

PROSPECTIVE STUDY OF HIGHER EDUCATION IN MEDELLÍN

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ABSTRACT: Higher education in Medellín operates within a complex environment characterized by a strong academic track record, technological capabilities, and rapid socioeconomic transformations. The study aims to analyze structural change dynamics and power relations among local stakeholders, and to project scenarios for the year 2035 to inform strategic decision-making within the local education system. Regarding methodology, a mixed-methods foresight approach was applied across three phases: i) strategic monitoring to identify ten drivers of change; ii) structural analysis using the cross-impact matrix (MICMAC) and actor-game analysis (MACTOR); and iii) construction of future scenarios based on Peter Schwartz's uncertainty axes and Michel Godet's toolkit. Results from the MICMAC analysis positioned factors such as Digital Transformation (Transdigi), Institutional Innovation (InnoInsnMo), Quality and Relevance (ForCalPert), and University-Industry-Government Articulation (ArtiEdSIInn) within the "key zone." Four plausible scenarios were identified, prioritizing the "Smart and Inclusive Higher Education" scenario, which integrates emerging technologies with an equitable innovation ecosystem. In conclusion, the system's transformation depends not solely on technological adoption, but on consolidating long-term collaborative governance that transcends the discontinuities of administrative cycles.

Keywords: higher education, territorial foresight, change management, territorial analysis, innovation, digital transformation.

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INTRODUCTION

Territorial foresight is based on the understanding that territories are dynamic, open systems that are affected by global, national, and local changes. In this regard, structural analysis helps us understand the forces of change driving the development of higher education and determine the appropriate nature of long-term strategic decisions made by territorial actors.

These elements constitute the territorial assets on which future scenarios for the development of higher education can be projected. This section also outlines the main territorial and strategic assets that make Medellín an area with the potential to establish a new, relevant, and regionalized higher education system.

It is not only a matter of analyzing changing conditions, but also of emerging trends that will transform how higher education institutions develop their capacities for teaching, research, outreach, and innovation. Once the regional capacities and dynamics of change in higher education in Medellín have been identified, the next step should be to determine which future strategic variables to focus on in order to identify the actors that may influence or limit these transformations.

Using the territorial foresight methodology, this approach allows us to focus on the factors that will have the greatest impact on the development of the target scenario, avoiding future resource fragmentation and fostering collective action among the entities that will have the greatest impact on the higher education system.

The stakeholder analysis, conducted using MACTOR, helped identify relationships of power, cooperation, and conflict among the institutions and organizations involved in developing the education system. Integrating these two analyses helps us determine which areas to prioritize for intervention and who has the power to lead them.

Regarding scenario building, Godet and Durance (2007) state that the scenario method can help construct scenarios of different possible futures and the paths that may lead to them to identify trends and potential disruptions that could affect the environment.

From the perspective of higher education, the Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura [UNESCO], in its report **Reimagining Our Futures*

Together*, argues that education must be a public good and a key means for transforming society and addressing global economic, social, and environmental crises. Currently, the way we organize education worldwide is not sufficient to ensure just and peaceful societies, a healthy planet, and shared progress that benefits everyone.

Some of our challenges stem from the way we deliver education. A new social contract for education must help us think differently about learning and the relationships among students, teachers, knowledge, and the world (UNESCO, 2022).

However, at the national level, various studies on foresight in higher education use different approaches, such as future scenarios, trends and challenges, foresight planning, and Education 4.0 in Colombia.

Espinal et al. (2020) propose a foresight model to help higher education institutions transition from the current state of uncertainty toward a world-class model—one in which the future is not merely predicted but actively shaped, with change occurring simultaneously.

In contrast, Moreno Cely and Gutiérrez Rodríguez (2020) analyze foresight in higher education at private institutions. They identify several factors that may or may not affect higher education in the country, since incorporating information technologies implies a complete overhaul of the educational models currently in use.

In the case of higher education in Medellín, the scenarios are based on strategic aspects of the education system, such as digital transformation, institutional innovation, the quality and relevance of education, the integration of higher education with innovation, education governance, the democratization of access, regionalization, the development of 21st-century skills, and sustainable development. In addition, the capacity of local stakeholders to collaborate in predicting the future of the education system in 2035.

Historically, the city of Medellín has followed a paradigm centered on traditional vocational training, in which institutions primarily prepared the workforce to meet labor market needs and support economic growth. Under this logic, universities' success was measured mainly by enrollment rates, the number of graduates, physical infrastructure, and the range of academic programs offered. While this model helped build significant institutional capacity

and expand access to higher education, it now has limitations in the face of challenges from the knowledge economy, digital transformation, and new social demands.

Although Medellín has regulatory instruments and institutional development plans, regulatory-based territorial planning is insufficient to manage highly uncertain scenarios. This limitation creates a gap in knowledge and practical intervention: a lack of comprehensive, forward-looking analysis that connects the variables of technological change with the power structure of territorial actors, preventing public policies from being subject to the discontinuity of four-year government terms.

