

Development of a Marketing Plan for the Specialization in Welding and Non-Destructive Testing Technology at Universidad Libre

Lina Jineth Obregón Vargas¹, Carlos Andrés Angulo Martínez²MBA.Ing Ever Fuentes Rojas²

¹(Departamento de Ingeniería Industrial, Universidad Libre, Colombia)

²(Departamento de Ingeniería Industrial, Universidad Libre, Colombia)

²(Departamento de Ingeniería Industrial, Universidad Libre, Colombia)

ABSTRACT: This article presents a marketing plan for the 2024 relaunch of the Specialization in Welding Techniques and Non-Destructive Testing at Universidad Libre (Bogotá campus), in response to changes in the competitive environment, the demands of the productive sector, and quality standards since its first offering in 2015. The study uses tools such as the SWOT matrix, Porter's Five Forces, the McKinsey matrix, and the Ansoff matrix [1, 2, 3], to analyze the market, identify opportunities, and propose repositioning strategies.

The necessity to update the curriculum with Industry 4.0 approaches [4], incorporate international certifications [5, 6], strengthen ties with the industry, and generate spaces for practice and applied research is highlighted. The marketing strategy is based on the 10Ps model of educational marketing [7], prioritizing digital media, corporate agreements, and financial sustainability.

The results show an expanding market and a high demand for certified specialists [6, 8]. It is concluded that the program has the potential to position itself as a benchmark in Colombia and Latin America, provided that it implements strategies for innovation, articulation with the productive sector, and academic excellence.

KEY WORDS: Financial Sustainability, Marketing Strategy, Welding, Non-Destructive Testing, Universidad Libre.

Date of Submission: 08-10-2025

Date of acceptance: 20-10-2025

I. INTRODUCTION

Globalization and technological transformation have shaped a highly dynamic scenario in which higher education institutions constantly face the challenge of aligning their academic programs with the demands of the productive sector and international standards [1, 4]. Advances in automation, process digitization, artificial intelligence, and new technologies applied to industry have radically modified the competencies required by professionals [4, 13]. In this context, the fields of welding and non-destructive testing are positioned as strategic areas due to their direct relevance to the quality, safety, and efficiency of industrial processes [6, 8]. These fields impact not only traditional sectors like construction and metalworking but also high-complexity industries such as aerospace, petrochemical, energy, and automotive [6, 8].

The growing need for professionals specialized in these areas highlights the relevance of designing academic programs aimed at developing advanced technical competencies, which go beyond the simple execution of processes and allow graduates to participate in the management, supervision, certification, and optimization of these processes [7, 12]. Globalization also implies that specialists must be able to comply with international standards such as ISO 9712, ASME, or American Welding Society (AWS) standards, which are indispensable requirements for ensuring labor mobility and insertion into globalized markets [6, 10].

In this context, Universidad Libre has formulated the Specialization in Welding Techniques and Non-Destructive Testing as a concrete response to these needs of the industrial and academic environment. This program has been designed under a comprehensive curricular approach that combines solid theoretical foundations with an applied practical component, allowing students to face real problems in the sector. Furthermore, the program seeks to foster the capacity for innovation, applied research, and articulation with companies and productive guilds, which ensures the relevance and constant updating of the specialization [9].

However, for this program to achieve sustainability and consolidation over time, it is essential to implement strategies that strengthen its visibility, differentiation, and positioning in the competitive national and international educational environment. The mere existence of a relevant curriculum does not guarantee its success if it is not accompanied by an institutional effort to promote it adequately, create academic and

industrial collaboration networks, and demonstrate the added value it provides to future specialists. In this sense, educational marketing becomes a key tool not only for attracting students but also for building a solid and recognized identity against the competition [7, 17, 19].

Educational marketing also allows for the optimization of institutional management processes by clearly identifying the target market, the needs and motivations of potential students, and the factors that determine their choice decisions [1, 7]. At the same time, it enables the design of strategic campaigns that highlight the differential attributes of the program, such as certified training, industry links, and graduate employability. Thus, the application of these tools contributes to institutional competitiveness, insofar as it projects Universidad Libre as an innovative institution, adapted to technological changes, and committed to academic quality [7].

