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Application of Systems Thinking to the Training of Engineers: A Practical and Strategic Approach

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***Abstract*– The use of systems thinking in the workplace is an effective strategy because it provides tools and approaches that allow the members of an organization to understand, manage, and improve complex information systems effectively and sustainably, adapting to changing demands and promoting long-term organizational growth. For this reason, it is sought that the engineer in training can adapt to the complexity of systems with multifaceted and dynamic situations, allowing the identification of connections and patterns that can affect the environment itself. This tool is intended to strengthen your decision-making by considering the full picture holistically, reducing the risk of suboptimal decisions with biased or fragmented analyses, promoting effective collaboration between team members, orienting towards common objectives, and resolving complex problems that could be interrelated in multiple entropy levels. Using systems thinking makes it easier to identify the underlying causes of problems at all levels of an integrated system.**

***Keywords*– MSMEs, systemic thinking, higher education, engineering training**

I. Introduction

The graduation attributes of a university student are based on the mastery of different skills and competencies that they acquire during their academic life and that they demonstrate in the occupational environment. This research aims to propose the use of systemic thinking as a study strategy in the training of engineers in a business management in a Technological University, through the exploration of a case based on a real problem faced by a Mexican MSME belonging to the graphic arts sector and seeks to address the economic recession caused by the COVID-19 pandemic.

The sample of 33 students is carried out at a university in the state of Mexico, attached to the National Technology of Mexico, in the municipality of Cuautitlan Izcalli, where the Business Management Engineering degree is offered, since due to the student's graduation profile, the aim is to compare the skills acquired to face the demands of the labor environment using the methodology of soft systems and CATWOE.

The results show the importance of using systems thinking as a pedagogical tool in higher education, to prepare the next generation of engineers and face the challenges of an increasingly changing and dynamic environment.

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Adaptation to changes, rapid response to various adversities and the need to innovate and optimize available resources are crucial challenges that companies of all sizes and sectors face today. These challenges intensified starting in 2019 with the arrival of the SARS-CoV-2 pandemic, known as COVID-19, which radically transformed the way business needs are addressed. This change has led to the closing of many companies, especially micro-, small, and medium-sized enterprises (MSMEs), causing a significant increase in layoffs and a decrease in consumption and economic activity in general. MSMEs are vital since they represent more than 90% of companies in most countries and up to 99% in the case of Mexico, generating 70% of employment and assets. Therefore, it is crucial to boost the economy that these economic units support. [1].

One of the fundamental aspects of this new reality is the ability of graduates to efficiently resolve the various situations that companies have. Currently, many growing countries have adopted practices that optimize time, improve interaction with customers and explore new markets, all driven by technology, which has become an indispensable tool in all economic sectors globally [2].

The generic or soft skills that are fundamental in university training and in the industry. Currently, it is not enough to demonstrate technical knowledge; it is essential to develop critical and analytical thinking that allows to understand all the elements of the environment. The challenge lies in motivating engineering students to use their critical and analytical skills to solve problems, constructing states that understand the system and exploring the requirements involved in each situation [3].

II. Literature review

A. Business context

Mexico is the eleventh largest economy in the world in 2020. However, its estimated annual growth has been moderate, reaching just over 2.0% between 1980 and 2018, which has limited progress toward convergence with high-income economies [4]. This panorama means that companies in Mexico encounter various difficulties in developing and maintaining sustained growth. These companies survive in an aggressive and demanding market [5]. It is relevant to highlight that Micro-, Small and Medium-sized Enterprises (MSMEs) have been fundamental for the Mexican economy, contributing almost 50% of GDP. More than 4 169 677 MSMEs are registered, distributed in sectors such as

manufacturing, commerce and non-financial private services [6]. Considering the challenging economic situation triggered by this factor, Mexico's economic resilience will depend on the complexity of its productive structure and the degree of articulation between its economic sectors [7].

The creation and development of a company goes beyond a simple vision It is necessary to establish a strategic framework that allows the infrastructure to be integrated with a strategy that ensures sustainability and positioning in the market, generating value through the fulfillment of its objectives [8]. The organizations acquire and generate knowledge by implementing new techniques, methods, processes, technologies, services and products, which can transform their organizational structure and have impacts on the economic and sociopolitical environments in which they operate. Therefore, it is crucial to start by understanding the internal structure of the company, identifying both its strengths and weaknesses, as well as areas that offer opportunities for improvement [9].