Therefore, the overall objective of this prospective study is to analyze structural factors of change, map power and cooperation relationships among territorial actors, and construct prospective scenarios for 2035 that will serve as a basis for formulating strategic guidelines for higher education in Medellín.

DEVELOPMENT

Historical Context and Evolution of Higher Education

Higher education in Antioquia began in the 19th century with institutions such as the Colegio de Antioquia and, later, the University of Antioquia, the first to offer professional training in the region. During this period, the university focused primarily on law, medicine, and theology, was strongly influenced by the Church, and was inaccessible to the social elites.

Throughout the 20th century, the higher education system flourished, especially between 1900 and 1990. The establishment of the Medellín campus of the National University of Colombia and the consolidation of private institutions such as the Pontifical Bolivarian University, the University of Medellín, and EAFIT University helped develop human capital for Antioquia's industrial and economic growth.

At the same time, the Antioquia Institute of Technology and other technological institutions promoted regional educational initiatives that fostered vocational training across the department. Ley 30 de 1992 reorganized the Colombian higher education system around university autonomy, quality, and relevance, and Ley 60 de 1993 strengthened the education

funding mechanism. At the same time, the National Accreditation Council (CNA) was established to ensure quality as a pillar of the system.

Between 2005 and 2015, higher education introduced new types of programs, such as online and distance learning, while institutions such as the Jaime Isaza Cadavid Colombian Polytechnic and the National Open and Distance University have expanded access to higher education throughout the country and have consolidated regionalization efforts to offer programs in subregions such as Urabá, Bajo Cauca, and northeastern Antioquia.

Then, from 2015 to 2020, the National Ministry of Education promoted policies on innovation, relevance, and the integration of education, research, and territorial development. As a result, the period strengthened active learning methods, curricular innovation processes, and strategies to address the country's social and economic needs.

The COVID-19 pandemic caused a structural disruption in the education system. Online learning shifted from a supplementary modality to a fundamental part of teaching and learning between 2020 and 2023. The digital transformation of higher education institutions intensified, driving extensive use of technological platforms and revealing deep access gaps in connectivity and digital skills.

From 2023 to the present, higher education has been shifting toward hybrid models that combine in-person and online learning technologies, data analysis tools, artificial intelligence, and student-centered approaches. At the same time, the territorial approach is being strengthened as a criterion for formulating educational policies, but challenges related to equity, access, and quality persist in various social contexts.

In this vein, this prospective study focuses on the city of Medellín, the epicenter of the department of Antioquia and Colombia's second-largest urban center. The city of Medellín has undergone continuous transformations since the 19th century and serves as a national and international benchmark for innovation, urban development, and education because it is the heart of a robust higher education system comprising public and private universities, as well as university and technological institutions such as the University of Antioquia, the Medellín campus of the National University of Colombia, EAFIT University, the University of

Medellín, the Metropolitan Technological Institute (ITM), the Colegio Mayor de Antioquia, Pascual Bravo, and the Technological Institute of Antioquia.

Medellín is a particularly strategic area from a long-term perspective because higher education is undergoing a transformation driven by rapid technological evolution, artificial intelligence, demographic change, and the growing demand of an ever-expanding labor market, as well as by research, innovation, and regional development. For this reason, the city is an ideal place to assess the factors that will shape the future of education in the 21st century.

Analysis of Territorial Assets

The historical evolution described above has enabled Medellín to accumulate significant territorial assets that now translate into competitive advantages for the future development of higher education. These physical, institutional, social, economic, and symbolic capacities have developed over time and are fundamental to shaping future scenarios.

The city boasts an excellent educational infrastructure, including universities, technical institutions, research centers, specialized libraries, scientific laboratories, and innovation hubs that also promote knowledge generation and transfer. This physical asset is complemented by an increasingly advanced technological infrastructure, driven by the rapid digital transformation of recent years.

From an institutional perspective, Medellín has extensive experience in designing public policies to promote higher education. The Medellín Mayor's Office, Sapiencia, higher education institutions, the business sector, and all public and private organizations have established programs focused on access, retention, student financing, research, and innovation to improve the local education system.

Another strategic asset is the highly qualified human capital that the city has developed over the past decades. The presence of faculty, researchers, scientists, entrepreneurs, and specialized professionals has created an academic community with strong capacity to lead research, innovation, and technological development.

Medellín has also established a well-known innovation ecosystem, characterized by constant interaction between universities, businesses, the government, and society. This cooperation has boosted applied research, technology transfer, science- and creativity-based entrepreneurship, and the generation of solutions geared toward the region's economic and social development.

The city has evolved from an economy based on economic knowledge to one based on knowledge itself, and sectors such as technology, innovation, the digital economy, and the creative industry require highly skilled individuals. This development makes higher education relevant to society as a whole and is very useful for continuously updating the academic curriculum.

Medellín has established a symbolic capital of innovation, resilience, and urban transformation. National and international recognition of its innovation processes strengthens the city's reputation as a hub of knowledge, science, and education, and positions it as a vehicle for sustainable development.