In this context, the central purpose of this article is to present a structured marketing plan for the Specialization in Welding Techniques and Non-Destructive Testing, based on a comprehensive analysis of the academic context, the industrial sector, and educational market trends in Colombia and Latin America. The research seeks to demonstrate how the application of strategic management tools, traditionally used in the business field, can be effectively transferred to the educational field, achieving better articulation between the academic offering and the needs of the productive environment [1, 2, 3].

Finally, it is proposed that the implementation of this marketing plan will not only contribute to guaranteeing the viability of the program but will also generate a positive impact on the development of specialized human talent. This talent, upon entering strategic sectors of the economy, will strengthen industrial competitiveness, drive technological innovation, and contribute to the economic and social growth of the country. Consequently, the Specialization is conceived not only as an academic offering but as a tool for transformation that directly links higher education with the challenges of Industry 4.0 and the global projection of Colombian professionals [7, 13].

II. METHODOLOGY

The present study was based on a mixed methodological approach, combining descriptive, exploratory, and strategic components, with the purpose of building a comprehensive marketing plan for the Specialization in Welding and Non-Destructive Testing Technology at Universidad Libre. This approach allowed for the articulation of both quantitative analysis, aimed at collecting objective data on the market and academic demand, and the qualitative perspective, focused on understanding the perceptions, expectations, and valuations of stakeholders linked to the educational and industrial sectors. In this way, the research managed to obtain a broad and substantiated vision that facilitated the formulation of relevant, sustainable, and differentiating strategies [5].

The methodology was structured into five main phases, which were developed sequentially and interrelatedly, ensuring coherence between the initial diagnosis, the context analysis, and the final strategic formulation.

2.1 Phase I: Documentary Review and Contextual Analysis: The first phase involved an exhaustive review of academic literature, institutional reports, regulatory documents, and secondary sources related to higher education, training in welding and non-destructive testing, and technological trends associated with Industry 4.0. This documentary process was key to laying the conceptual and operational foundation for the research, as it allowed for:

- Identify the state-of-the-art of similar postgraduate programs, both nationally and internationally, analyzing their curricular structure, accreditation level, and pedagogical approaches.
- Recognize the main certification and employability trends in the industrial sector, linked to international standards such as ISO 9712, ASME, and AWS (American Welding Society), which are currently fundamental requirements in the workplace [6, 10].
- Establish theoretical and practical benchmarks on educational marketing in higher education institutions, identifying successful experiences in the promotion of specialized programs and student recruitment models in competitive markets [1, 7].

This phase served as a starting point for understanding the relevance of the specialization and guiding the methodological design of the subsequent phases [10].

2.2 Phase II: Internal and External Diagnosis This phase sought to evaluate the current situation of the Specialization in Welding Technology and NDT (Non-Destructive Testing), considering both the internal factors of Universidad Libre and the external elements of the educational and labor market. For this, various strategic analysis tools were used:

- SWOT Analysis (Strengths, Weaknesses, Opportunities, and Threats): This allowed for the classification and prioritization of internal and external factors influencing the program, such as institutional

infrastructure, academic prestige, the lack of international certifications, or the growing demand from the productive sector.

