Socioeconomic and Academic Profile of Applicants to the Industrial Engineering Program at Tecnológico de Colima: A Cross-Sectional Analysis

Pedro Itzvan Silva Medina[1], Johann Mejías Brito[1], Norberto Gómez López[1], María Cristina Salas Moreno[1], Pedro Itzvan Silva Arias[2]

[1]*Departament of Industrial Engineer, Tecnologico Nacional de México/ IT de Colima*
[2]*Student of Industrial Engineer, Tecnologico Nacional de México/ IT de Colima*

ABSTRACT
This cross-sectional study analyzes the profile of 108 applicants to the Industrial Engineering program at Tecnológico de Colima. Results reveal a predominantly male cohort (52%), aged 18-20 years (54%), with 57% originating from local high schools. Critical academic gaps include limited English proficiency (5% at B1+ level) and socioeconomic disparities (40% report household incomes <$10,000 MXN/month). Career expectations show strong preference for Quality Management (25%) and Logistics (18%) specializations, with high projected mobility (76% planning to work outside Colima). The findings provide actionable insights for curriculum design and student support strategies in regional engineering education.

I.   INTRODUCTION

Understanding the profile of students entering industrial engineering programs in Mexico is essential for designing educational strategies that enhance academic success and align with the evolving demands of the labor market. Industrial engineering plays a critical role in optimizing processes, improving productivity, and fostering innovation across various sectors in Mexico (Alexandro, 2023). Given the high demand for qualified industrial engineers and the diversity of programs offered nationwide—over 1,200 across more than 1,000 institutions (ANFEI, 2019)—it is crucial to comprehend the backgrounds, skills, and motivations of incoming students to ensure their preparedness and retention in these programs.

Recent research emphasizes that students' academic preparedness, including their proficiency in mathematics, sciences, and language skills, significantly impacts their ability to succeed in engineering curricula (García-Peñalvo, 2021; Sánchez et al., 2022). Additionally, personal attributes such as creativity, analytical thinking, and problem-solving aptitude are considered fundamental for industrial engineering aspirants (UNAM, 2024; CUCEI, 2023). Understanding these characteristics at the point of entry allows institutions to tailor support mechanisms, remedial courses, and curricular adjustments that respond to students' needs, ultimately improving graduation rates and professional outcomes.

Moreover, the rapid technological transformation associated with Industry 4.0 demands engineers who combine technical expertise with soft skills such as teamwork, leadership, and entrepreneurial mindset (Hernandez-de-Menendez et al., 2020). Profiling incoming students helps universities identify gaps in these competencies early and develop programs that foster innovation and adaptability. This is particularly relevant in the Mexican context, where industrial engineering graduates are expected to contribute not only to local industries but also compete in global markets (Vodovozov et al., 2021).

The socioeconomic context of applicants is another critical factor influencing academic trajectories. Many students face challenges related to economic constraints, limited access to resources, and diverse living conditions, all of which affect their academic performance and persistence (Gobierno de México, 2023). By identifying these factors, higher education institutions can implement inclusive policies and financial support programs to reduce barriers and promote equitable access to quality engineering education.

Finally, understanding the career expectations and motivations of industrial engineering aspirants provides valuable insights for aligning educational offerings with labor market demands. Studies show that students increasingly seek specializations in areas such as quality management, logistics, and entrepreneurship, reflecting the dynamic nature of Mexico's industrial sectors (CANACINTRA, 2023). Institutions that adapt their curricula to these trends can better prepare graduates for successful careers, fostering innovation and competitiveness in the national economy.

II. MATERIAL AND METHODS

Research Design

A **descriptive cross-sectional census** was conducted among all 108 applicants admitted in 2025. Inclusion criteria required:

* High school graduates
* Formal applicants to the Industrial Engineering program

Data Collection Instrument

A 42-item structured survey was administered, validated through:

* **Expert judgment** (5 industrial engineers, α=0.91)
* **Pilot testing** (n=30, α=0.87)

Variables analyzed:

Table 1: 4 variables to be analyzed.

Category	Key Indicators
Socioeconomic	Gender, age, geographic origin, household income, vulnerability status
Academic	GPA, English proficiency, reading habits, perceived academic strengths/weaknesses
Career Expectations	Specialization preferences, projected income, employment sector interests
Institutional Factors	Program selection rationale, commute time, post-graduation mobility plans

Analytical Approach

* Descriptive statistics (frequencies, percentages)
* Data processing using SPSS v28

CASE STUDY: APPLICANT PROFILE AT TECNOLÓGICO DE COLIMA

Institutional Context

Instituto Tecnológico de Colima serves as a key engineering education hub in western Mexico, with Industrial Engineering among its most competitive programs. The institution attracts students primarily from Colima state (82%) but also from other Mexican states (8%) and internationally (1%).