Finally, international organizations and entities have endorsed this positioning, notably the 2013 Most Innovative City Award, which The Wall Street Journal, Citigroup, and the Urban Land Institute (Riggs et al., 2013) awarded to Medellín, ahead of New York and Tel Aviv. Subsequently, Netexplo, an organization sponsored by UNESCO, recognized the city as a Smart City, and the Australian firm 2ThinkNow named it a Global Innovation Hub.

These achievements reflect a long-term transformation strategy based on innovation, education, entrepreneurship, and collaboration among universities, businesses, and the government, building an ecosystem of science, technology, and innovation that offers a competitive advantage in higher education development.

Strategic Diagnosis: Regional Potential

The most important potential lies in establishing an innovation ecosystem—through a partnership among universities, businesses, the government, and society—to promote applied research, technology transfer, and entrepreneurship. This capacity represents a competitive

advantage for responding to changes in the knowledge economy and further enhancing regional development.

The institutional experience in public policy established within the education system also provides a solid foundation for addressing the challenges of digital transformation, artificial intelligence, internationalization, and new forms of learning. Organizations such as Sapiencia and mechanisms for inter-institutional cooperation enable us to develop long-term approaches for the education system.

The technological and scientific infrastructure is in place to expand research into new areas, develop interdisciplinary educational programs, and utilize advanced technologies in training. Likewise, a culture of innovation and continuous learning enables institutions to adapt to uncertainty and rapid change.

Finally, Medellín's geographic location, international recognition for innovation, and extensive network of academic partnerships offer opportunities to link internationalization with research and make the city a Latin American leader in higher education, science, technology, and innovation.

Thus, Medellín has a strategic foundation for establishing a higher education system that is more innovative, relevant, inclusive, and committed to the region, with an eye toward the country's future. This regional analysis will form the basis for the trends, drivers of change, and scenario-building discussed in the following chapters.

METHODOLOGY

From a territorial foresight perspective, territories should be viewed as complex systems in which economic, social, political, technological, and environmental factors interact to shape and transform them (Instituto Geográfico Agustín Codazzi, 2022). Thus, territorial foresight recognizes territories as dynamic, open systems subject to global, national, and local change. Consequently, environmental analysis helps understand the forces of change that shape higher education and will influence the policy decisions of territorial actors in both the short and long term.

In Medellín, higher education is undergoing rapid technological change, the globalization of knowledge, the shift toward innovation-based economies, sustainability needs, and new pressures from the labor market. These factors can boost the region’s competitiveness, but institutions need the capacity to anticipate change and adapt the education system to future needs.

The study adopted a methodological design structured in three consecutive phases to ensure the replicability of the prospective analysis.

Table 1

Methodological Design

Methodological Design				
Phase 1: Strategic Monitoring		Phase 2: Structural Analysis		Phase 3: Scenario Development
- Literature review and expert consultation - Identification of 10 drivers of change		MICMAC Matrix (Influence vs. Dependence)		- Schwartz's Pillars - Selection of the target scenario. - Strategic guidelines.
		MACTOR Matrix (Actors and Power)		

From this perspective, a strategic monitoring exercise identifies the main environmental trends and characterizes the factors of change shaping the future of higher education in Medellín.

Trend Analysis - Strategic Monitoring

A systematic review of academic literature and sectoral plans identified past trends, disruptions, and future-shaping developments in higher education.

Higher education today is undergoing a fundamental transformation driven by digitization, artificial intelligence, automation, and hybrid and virtual learning models worldwide. Universities are becoming digital ecosystems in which technology platforms, data analytics, open educational resources, and artificial intelligence tools foster personalization, enabling students to understand how things work and access knowledge.

Another important trend is the consolidation of lifelong learning, given the rapid obsolescence of knowledge and the need to constantly update professional skills. Consequently, institutions of higher education are expanding their offerings through flexible programs, microcredentials, specialized certifications, and continuing education for students and professionals in both traditional and vocational fields.

Internationalization is also taking on new dimensions through global research networks, academic mobility, scientific collaboration, and joint programs between universities in different countries. This is making the world more open to knowledge exchange and the development of solutions to global problems.

Finally, the 2030 Agenda and the Sustainable Development Goals (SDGs) establish sustainability as a cross-cutting theme in higher education and encourage institutions committed to inclusion, equity, social innovation, and environmental protection (Naciones Unidas, 2015).

Higher education in Colombia is undergoing transformative processes to expand access and improve the quality and relevance of education to national development. The growing integration of higher education, science, technology, and innovation is another trend aimed at strengthening the country's competitiveness through the transfer of applied knowledge and the development of research capacity.

Higher education is gradually being integrated into Medellín's urban model for innovation, knowledge, and technological development. This is because the District of Science,

Technology, and Innovation strengthens coordination among universities, businesses, the government, and citizens to promote research, innovation, and entrepreneurship (Ruta N Medellín, 2023). This coordination facilitates the transfer of knowledge from academic research to the productive sector, supports applied research, and strengthens regional competitiveness and sustainable development.

Finally, expanding strategies for educational regionalization, online education, and social inclusion helps broaden access to higher education across municipalities and districts, reducing regional inequalities.