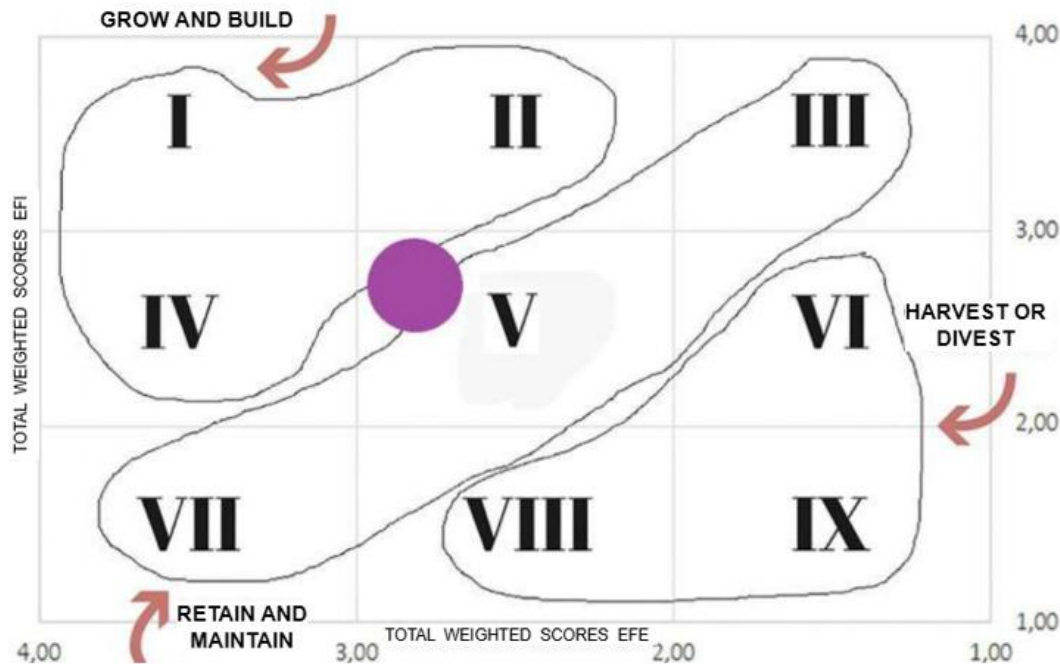


Figure 1. BCG Matrix Applied to the Strategic Evaluation of the Specialization in Welding and Non-Destructive Testing

- **Porter's Five Forces Model:** This facilitated a detailed examination of the level of competition in the market, the bargaining power of students and employers, the threat of substitute programs (specializations in project management, metalworking, or industrial maintenance), and the likelihood of new institutions entering with similar offerings [2].
- **Benchmarking:** A systematic comparison was conducted with similar programs offered at national universities (Universidad Nacional, Universidad de Antioquia, EAFIT) and specialized centers such as CISold, as well as with international benchmarks led by the AWS (American Welding Society). This exercise allowed for the identification of competitive advantages of the Universidad Libre program, such as its academic trajectory and national coverage, but also gaps to close, related to internationalization and business linkage [4, 20].

The diagnosis allowed for the conclusion that, although there is a solid foundation for the development of the specialization, it is necessary to strengthen the value-added component and work on strategies that improve its visibility and differentiation in the market.

2.3 Phase III: Market Analysis and Segmentation

The third phase focused on understanding the characteristics of the **target audience**, mainly composed of engineers, technologists, and professionals linked to strategic sectors such as **construction, metalworking, energy, oil, gas, and transportation**. To achieve this, several techniques were implemented:

- **Market Segmentation:** Based on demographic criteria (age, academic level, socioeconomic status), geographic criteria (regions with the highest industrial concentration), occupational criteria (professionals in the productive sector), and academic criteria (interest in certification and advanced training).
- **Geomarketing Analysis:** Using statistical data on industrial growth and business concentration in key cities such as Bogotá, Medellín, Barranquilla, and Cali, which allowed for the identification of territories with the greatest potential for student recruitment.
- **Demand Projection:** Scenarios were calculated based on employability indicators, analysis of the existing educational offerings, and the growing need for NDT and welding certifications. The results showed a solid potential market, driven by the dynamism of the industrial sector and regulatory requirements regarding safety and quality [3, 8].

This phase provided valuable input for defining the target student profile and adjusting the promotion and recruitment strategies.

2.4 Phase IV: Strategic Formulation

With the findings from the previous phases, the marketing plan was designed using the 10Ps model of educational marketing as a framework: Product, Price, Place, Promotion, People, Processes, Positioning, Presentation, Productivity, and Partners. Each variable was defined based on three central elements:

- The target student profile, identified as a professional seeking international certification, technological updates, and career advancement.
- The needs of the labor market, which demand specialists capable of responding to the requirements of Industry 4.0
- International standards for training and certification, which guarantee the competitiveness of the graduate in the global sphere [7,13]

Additionally, strategic planning tools were used, such as the McKinsey Matrix, which allowed for crossing institutional competitiveness with market attractiveness, and the Ansoff Matrix, to define growth strategies in four directions: market penetration, product development, market development, and diversification [1,3].