Due to its nature as a decentralized body, TecNM possesses technical, academic, and management autonomy; it has the authority to coordinate the functions, substantive activities, and complementary actions previously overseen by DGEST through technological institutes and centers for research, teaching, and the development of educational technologies, in accordance with the Decree of its creation. With these powers, TecNM has as its essential objective:

"To provide, develop, coordinate, and guide the services of higher technological education, secular and free of charge, at the levels of higher university technician, undergraduate, and graduate, in on-campus, distance (non-face-to-face), and mixed modalities, with the aim of training professionals and researchers capable of applying and generating knowledge, with a broad culture, sufficient skills and competencies to solve problems, critical thinking, ethical sense, entrepreneurial attitude, creative and innovative capacity, as well as the ability to incorporate scientific and technological advances that contribute to the development of the sectors that make up the regional and national context."

Thus, TecNM has the institutional commitment and obligation to design and establish programs to address the education model, focused not only on facilitating and promoting academic learning, but also through the incorporation of students into working life and the productive processes of companies.

Data Collection Process

1. **Sampling Frame**: All 2025 applicants admitted through the national technological education system
2. **Survey Administration**: On-campus instrument deployment during orientation week
3. **Temporal Coverage**: Data collected August-October 2025

Demographic Profile

* **Gender Distribution**: 52% male, 48% female
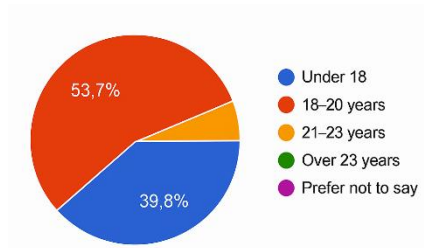* **Age Structure**: 40% minors, 54% aged 18-20 years

Figure 1: Age Structure

- **Geographic Origin**: 57% from University of Colima high schools, 23% from federalized institutions
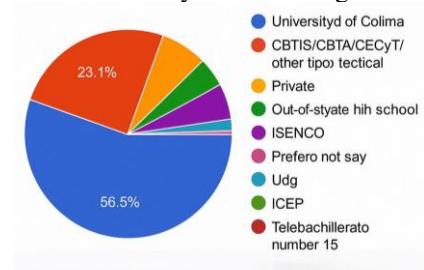

Figure 2: Geographic school Origin
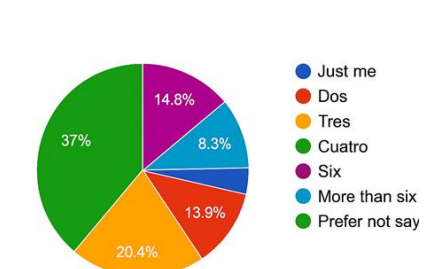
- **Living Arrangements**: 97% in households of 2-6 members

Figure 3: Living Arrangements

Table 2. Vulnerability Factors

Group	Percentage
Single parents	7%
Visual disability	5%
Economic insufficiency	5%
Neurodivergent	1%

III. RESULTS

Table 3. Academic Preparation Grade Distribution

GPA Range	Percentage
95-100	17%
90-94.9	27%
85-89.9	28%
80-84.9	13%
70-79.9	16%

Language Proficiency
- 5% English level B1 or higher
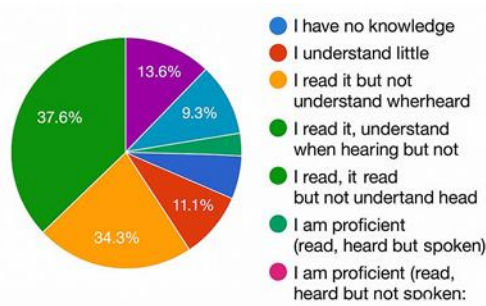- 34% report "very little understanding"

Figure 3: Living Arrangements

Economic Indicators
- 40% report household income <$10,000 MXN/month
- 84% primarily funded by parents
- 29% self-financed through work

Career Expectations

Table 4. Specialization Preferences

Area	Preference
Quality Management	25%
Industrial Relations	22%
Entrepreneurship	20%
Logistics	18%

Projected Career Roles
- Supervisor/Manager (32%)
- Director/Executive (28%)
- Business Owner (22%)

Post-Graduation Mobility
- 76% plan to work outside Colima state
- 33% intend to work internationally
- 79% perceive high employability in industrial engineering

IV. DISCUSSION

Academic-Industry Alignment

The preference for Quality Management and Logistics specializations aligns with industrial clusters in western Mexico (CANACINTRA, 2023). However, the discrepancy between perceived strengths (39% in basic sciences) and weaknesses (33% in same area) signals curricular gaps requiring foundational reinforcement.

Socioeconomic Considerations

The combination of low English proficiency (5% B1+) and economic constraints (40% low-income households) creates dual barriers for global workforce integration. Targeted interventions should include:
1. Intensive English immersion programs
2. Industry-sponsored scholarships for vulnerable groups
3. Curricular integration of entrepreneurial competencies

Limitations
- Regional focus limits generalizability
- Self-reported income data potential inaccuracies

V. CONCLUSION

This study provides the first comprehensive profile of Industrial Engineering applicants at Tecnológico de Colima. Key findings reveal:

1. Significant gender parity nearing equilibrium (52% male, 48% female)
2. Critical need for English language development initiatives
3. Strong market-driven specialization preferences requiring curriculum adaptation
4. High mobility expectations demanding institutional partnerships beyond Colima

These insights enable evidence-based interventions to enhance student retention, academic performance, and graduate employability in technical higher education.

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