Characterization of Drivers of Change

Based on strategic monitoring and structural analysis, ten drivers of change were identified as key determinants of the future of higher education in Medellín. These factors hold the greatest potential to transform our education system in the coming years.

Table 2

Drivers of Change

DRIVERS OF CHANGE	SHORT NAME	DESCRIPTION
1. Digital transformation of higher education	Transdigi	The growing incorporation of digital technologies, artificial intelligence, data analytics, and virtual and hybrid modalities that are transforming teaching, learning, and research processes.
2. Democratization of access to and retention in higher education	Democra	Expand strategies to reduce economic and geographical barriers, ensuring greater opportunities for admission, retention, and graduation for vulnerable populations.
3. Linkages between higher education, innovation, and regional development	ArtiEdSInn	Strengthening the university-business-government partnership to promote competitiveness, applied research, and the region's economic and social development.
4. Strengthening the Quality and Relevance of Education	ForCalPert	Adapting academic programs to the needs of the labor market, social demands, and contemporary scientific and technological challenges.

5. Internationalization and Global Academic Cooperation	InterCoop	Integration of higher education institutions into international networks of knowledge, research, and innovation.
6. Regionalization and Territorial Equity	RegEquiTE	Develop strategies to expand coverage and ensure educational opportunities across regions and among diverse populations.
7. Institutional Innovation and New Learning Models	InnoInsMo	Transform curricula, teaching methods, and organizational models to respond to rapid change and lifelong learning.
8. Strengthening Governance and Educational Foresight	ForGobPros	Incorporate strategic planning, foresight, and public policy formulation processes to anticipate future changes in the education system.
9. Developing 21st-Century Skills	DIICompXX I	The need to train professionals in digital skills, critical thinking, innovation, interdisciplinary approaches, and adaptability.
10. Higher Education's Contribution to Sustainable Development	ContESDSO S	Greater institutional commitment to the Sustainable Development Goals (SDGs), environmental sustainability, and university social responsibility.

Note. Created by the author.

Integrative Analysis of Factors of Change—Structural Analysis

The structural analysis shows that these factors do not operate independently but rather form a highly interrelated system. Digital transformation, institutional innovation, the quality and relevance of education, the link between higher education and innovation, and educational governance are all important factors throughout the rest of the system; therefore, they are strategic variables for developing future scenarios.

In contrast, internationalization, regionalization, sustainable development, and the development of 21st-century skills are expected outcomes of strengthening the driving forces and reflect the effects that proper management of the education system can have on territorial development.

This interaction confirms that the future of higher education in Medellín will depend on stakeholders' ability to lead a coordinated transformation, strengthen governance, foster innovation, and build partnerships that can respond to environmental changes.

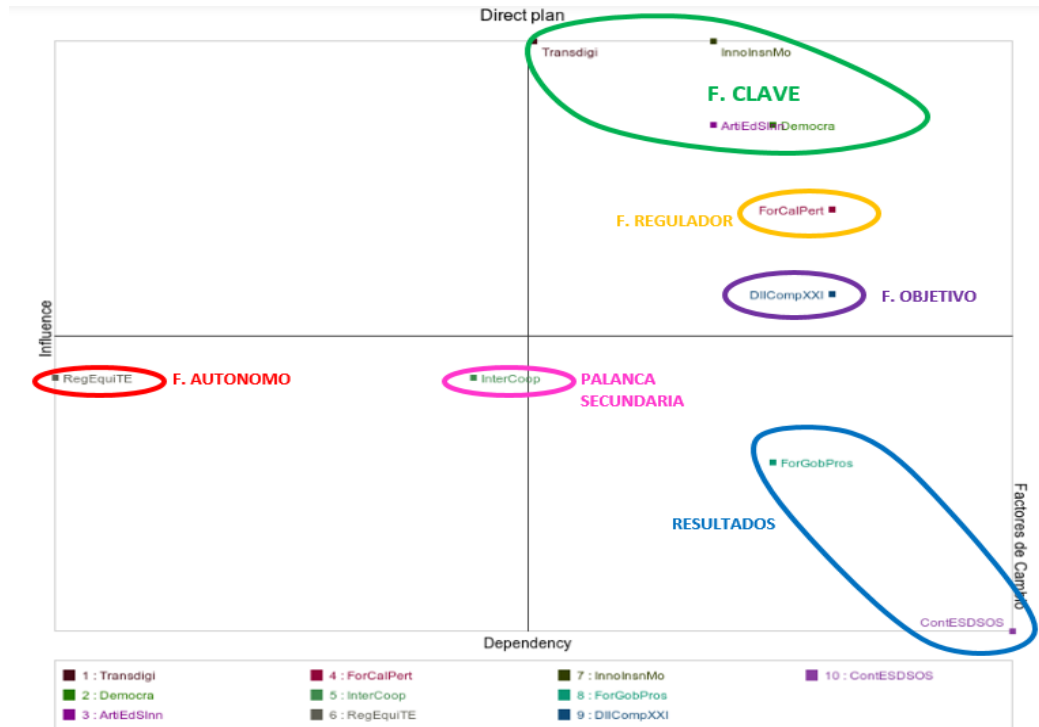
For strategic prioritization, the MICMAC methodology was applied to identify the variables with the greatest impact on the higher education system. The study evaluated direct and indirect relationships between the factors using a qualitative matrix, categorizing the variables into four quadrants: Power Zone, Key Zone, Autonomous Zone, and Results Zone.

