
LINK WITH SOCIETY	WINNING MEMBERS	Interaction between the university and society through social impact projects	Social
GRADUATE FOLLOW-UP	FOLLOW GRAD	Programs and systems implemented to track and support the professional and academic trajectory of university graduates.	Institutional
INNOVATION AND ADAPTATION OF THE ACADEMIC OFFER	INNOV OR AC	Ability of the university to update and adapt its curricula to the current needs of the labor market and scientific and technological advances.	Academic
INTERNAL COORDINATION	DON'T AGREE	Level of articulation and communication between the different areas of the university, ensuring that administrative and academic processes are aligned to optimize institutional management, decision-making, and efficiency in the fulfillment of strategic objectives.	Institutional
PUBLIC POLICIES	POLIT PUBL	Normative framework and regulations established by the State that govern the operation of universities, including laws, decrees, regulations and guidelines that guide their development, financing, evaluation and compliance with quality standards.	Political
STATE FUNDING	EAST FINANCE	Economic resources provided by the government to public universities in each fiscal period, intended to cover operating expenses, infrastructure, research, teaching, and institutional development programs.	Economical
STANDARDIZATION OF INDICATORS	IND STATE	Definition and application of homogeneous criteria to evaluate the performance of higher education institutions, guaranteeing comparability, transparency and compliance with minimum quality standards in	Institutional

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		areas such as teaching, research, linkage and institutional management.	
WORK OVERLOAD OF TEACHERS	ON LABO	Excessive responsibilities assigned to teachers, including activities outside of classroom teaching, such as research, thesis advisory, participation in institutional projects, administrative activities, and engagement with society, which can affect their well-being and performance.	Academic
LANGUAGE OFFER	IDIO OFFERS	Availability of multi-language teaching programs within the university, allowing students to access training in foreign languages such as English, French, German, Chinese, among others, in order to improve their academic and professional competitiveness.	Academic
EFFICIENCY OF ADMINISTRATIVE MANAGEMENT	EFI GEST ADM	Degree of compliance and improvement of institutional processes based on strategic goals.	Economical
SMART SOLUTIONS I+D+i	SMART IDI	A number of smart solutions developed under the focus of research, development and innovation.	Academic
UNIVERSITY WELFARE	UNIV ASSETS	Availability and quality of services that promote health, comfort, coexistence and development of staff and students.	Academic
INTERNAL AND EXTERNAL USER SATISFACTION	SATIS USUA	Index of perception of quality of services by students, teachers and society.	Academic
DIGITIZATION OF INFORMATION	DIGI INFO	Percentage of institutional information formalized and digitally safeguarded according to regulations.	Academic
TECHNOLOGICAL MODERNIZATION	TECHNO MODER	Proportion of equipment and technological infrastructure updated in relation to current standards.	Technological
UNIVERSITY INTEGRATED SECURITY	INTEG INSURANCE	Degree of implementation of physical, digital, occupational and environmental security systems.	Academic
INNOVATION CLUSTER MANAGEMENT	CLUSTER INNO	Level of articulation and maturity of the research, incubation and technology transfer ecosystem.	Academic
ENTREPRENEURSHIP DEVELOPMENT	EMPREND DEV	Number of startups or innovative ideas incubated by the university with technical-academic support.	Academic

**Note:** Workshops with experts, SWOT, and competency tree

# Key Success Factors for Public Higher Education: Structural Analysis

## Qualification of the variables

In order to analyze and explain the ratings of the variables in the Direct Influences Matrix (MDI) presented, it is important to correctly interpret the values that represent the direct influence of one variable on another. These values are assigned according to a specific scale that defines the intensity of that influence.

- 0: No influence
- 1: Weak Influence
- 2: Moderate influence
- 3: Strong Influence
- Q: Potential Influence

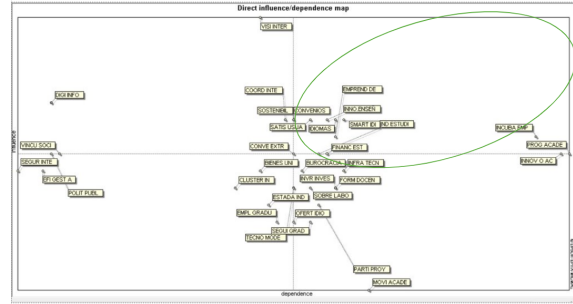
**Figure 1: Variable Rating**

**Note: Variable Rating**

After assigning the grades according to the selected criteria and justifying each decision based on the variables considered, a data matrix generated by the Mic Mac was obtained. When you finish the list of variables, the program organizes the list of variables.