In this way, the strategic formulation was not only focused on attracting students but also on positioning the specialization as an academic and professional benchmark in Colombia and Latin America.

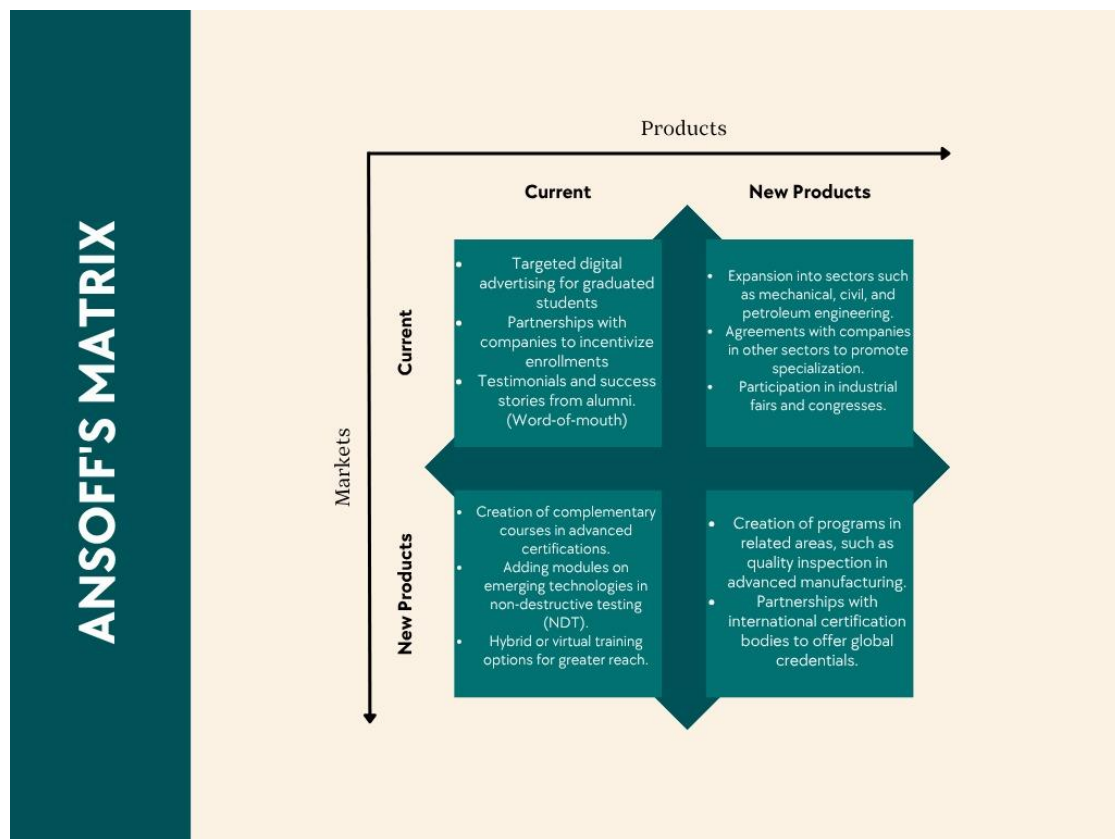


Figure 2. Ansoff Matrix Applied to the Growth Strategy of the Specialization in Welding and Non-Destructive Testing

2.5 Phase V: Validation and Projection

In the final phase, the results and proposals of the marketing plan were subjected to a process of participatory validation, which included feedback sessions with program faculty, industry professionals, and educational marketing experts. This stage was fundamental because it allowed for contrasting the relevance of the strategies with the experience of the stakeholders directly linked to the sector.