The stakeholder analysis, using the MACTOR methodology, helped identify relationships of power, cooperation, and conflict among the organizations and institutions involved in developing the education system. By combining the different analyses, it was possible to identify not only what needs to be addressed—and, therefore, which part of the process should be considered—but also who can lead that process.

Strategic Prioritization

Strategic prioritization involves selecting the factors that most influence the behavior of the territorial system. Based on the structural analysis, ten factors of change were identified, and their influence and interdependence were defined to determine their importance for the future of higher education in Medellín.

The results show that the variables do not have the same level of impact. Some have a high transformative power and influence others, while others result from the strengthening of strategic variables. In this case, priority is given to those variables that can influence systemic changes and multiplicities within the system as a whole.

Figure 1*Structural Analysis. MICMAC***Table 3***MICMAC (Influence-Dependence) Structural Analysis*

POWER	
ZONE	On the influence-dependence plane, the “power” zone shows no significant concentration of drivers of change. This indicates that, for Medellín’s higher education system with a 2035 horizon, no variables exert a strong influence on the system as a whole without, in turn, depending on other factors. This shows that the system’s transformation does not depend on a single element that can shape the future in isolation, but requires the interaction and coordination of multiple strategic factors. Consequently, the system’s governance is built collectively, not on completely independent variables.
KEY AREA	This key area encompasses most of the drivers of change, including the Digital Transformation of Education (Transdigi), Institutional Innovation and New Learning Models (InnoInsnMo), the Linkage between higher education, innovation, and regional development (ArtEdSInn), the Strengthening of the quality and relevance of

education (ForCalPert), and the Development of 21st-century skills (DCompXXI), all located very close to the point of maximum influence and interdependence. This concentration indicates that the future of higher education in Medellín will be determined by highly interrelated variables, in which any change in one directly affects the others. In this sense, this area constitutes the strategic core of the system and requires coordinated interventions, since strengthening these factors will enable structural transformations geared toward the target scenario.

AUTONOMOUS ZONE The only factor located in the autonomous zone is “Regionalization and Territorial Equity” (RegEquiTE), which exhibits low levels of influence and dependence relative to the rest of the system. Its location indicates that, at present, this factor has a limited impact on the overall dynamics of the higher education system and, in turn, does not depend significantly on the other variables analyzed. However, its presence in this zone does not diminish its importance for territorial planning; rather, it shows that, under the current conditions of the analysis, its behavior is relatively independent and should be monitored to identify possible future changes.

RESULTS SECTION The “Strengthening Governance and Educational Foresight” (ForGobPros) and “Contribution of Higher Education to Sustainable Development” (ContESDSOS) are located in the outcomes zone. Their position reflects that these factors depend largely on the behavior of the strategic variables in the key zone. In other words, they are expected outcomes of the system’s functioning and the success of strategies implemented for the most influential factors. This means that strengthening educational governance and the effective contribution of higher education to sustainable development will result from progress in areas such as digital transformation, institutional innovation, the quality of education, and coordination with the local community.

Note. Prepared by the author. MICMAC analysis

Priority Strategic Variables

● Digital Transformation of Higher Education

Digital transformation is a key strategic priority because it can transform teaching, learning, research, and institutional management processes. New technologies, artificial intelligence, data analysis, and hybrid learning models have changed the skills students and faculty need to perform more effectively in the classroom and improve the quality of education. It is cross-cutting and therefore drives innovation in infrastructure and internationalization, as well as the development of 21st-century skills.

- **Strengthening Educational Governance and Foresight**

Educational governance is at the heart of the system because it enables public, private, and social institutions to coordinate the development and decision-making of public policies across an entire family of public organizations in a coherent, long-term, and evidence-based manner. Strong governance can build institutional capacity to anticipate change, manage uncertainty, and lead the development of higher education.

- **Institutional Innovation and New Learning Models**

Institutional innovation enables institutions of higher education to respond to technological, social, and economic changes by updating curricula, adopting active learning methodologies, and creating new pedagogical models. These factors promote academic flexibility and enhance the ability to respond to a knowledge-based society.

- **Strengthening the quality and relevance of education**

Quality and relevance are cornerstones of education and essential to ensuring it aligns with regional and labor market needs. This will improve institutional competitiveness, increase graduates' employability, and strengthen public trust in higher education institutions.

- **The Link Between Higher Education, Innovation, and Regional Development**

Fostering harmonious communication among universities, businesses, the government, and society is key to promoting applied research, technological innovation, and the region's economic development. This cooperation promotes knowledge exchange, strengthens the innovation ecosystem, and positions higher education as a vital component of regional development.

Consolidation Variables

The analysis also identifies variables whose evolution depends on strengthening strategic variables but that constitute fundamental outcomes for territorial development.