B. Systemic Context: University-Industry

Formal education is meant to empower students to excel in life more efficiently. When it is systemic in each of its aspects like curriculum design, teacher training and work environment, is going to prepare students to face the changing realities of the present times. Monodisciplinary engineering education would be made systemic, to think and excel in practical real-life situations in the most innovative ways possible, for the benefit of students, teachers and their communities. A systemic curriculum would be designed with adequate scope to bridge theory and practice in real-life settings with appropriate use of technology [10].

Systems engineering promotes a vision where each element is part of a broader system, generating interrelated subsystems whose actions have repercussions on each other, based on levels of entropy. In this context, two fundamental open systems stand out: the university and the industry. It is crucial to understand that Systems Thinking acts as an integrator both in the analysis of problems and in the formulation of hypotheses during research. To address the identified problems, the proposed actions must consider all the elements that make up the system structure, as well as their interrelationships with other external elements, the SSM offers a holistic approach to understanding information, allowing the perceptions of the agents involved in the system to be compared [11]. As a holistic approach, in order to address complex, interdisciplinary and real-world problems, STEM (Science, Technology, Engineering and Mathematics) students requires systems thinking [12]. As for engineering education, as well as for STEM, the incorporation of the systemic vision must be supported by a procedure that ensures its use in organizational change. Four frames are stablished for the systemic change, namely structures, symbols, people, and powers thinking [13].

The main methodology refers to the study of soft systems. Characterized by Peter Checkland, its main characteristic is a deep exploration of the requirements of individuals who maintain some type of relationship with the system [14]. From this point, the systemic context allows us to see organizations as living systems that interact with other subsystems, in addition to being constantly changing, this change is related to the levels of entropy that occur within the systems. Systems are like integral wholes, they have an objective reality, they exist in the world, they are found in nature and in society and, furthermore, they are also invented and constructed by man, conceptually and materially through his scientific and technological practices [15].

C. Systemic Thinking and Soft System Methodology

The SSM by Checkland is based on the concept of perspective or *Weltanschauung* in the language of the "worldview" methodology. Weltanschauung represents the own vision of an observer, or group of them, about an object under study, a vision that affects the decisions that the observer can make at a given moment of his actions with the object. The SSM takes as its starting point the idealization of this Weltanschauung to propose changes to the system that in theory should tend to improve its functioning [16]. In his methodology, systems are seen as mental constructions of observers of the world. Different descriptions of reality, based on different worldviews, are embodied in "fundamental definitions." These fundamental definitions become conceptual models that are explicitly one-sided representations of reality that express a particular Weltanschauung. A debate is then structured around the implications of these different perceptions of how things could be [17]. There are different complexities in a system. As the system disintegrates into subsystems, it goes from lower to higher complexity and vice versa: from subsystems to larger systems (or from systems to supersystems), gaining understanding of the whole and the interrelationships between the parts [18]. This representation allows us to see, from a holistic point of view, all the information that is of great importance and that reflects the situation of the company to visualize and understand the problem. A social system is constituted as an integrated network of relationships, a domain of coupling between different autopoietic units that co-realize their organization, cooperate and co-derivate following a course of intertwined structural changes [19].

There are six elements that a root definition should refer to. These are captured in the mnemonic CATWOE as follows:

- "C" Customers: The beneficiaries or victims of the transformation process;
- "A" Actors: Those who would undertake the transformation process;
- "T" Transformation: The conversion of input to output;
- "W" World view: The worldview that makes this transformation meaningful;
- "O" Owners: Those who could stop the transformation;
- "E" Environmental constraints: Elements outside the system that are taken [20].