The main achievements of this phase were:

- Adjusting digital promotion strategies, incorporating search engine optimization actions (SEO/SEM), campaigns on professional social media platforms like LinkedIn, and active presence at academic and professional guild fairs.

- Defining strategic alliances and cooperation agreements with companies in the metalworking, energy, and construction sectors, as a mechanism to strengthen employability and ensure the relevance of the training.
- Estimating the financial sustainability of the program, based on projected enrollment scenarios and cost analysis, in order to ensure its long-term continuity and competitiveness.
- Establishing success indicators and monitoring mechanisms, such as the graduate employability rate, new student recruitment, graduate satisfaction, and institutional recognition in academic rankings[5]

III. MARKET ANALYSIS

The market for the Specialization in Welding and Non-Destructive Testing Technology in Colombia is characterized by a growing demand for highly qualified professionals, driven by the requirements of strategic sectors such as construction, energy, oil and gas, metalworking, and advanced manufacturing. This analysis was carried out based on the characterization of demand, the identification of existing supply, and the evaluation of competitive opportunities.

3.1 Demand Characterization

The potential students primarily correspond to:

- Mechanical, Metallurgical, Industrial, and Materials Engineers
- Technologists in welding, quality control, and industrial processes
- Professionals linked to infrastructure, energy, transportation, and metalworking production projects

The demand is strengthened by three main factors:

1. The mandatory nature of international certifications (such as AWS and ISO 9712) for participation in large-scale projects [6, 10].
2. Digital transformation and the incorporation of Industry 4.0, which demand competencies in robotic welding, advanced NDT techniques, and quality management [7, 10].
3. The shortage of certified specialists in the country, which has generated employment opportunities with average salaries ranging between COP 3.5 and 7 million per month, higher than those in other postgraduate areas [7].

3.2 Competition Analysis

The Colombian market presents a limited academic supply, concentrated in a few institutions:

- Universidad de Antioquia: Offers postgraduate programs in welding with a focus on applied research [7].
- Universidad Nacional de Colombia: With master's programs and diplomas in materials and joining processes [7].
- EAFIT and Universidad Santo Tomás: With short courses and extension programs in welding [7].
- CISold: Specialized in technical certifications and training for the productive sector [6].

At the international level, the American Welding Society (AWS) is the main benchmark, as it certifies specialists and establishes global standards [6]. In this scenario, Universidad Libre can differentiate itself by integrating university academic training with international certification and industrial practices.

3.3 Geographic Segmentation and Geomarketing

The geomarketing analysis identified four priority regions for student recruitment:

- Bogotá: Concentrates the highest demand due to its industrial diversity and the presence of multinational companies [11].
- Medellín: A focal point for the metalworking industry and manufacturing innovation [11].
- Barranquilla and the Caribbean region: With growth in port infrastructure and energy projects [11].
- Cali and Valle del Cauca: A development hub for agribusiness and metallurgical production [11].

The geographic coverage strategy is supported by the hybrid modality (in-person and virtual), which increases the capacity to attract students nationwide and, eventually, throughout Latin America.

3.4 Market Opportunities

The analysis shows that the specialization has a high viability for growth, thanks to:

- The shortage of certified specialists in NDT and welding [7].
- The need for programs that articulate academic training with international certifications [6, 10].
- The projected investments in infrastructure, energy, and transportation in Colombia over the next decade [11].
- The possibility of strategic linkage with national and international companies, which demand constant updates in joining technologies and quality control [6].

IV. MARKETING STRATEGY

The marketing plan for the Specialization in Welding and Non-Destructive Testing Technology was designed under the 10Ps model, which allows for the integration of the traditional marketing mix variables with additional elements oriented towards the educational sector. These strategies seek to guarantee the differentiation, visibility, and sustainability of the program in a highly competitive environment [1].

4.1 Product

The specialization is conceived as a unique program in the country, as it integrates advanced training in welding with Non-Destructive Testing (NDT) techniques. The curricular design incorporates:

- Modules oriented towards modern welding technologies (MIG, TIG, robotic welding).
- International certification components (AWS, ISO 9712).
- Focus on Industry 4.0 and quality management.