These variables are:

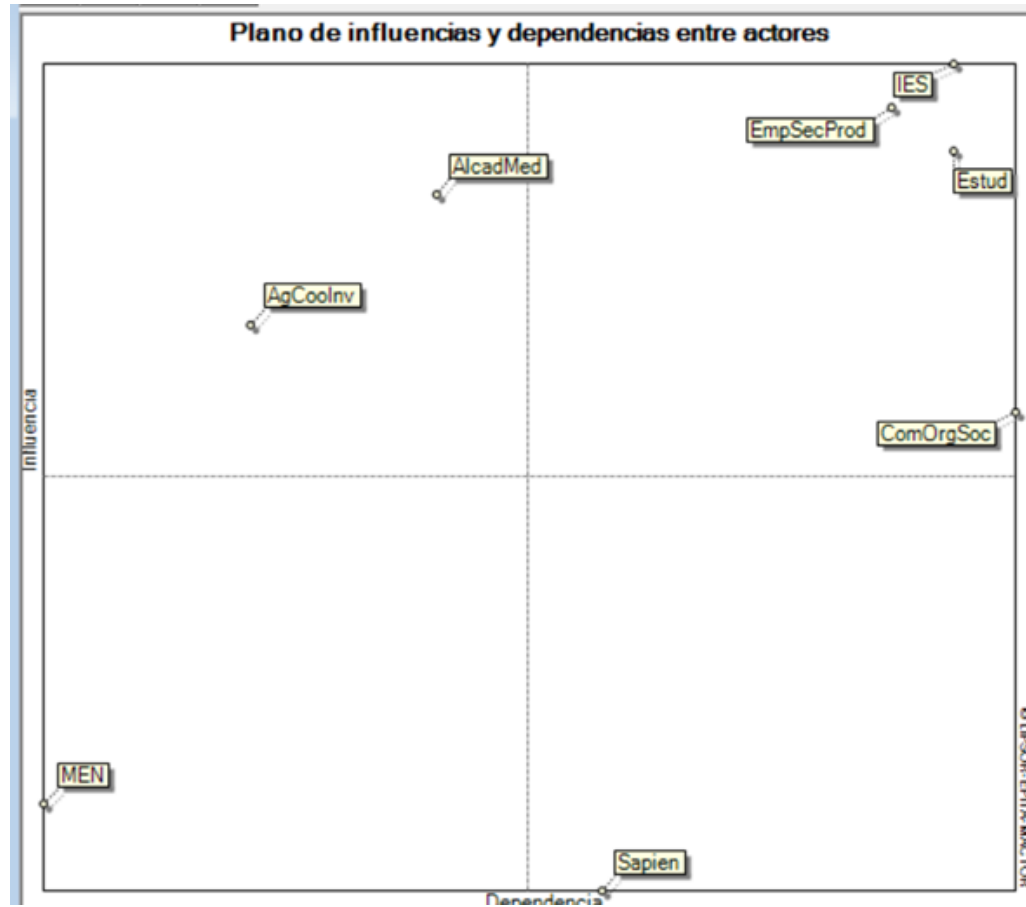
- Democratization of access to and retention in education.

- Internationalization and academic cooperation.
- Regionalization and territorial equity.
- Development of 21st-century skills. Higher education's contribution to sustainable development.

Although they depend more on systems, the consolidation of their strategies is the main indicator of the success of the strategies implemented.

Stakeholder Mapping and Analysis

The future of higher education depends not only on strategic variables but also on local stakeholders' ability to cooperate, negotiate, and coordinate actions. Thus, the stakeholder analysis identified the institutions and organizations that play the most crucial role in developing the education system, as well as their interests, responsibilities, and power relationships.

Figure 2*List of actors. MACTOR*

Note. Created in-house using the MACTOR app.

- **Ministry of National Education (MEN)**

The Ministry of National Education plays a leading role in Colombia's higher education system. It has the greatest regulatory authority to formulate public policy, set quality standards, allocate resources, and regulate institutional operations. Its primary focus is to ensure higher education is high-quality, relevant, and inclusive, and aligned with national development goals.

- **Medellín City Hall**

Medellín City Hall plays a strategic role in implementing regional policies related to higher education. It is committed to fostering innovation, educational inclusion, research, and local economic development through investment programs, planning, and institutional coordination. Its leadership is crucial for integrating educational strategies with regional development and aligning them with the development plan.

- **Sapiencia**

Sapiencia is the primary local coordinator of policies regarding access to and retention in higher education. Its oversight of funding programs, scholarships, educational grants, and strategies for collaboration with higher education institutions makes it a key player in reducing access gaps and promoting educational equity in Medellín.

- **Higher Education Institutions (HEIs)**

Universities and higher education institutions are central to education. They train talent, advance scientific knowledge, conduct research, foster innovation, and provide community outreach. They also maintain ongoing relationships with businesses, public entities, and social organizations to transfer knowledge to the local community.

- **Sector and Businesses**

Businesses are deeply involved in defining professional profiles, developing applied research projects, academic internships, and innovation processes. Their relationship with universities is crucial to the region's workforce development and competitiveness.