Foresight does not aim to eliminate uncertainty, but to minimise it in order to facilitate better decision-making and to guide the future towards the desired objectives. Structural analysis seeks to identify the variables with the greatest influence and their impact on the others. Special attention will be given to the key variables, as they determine the most influential factors in terms of dependence and impact, without neglecting the relevance of the other variables in the fulfilment of their function within the system.

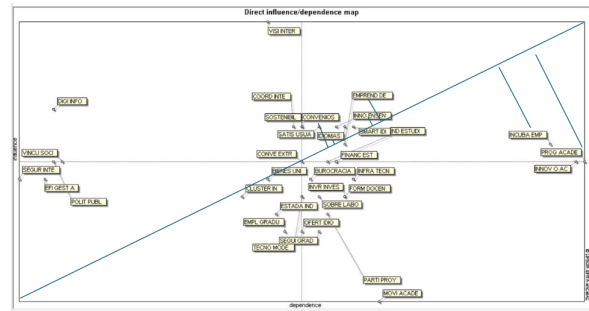
**Figure 2 : Direct influence / Dependency map**



**Note: Direct Influence / Dependency Map**

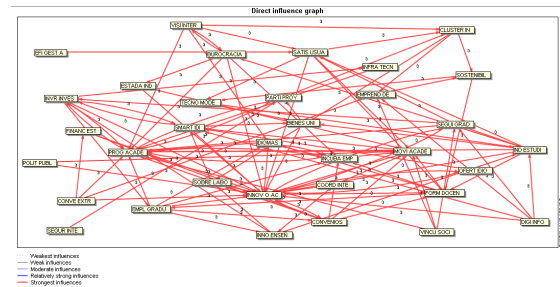
In the figure we can see with the help of a bisector the variables formed according to the result provided by the MICMAC analysis software. The following section of results describes in detail the reflection of the analysis in the research study, according to the categories defined by the MICMAC method and its assumptions. Next, the characteristics and position of the variables in the plane of direct influence and dependence will be explained, as well as the identification of each variable that places the system in the plane.

**Figure 3: Indirect influence/dependence**



**Note: Direct Influence Elaboration: The authors**

**Figure 4: Direct influence**



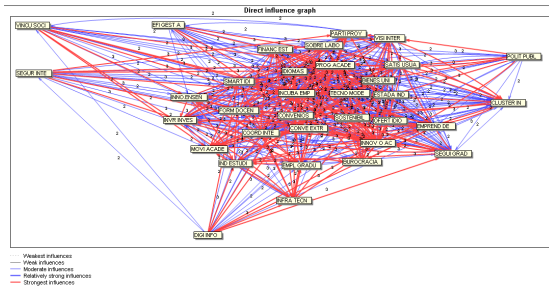
**Note: Direct influence 10% Elaboration: The authors**

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The direct influence graph shows key relationships between the variables of the system, highlighting those with the greatest impact. Nodes such as "Innov o Ac" (INNOVATION AND ADAPTATION OF THE ACADEMIC OFFER), "Incuba Emp" (NUMBER OF ENTREPRENEURSHIP INCUBATORS IN THE UNIVERSITY), "Prog Acade" (NUMBER OF NEW AND REFORMED ACADEMIC PROGRAMS), "Languages" (LANGUAGE PROFICIENCY IN STUDENTS), "Smart IDI" (SMART SOLUTIONS I+D+i) and "Agreements" (AGREEMENTS WITH COMPANIES AND PRODUCTIVE SECTORS) appear as central elements with multiple connections, indicating its strategic importance. The arrows reflect the direction of the influence, while the numbers (such as "3") represent a greater intensity in the relationship.

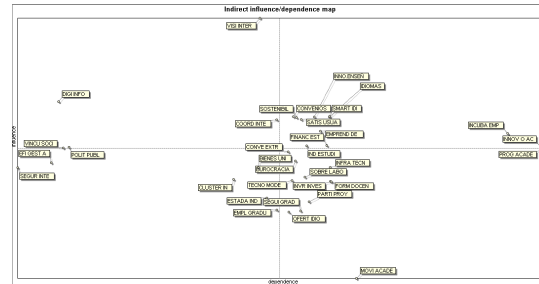
It is observed that variables such as "MOVI ACADE" (ACADEMIC MOBILITY OF STUDENTS AND TEACHERS), "IND ESTUDI" (STUDENT PERMANENCE INDEX) and "FINANC EST" (STATE FUNDING) also concentrate various interactions, evidencing their relevance within the system.