This added value makes it an academic product with high relevance and differentiation [7].

4.2 Price

The pricing strategy seeks to maintain accessibility and competitiveness compared to the existing offering:

- Tuition fees adjusted to the national average for specialized postgraduate programs.
- Flexible financing plans and agreements with banking institutions.
- Partial scholarships aimed at professionals from sector companies that establish agreements with Universidad Libre [7]

4.3 Place (Distribution)

The program will be offered in a hybrid modality, combining in-person sessions in Bogotá with synchronous and asynchronous virtual activities. This will allow for expanding coverage in strategic cities such as Medellín, Barranquilla, and Cali, with the possibility of reaching students from other Latin American countries [11].

4.4 Promotion

Promotion actions will focus on strengthening the program's visibility through:

- Digital campaigns on social media (LinkedIn, Facebook, Instagram, YouTube).
- SEO positioning and advertising on Google Ads to capture prospects interested in technical and postgraduate training.
- Participation in industrial and academic fairs, where the benefits of the specialization will be promoted.
- Geomarketing strategies to segment messages according to regions with higher demand[11]

4.5 People

Human resources constitute a key competitive advantage. The program will feature:

- Internationally certified faculty with industry experience.
- An alumni network that will participate as program ambassadors.
- Academic and administrative advisors trained for student support [7].

4.6 Processes

The aim is to guarantee transparent and efficient academic and administrative processes:

- A flexible curriculum that allows for adaptations based on technological changes.
- 100% online registration and enrollment processes.
- Use of LMS (Learning Management Systems) platforms for content and evaluation management [1].

4.7 Positioning

Positioning will focus on projecting the specialization as a leading program in Colombia and a benchmark in Latin America due to its:

- Direct linkage with the industry.
- Dual value proposition: university academic training + international certification.
- Recognition of Universidad Libre as an institution with a track record in engineering [7].

4.8 Presentation (Physical Evidence)

Institutional image will be strengthened through:

- Specialized laboratories for welding and NDT with state-of-the-art equipment.
- Digital support resources, such as virtual classrooms and simulators.
- Institutional graphic material (brochures, videos, infographics) that convey quality and innovation [1]

4.9 Productivity

To ensure measurable results, indicators will be implemented, such as:

- Annual enrollment rate and student retention percentage.
- Graduate employability level.
- Number of international certifications obtained per cohort.

These indicators will allow for the evaluation of the real impact of the marketing plan on the program's sustainability [7].

4.10 Partners (Alliances)

Finally, the strategy contemplates the creation of strategic alliances with:

- Companies in the energy, construction, oil, and metalworking sectors.
- Chambers of commerce and professional associations (guilds).
- International organizations such as AWS and ISO standards bodies.

These alliances guarantee constant updating, professional practices, joint projects, and greater employment opportunities for students [7].

V. RESULTS AND DISCUSSION

The marketing plan allowed for the identification of relevant findings that support the viability and differentiation of the Specialization in Welding and Non-Destructive Testing Technology at Universidad Libre. The main results are grouped into four dimensions:

5.1 Results of the Strategic Diagnosis

The SWOT analysis highlighted the institutional trajectory of Universidad Libre, the growing demand for specialists, and the opportunity to articulate university training with international certification as strengths. Among the weaknesses are the recent reactivation of the program and the need for greater recognition compared to competitors. Threats identified include the offering of short technical courses and the rapid technological evolution that necessitates constant curricular updating [11].

Porter's model confirmed a market with moderate competition, where the main pressure comes from substitute programs and the entry of new academic offerings. However, the combination of welding and NDT in a single program was emphasized as a differentiating factor against the competition [11, 18].

5.2 Results of the Market Analysis

The geomarketing study determined that the cities with the highest recruitment potential are Bogotá, Medellín, Barranquilla, and Cali, due to the concentration of industries that handle welding and NDT processes. The potential demand was estimated to be growing, projecting a constant flow of professionals interested in certifying and specializing in these areas [6]. Likewise, it was verified that the projected salaries for certified specialists surpass the average for other professionals with postgraduate degrees, which constitutes a key argument in the program's value proposition [6].