- **Medellín Agency for Cooperation and Investment (ACI Medellín)**

ACI Medellín promotes the internationalization of the higher education system through strategic partnerships, international cooperation, attracting investment, and strengthening global knowledge networks. Its involvement is crucial to consolidating Medellín's international profile as a city of knowledge.

- **Community and Social Organizations**

Citizens and social organizations are the most direct beneficiaries of the education system; they also help shape public policy, participate in mechanisms for citizen participation, and drive social innovation projects. This contributes to the system's legitimacy and ensures that educational strategies respond to the realities of the local context. From the stakeholders' perspective, the success of these strategies will depend on their ability to build partnerships, coordinate resources, and foster a shared vision.

RESULTS

According to the foresight approach developed by Godet and Roubelat (1996), scenarios are not only a tool for predicting future events but also for building a positive future based on present decisions. Scenario building is part of the integrated territorial foresight process, as it incorporates territorial assessment, environmental analysis, factors of change, and stakeholder analysis. This process helps create plausible futures and supports strategic planning and decision-making for the territorial area's future development. In line with Peter Schwartz's strategic foresight, scenarios do not aim to predict the future, but rather to provide a coherent narrative of how the system may evolve based on strategic variables and territorial actors.

From a strategic perspective, and following the approach proposed by Peter Schwartz, scenarios do not seek to predict the future, but rather to construct consistent narratives about the various ways the system may evolve. In this sense, scenarios are tools for anticipating risks, identifying opportunities, and improving long-term planning.

For higher education in Medellín, scenario building is based on the previously highlighted drivers of change: digital transformation, institutional innovation, the quality and relevance of education, the relationship between higher education and innovation, and skills development and learning in 21st-century countries. If these variables are interrelated, we can envision different development trajectories for higher education through 2035.

Development of Prospective Scenarios

Applying Schwartz's methodology made it possible to identify four plausible scenarios for the evolution of higher education in Medellín. These scenarios are organized around two key uncertainties regarding the future of the system:

- Innovation and educational transformation.
- Interactions among institutional and regional stakeholders.
- Based on these uncertainties, four potential futures are developed, each with its own advantages and disadvantages.

Scenario 1. Smart and Inclusive Higher Education (Target Scenario)

The best-case scenario for Medellín by 2035. The city has built a modern, flexible, and inclusive higher education system, internationally recognized for developing highly qualified talent and supporting regional progress. Schools, administrative offices, laboratories, and learning platforms are digitized through artificial intelligence, data analysis, virtual laboratories, and information technology. Technology is not replacing education; rather, it enhances quality, personalized learning, and data-driven decision-making.

Higher education institutions implement dynamic curricula, active teaching methods, and student-centered learning models to develop lifelong learning skills relevant to the 21st century, including critical thinking, creativity, teamwork, innovation, and complex problem-solving.

Collaboration among universities, businesses, the government, and society forms a true innovation ecosystem for applied research, entrepreneurship, knowledge transfer, and regional competitiveness. Public policies also contribute to equitable access and student retention through strategies for regionalization, hybrid education, and social inclusion.

As a result, Medellín has established itself as a Latin American leader in higher education, innovation, and sustainable development and is training professionals capable of leading economic and social transformation in the region.

Scenario 2. Technological Modernization Without Educational Transformation

In this scenario, institutions make substantial investments in technological infrastructure and digitization, and incorporate virtual platforms, artificial intelligence, and digital tools into their academic processes.

However, innovation is primarily limited to the technological sphere, with no significant changes in pedagogical models or curricular structure. Teaching remains centered on traditional methods, and academic programs are evolving slowly to adapt to new environmental needs. Although institutional quality is improving slightly and technological resources are increasing, the gap between vocational training and the skills the labor market requires persists. Research and innovation are advancing, but collaboration among universities, businesses, and the government has not yet been firmly established.

Consequently, Medellín has technologically advanced institutions, yet it faces challenges in completely transforming higher education and meeting the demands of a knowledge-based economy.

Scenario 3. Traditional Education in a Changing World

This is the least favorable scenario for education. Institutions continue to operate with very rigid organizational structures and traditional pedagogical frameworks, leaving little room for digital technologies and curricular innovations. The lack of investment in research and development hinders the ongoing updating of academic programs and makes institutions less competitive.

The lack of collaboration with the private sector reduces the relevance of education and limits graduates' opportunities to enter the workforce. At the same time, institutions are not developing skills in digital transformation, creativity, critical thinking, and innovation.

Without coordinated public policies and a common strategic vision, Medellín cannot establish a higher education system that adapts to changing technologies and the social and economic landscape, both nationally and internationally. As a result, the city loses competitiveness compared to other locations, and higher education cannot drive economic and social development.

Scenario 4. Fragmented Innovation and Educational Gaps

This scenario reflects highly uneven development in higher education. Some universities—particularly those with stronger financial, technological, and institutional capacities—achieve significant progress in innovation, research, and digital transformation. However, these improvements are isolated and do not extend to the entire education system.