**Figure 5: Graph of direct influences**



The 50% direct influence graph shows a denser network of interactions between the key variables, differentiated by colors that represent the intensity of the influences: red for the strongest and blue for the weakest. Nodes such as "Digi Info" (DIGITIZATION OF INFORMATION) and "Efi Gest" (EFFICIENCY OF ADMINISTRATIVE MANAGEMENT) are loosely connected, suggesting that there is no influence. The arrows reflect the direction of these relationships, while the numbers (1-3) quantify their weight. This 50% level highlights both critical and weaker influences within the system analysis.

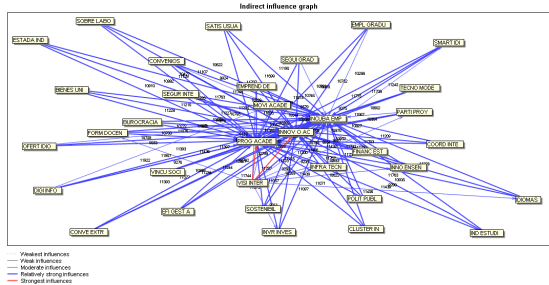
**Fiura 6: Indirect influence MAP**



The map of indirect influences in the MICMAC method shows how the variables of the system affect each other in a non-direct way, that is, through other intermediate variables. The map of indirect influences of the MICMAC allows us to identify how the variables of the system are related to each other in a non-direct way, revealing their strategic weight in the transformation of the environment. In this analysis, those located in the upper left quadrant (such as Digitization of information, Public policies and Efficiency in administrative management) stand out as determining variables, since they have a high capacity to influence others without depending much on the system, becoming true levers of change. On the other hand, in the upper right quadrant, critical or unstable variables are grouped, such as Innovation of the academic offer, Academic Programs and Business Incubation, which combine high influence and high dependence, which makes them very sensitive and strategic but complex to intervene. The variables located in the lower right, such as Academic mobility or Graduate follow-up, are mainly dependent, that is, they reflect the effects of decisions made in other areas. Finally, those in the lower left quadrant have low influence and dependence, being autonomous or peripheral, with less impact on the global system. In the center of the graph are balancing variables, such as Sustainability or Student Financing, which moderate the dynamics of the system and allow for a more stable and controlled intervention. This map, as a whole, helps to prioritize strategic actions from a systemic and indirect perspective.

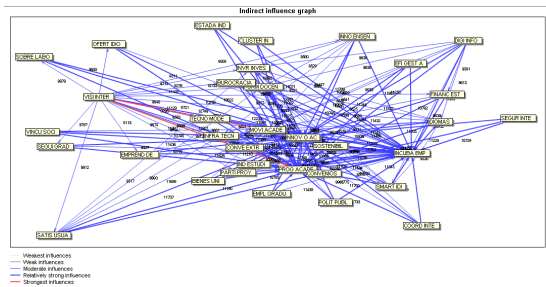
**Figure 7: Indirect influence**

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In the image it can be seen that the VISI INTER variable is the central node with multiple connections, reflecting its key role in the network of influences. A strong relationship is observed with PROG ACADE and INNOV O AC, which indicates the importance of innovation and adaptation to new changes in the environment to obtain greater foreign recognition.

Figure 8: Graph of direct influences



Source: Indirect influence 15%  
Elaboration: The authors

The same consideration is taken as with an indirect influence of 10% where the variables of VISI INTER, INNOV OR AC and PROG ACADE are the central variables and the strong relationship that they maintain.