5.3 Results of the Marketing Strategies

The application of the 10Ps model allowed for structuring a comprehensive strategy with an impact on three main areas:

- **Visibility and Student Attraction:** Through digital campaigns and positioning at industrial fairs, which will increase the program's notoriety [7].
- **Competitive Differentiation:** Thanks to the integration of academic training and international certification, a feature no national competitor offers simultaneously [7].
- **Sustainability and Employability:** With strategic alliances that ensure professional internships and the technological updating of the curriculum [7].

5.4 Discussion

The study results confirm that the success of the Specialization in Welding Techniques and Non-Destructive Testing will depend on its ability to coherently integrate curricular innovation, international certifications, and active linkage with the industrial sector. This strategic triad has been widely recognized by authors such as Kotler and Fox (1995) in the field of educational marketing, who emphasize that the differentiation of academic programs in highly competitive contexts requires a value proposition focused on relevance and quality [1]. Furthermore, the hybrid modality emerges as a key expansion factor, coinciding with recent studies on post-pandemic higher education (UNESCO, 2022), which show a growing preference for flexible and accessible schemes [10]. This modality not only broadens the program's geographic coverage

without requiring large infrastructure investments but also responds to the labor dynamics of potential students, many of whom work in productive sectors with complex schedules [10].

On the other hand, agreements with companies in the metalworking, oil, and aeronautical sectors should be understood not only as mechanisms for job placement but as opportunities to build a community of practice (Wenger, 1998), where knowledge flows between academia and industry [11]. This articulation allows for the development of joint applied research projects, necessary to strengthen both the relevance of the curriculum and the program's impact on the country's industrial development [11].

Finally, although the financial analysis projects increasing sustainability for the program, it is necessary to consider the risks associated with dependency on small cohorts or the variability of the labor market. At this point, Porter's (1996) assertion about the need to build sustainable competitive advantages through unique proposals that cannot be easily imitated becomes relevant. The integration of international certifications and a focus on Industry 4.0 can be that differentiator, provided it is accompanied by a flexible, innovative, and results-oriented academic and operational management model [11].

VI. CONCLUSIONS

The development of the marketing plan for the Specialization in Welding and Non-Destructive Testing Technology at Universidad Libre allowed for outlining a strategic roadmap aimed at strengthening, positioning, and sustaining the program in the competitive Colombian educational market. This process not only demonstrated a growing demand for certified professionals in key sectors such as construction, energy, the oil industry, and manufacturing but also confirmed the relevance of an academic offering that combines university training with high-level international certifications [1, 3].

The proposal stands out for its comprehensive approach, where the 10Ps model of educational marketing served as a framework for designing strategies aligned with current trends in higher education, strengthening both institutional visibility and graduate employability [7]. Additionally, the application of strategic analysis tools—such as the SWOT matrix, Porter's Five Forces model, the McKinsey matrix, and the Ansoff matrix—allowed for the identification of growth opportunities, critical success factors, and potential risks, contributing to informed and proactive decision-making [11].

In summary, it is concluded that the success and sustainability of the program will depend on its capacity to:

1. Continuously update the curriculum, incorporating emerging technologies and competencies specific to Industry 4.0 [6, 10].
2. Strengthen ties with the productive sector, through strategic alliances that include professional internships, joint projects, and knowledge transfer [11].
3. Guarantee academic quality standards, by linking certified faculty, using specialized laboratories, and implementing continuous evaluation processes [7].
4. Build a solid institutional positioning, projecting the specialization as an academic benchmark in Colombia and Latin America, capable of responding to the technological and productive challenges of the region [1, 7].

This marketing plan, therefore, constitutes a key instrument not only for the relaunch of the program but also for its consolidation as a relevant, innovative postgraduate offering aligned with the needs of the current and future labor market [11].

ACKNOWLEDGMENTS

The authors thank Universidad Libre and the Faculty of Engineering for their support in the development of this research.

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