Differences among universities create gaps in academic quality, access to technology, teacher training, research, and internationalization. Cooperation among universities remains limited, and learning opportunities still depend largely on students' socioeconomic conditions and each university's institutional capacity.

Although Medellín has had success with educational innovation in the past, the absence of a coordinated regional plan prevents the creation of an equitable and integrated school system, thereby limiting the collective impact of higher education on regional development.

DISCUSSION OF RESULTS

Comparative analysis of the scenarios

A comparison of the four scenarios shows that the future of higher education will depend fundamentally on the interaction between the capacity for educational innovation and the level of institutional collaboration achieved by the system's stakeholders.

While Scenario 1 is a model characterized by high levels of innovation and cooperation, Scenario 3 is one in which there is no transformation and competitive erosion continues. Scenarios 2 and 4, meanwhile, represent intermediate trajectories in which progress is evident, but structural challenges persist that prevent the emergence of a fully integrated and innovative educational system.

This comparison shows that transforming higher education through technology is far from the only path. Change also requires curricular innovation, good governance, institutional cooperation, and public policies to address equity and quality in education.

Scenario and Strategic Lines

Based on the prospective analysis, the preferred scenario, “Smart and Inclusive Higher Education,” is selected as the future that best aligns with the region’s current capabilities and Medellín’s development aspirations.

Realizing this scenario requires strengthening the three strategic lines defined in the study:

Social Strategy

To consolidate an inclusive, flexible, relevant, and innovative model of higher education that supports digital transformation, educational quality, institutional innovation, and the development of 21st-century skills, bringing together students from diverse social backgrounds so they can enroll in college and graduate as an educated class.

Territorial Strategy

Higher education should be viewed as the foundation of territorial development, as it drives applied research, innovation, international cooperation, knowledge transfer, and partnerships and cooperation among universities, businesses, the government, and society to enhance competitiveness and achieve the Sustainable Development Goals.

Strategic Policy Priority

Strengthen the system of educational governance and foresight to anticipate changes, coordinate local stakeholders, and establish forward-looking public policies for the sustainable development of the higher education system, so it develops in a sustainable and evidence-based manner.

The scenario-building exercise shows that the future of higher education in Medellín depends not only on technological evolution but also on the collective capacity to renew educational systems, increase institutional cooperation, and build long-term-oriented governance. Schwartz’s approach shows that multiple futures are possible and that present decisions will directly shape the region’s future direction. The “Smart and Inclusive Higher Education” scenario is the most desirable because it integrates innovation, equity, quality, and regional

coordination, leveraging the strengths identified in the assessment and addressing the prioritized drivers of change.

The scenarios show that Medellín can be a national and international leader in higher education, provided we strengthen the strategic factors identified in the prospective analysis and promote collaborative governance among the government, higher education institutions, the private sector, and society. The four possible futures for the region show that its success will depend on combining digital transformation with profound pedagogical innovation, greater institutional coordination, and policies that promote inclusion and sustainability. As a result, the scenario describes a smart, inclusive, and regionally relevant higher education system that could drive innovation, competitiveness, and sustainable development by 2035.

CONCLUSIONS

The territorial foresight exercise for higher education in Medellín revealed that the future of the education system depends on the dynamic interaction among the region's accumulated capabilities, environmental trends, factors of strategic change, and stakeholders' ability to build a shared long-term vision. Medellín possesses significant institutional, academic, and technological strengths that provide a solid foundation for consolidating a more innovative, inclusive, and relevant higher education system.

The territorial assessment revealed that, in recent decades, the city has built a set of strategic assets: a major institution of higher education, a well-established innovation ecosystem, and a highly skilled academic community, along with excellent communication among universities, businesses, and the government. These assets set Medellín apart from other cities in the country and provide competitive advantages for digital transformation, internationalization, and the knowledge economy.

The drivers of change indicate that digital transformation, institutional innovation, the quality and relevance of education, the integration of higher education, innovation, and regional development, and educational governance constitute the system's strategic core. Their influence on higher education is significant; therefore, any intervention based on these factors must focus on these variables due to their multiplier effects on the rest of the system.

Stakeholders in higher education indicated that the future of higher education will be shaped through a collaborative governance partnership based on coordination among the National Ministry of Education, the City of Medellín, Sapiencia, higher education institutions, the private sector, international cooperation, and civil society. No single stakeholder can bring about the necessary transformation on its own; achieving the envisioned scenario requires forming strategic alliances and establishing formal institutional communication mechanisms.

Scenario building, using Peter Schwartz's methodology, enabled exploration of different future trajectories for the education system through 2035. The four scenarios were compared, and the most promising was "Smart and Inclusive Higher Education," which features high levels of educational innovation, digital transformation, social inclusion, and territorial

coordination. This scenario is a shared vision in which higher education drives economic, social, and environmental development in Medellín.

Finally, the study shows that territorial foresight is a strategic tool for guiding the university's higher education planning process and that it will help predict future changes, reduce uncertainty, and make institutions more adaptable to the future scenario. In this regard, higher education should be viewed not only as a system of professional training but also as a fundamental mechanism for knowledge generation, innovation, competitiveness, and the region's sustainable development.

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