Figure 9: Classification of variables according to their influences

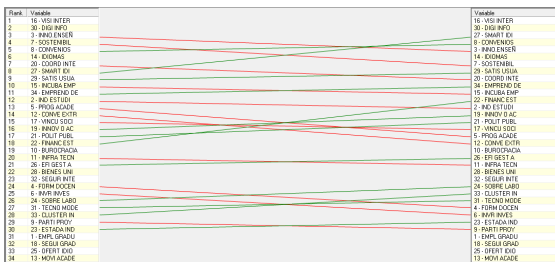
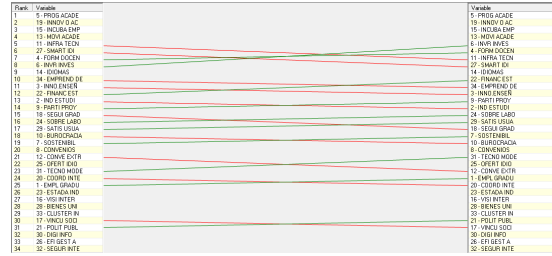


Figure 10: Classification of variables according to their dependencies



Once all the variables have been distributed and identified in the different graphs and figures, the next step is to determine the strategic axis. According to Martínez, this axis is made up of those variables that have a high level of motor skills, which means that they have a great capacity to influence the system, and, at the same time, present a level of dependence that makes them susceptible to being impacted by other variables.

## STRATEGIES FOR KEY VARIABLES INNOVATION AND ADAPTATION OF THE ACADEMIC OFFER

Implement a continuous system of prospective analysis of the work and technological environment, which allows for the rapid adaptation of the contents, modalities and profiles of graduates of university careers, incorporating digital skills, sustainability and interdisciplinary approaches.

Include the voice of graduates and employers in academic redesign processes

## NUMBER OF NEW AND REFORMED ACADEMIC PROGRAMS

Establish an institutional policy of curricular redesign by cycles, aligned with the needs of the productive and social environment, which promotes the creation of flexible, modular and updated academic programs.

Identify emerging areas (artificial intelligence, renewable energy, circular economy, etc.) as a basis for new programs.

Digitize the curriculum design process to speed up approval and accreditation times.

## AGREEMENTS WITH COMPANIES AND PRODUCTIVE SECTORS

Design a comprehensive strategy for linking university-business-public sector, which transforms agreements into active and collaborative alliances focused on pre-professional practices, technology transfer and co-creation of knowledge.

Create a Strategic Alliances Portal that centralizes the management, monitoring and

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evaluation of agreements.

Promote real classroom projects with the participation of external actors as a learning method and link

### NUMBER OF ENTREPRENEURSHIP INCUBATORS AT THE UNIVERSITY

Strengthen the university entrepreneurial ecosystem through the creation and articulation of specialized incubators, with a focus on social, technological and sustainable innovation, which accompany students from idea to acceleration.

Promote a University Network of Incubators connected to each other and to external networks (guilds, banks, startups).

Incorporate mandatory entrepreneurship modules in all academic programs.

Develop institutional seed funds and coworking spaces for incubated projects.

### Conclusions

The MICMAC method is an effective tool to visually represent the relationships of influence and dependence between variables, which facilitates the identification of strategic elements and improves decision-making in complex environments.

Prospective structural analysis helps to reduce uncertainty in strategic planning, allowing future scenarios to be anticipated based on the systemic interaction of key variables.

MICMAC allows for detailed classification of variables such as motor, resultant, autonomous, or link, providing an orderly framework for prioritizing actions based on their expected impact. The participation of experts in the construction of the matrix and the use of visual tools improves the collective understanding of the system, promoting more informed and consensual decisions within an organization.

The MICMAC analysis applied at the ESPE made it possible to identify key variables such as the innovation of the academic offer, the number of reformed programs and the agreements with the productive sector, which have high influence and dependence, becoming strategic levers for institutional improvement.

Variables such as academic mobility, international positioning and technological infrastructure were highly dependent on the rest of the system, which

indicates that their strengthening must be accompanied by improvements in other influential variables to achieve significant impacts.

### Recommendations

Institutionalize the use of MICMAC analysis in medium- and long-term strategic planning processes, ensuring that key variables are periodically reassessed based on changes in the internal and external environment.

Incorporate teachers, students, and administrative staff in participatory workshops to build and validate the strategic variables, which will increase the relevance and acceptance of the decisions derived from the analysis.

Align the institutional strategies of the ESPE with the identified driving variables, such as educational innovation, agreements with the productive sector and the creation of entrepreneurship incubators.

Cross-reference the MICMAC analysis with other instruments such as the SWOT and the Competency Tree, to obtain a more comprehensive view of the system and thus enhance strategic decision-making.

Improve the management of institutional data and indicators, so that the collection, systematization and digitization of information continuously feed the prospective analysis.

To take advantage of the indirect relationships detected by MICMAC to identify hidden or underestimated strategic variables, which can open new opportunities for systemic intervention in critical areas of the university.

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