III. METHODOLOGY

Initially, the financial behavior of a company in the graphic arts sector in the State of Mexico is examined, using the soft systems and CATWOE methodology. This study is based on a comprehensive review of the literature on the application of the soft systems methodology of Peter Checkland and CATWOE. The research is based on a documentary approach that includes the analysis of historical information on the company's sales. In addition, a detailed analysis of sales behavior during the periods 2020-2023 was carried out using the Minitab statistical software. In parallel, the graduation attributes of the engineering degree in Business Management were investigated and a qualitative survey was applied using the Likert scale, validating the instrument with Cronbach's alpha coefficient. In this way, the profile of the engineer was compared with the skills demanded by companies. The Higher Studies Technological University of Cuautitlan Izcalli (TESCI) is part of the National Technological Institute of México (TecNM), which is located northwest of the state of Mexico, created on August 28, 1997, as a decentralized public organization. Based on feasibility studies, the university has an educational offer of nine presential courses, two in distance learning, and two master's degrees. It is worth mentioning that the Business Management Engineering degree emerged in 2008, on the Tamaulipas campus; and in 2009 it opened in Cuautitlan Izcalli, currently, it has an enrollment of 493 students in a presential modality.

The objective of the career is "to have professionals trained to contribute to business management, process innovation, and the design, implementation, and development of strategic business systems. This approach seeks to optimize resources in a global context, promoting ethics and social responsibility" [21].

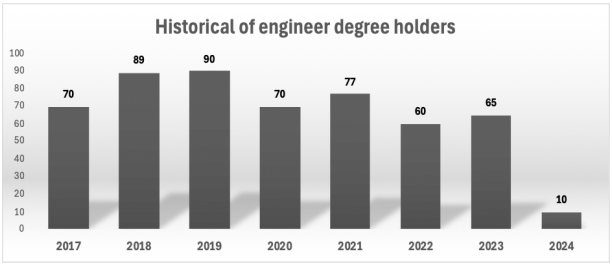

Figure 1. Historical of engineer degree holders. Elaboration based on [18].

The Business Management Engineering degree is structured in four years, distributed over nine semesters. The first seven semesters follow the National Technological Institute of Mexico class, while the eighth semester focuses on specialty classes. The ninth semester is dedicated to completing a professional residency in a company. Fig. 2 illustrates the subjects available in the approved career.

	1° Semester	2° Semester	3° Semester	4° Semester	5° Semester	6° Semester	7° Semester	8° Semester
CLASS	Fundamentals of research	Executive Application Software	Legality of Companies	Economy Engineering	Finance in Organizations	Occupational Health and Safety Administration	Quality Applied to Business Management	Communication and corporate image for Industry 4.0
	Differential Calculus	Integral Calculus	Probability and Descriptive Statistics	Inferential Statistics I	Inferential Statistics II	The Entrepreneur and Innovation	Business Plan	Simulation Models for Decision-Making
	Human Development	Business Accounting	Business Costs	Business Budgeting Instruments	Process Engineering	Production Management I	Production Management II	Quality for competitiveness
	Fundamentals of Business Management	Social Dynamic	Directive Abilities I	Directive Abilities II	Human Capital Management	Organizational Design	Strategic Management	Productivity and the Supply Chain
	Fundamentals of Physic	Ethics Seminar	Business Economy	Macroeconomic Environment	Sustainable Development	Seminar Research I	Seminar Research II	Business sustainability
	Fundamentals of Chemistry	Laboral Legislation	Linear Algebra	Operations Research	Marketing	Marketing Information Systems	Digital Marketing	Formulation and evaluation of projects
	Complementary Activity I	Complementary Activity II	Complementary Activity III	Complementary Activity IV	Complementary Activity V	Supply Chain	Social Service	
	English I and II	English III and IV	English V and VI	English VII and VIII	English IX and X			

Fig. 2. Classes offered at the University [18].

During the first seven semesters, the aim is to work with the graduation profile, based on the 2009 competency model. Each of the subjects seeks to contribute to one of the eight graduation attributes that the future professional will acquire upon graduating from the educational institution.

A detailed analysis of the student's attributes and perception is carried out on the training of the career is designed so that the future engineer is trained with eight graduation attributes, which are distributed in the classes. Below is the distribution of the attributes in each of the subjects. The eighth semester subjects are not considered because they are specialty subjects, which change depending on the generational cohort and changes in the environment, likewise, complementary activities and social service are not considered as part of the attributes, since these They aim to ensure that students form other types of skills, such as sports or cultural skills. Finally, foreign language is a mandatory subject in all campus courses. Each of the taken subjects gives the student skills that form the graduation attribute. Each of the subjects is grouped according to the characteristics of the syllabus, the competencies achieved and the level of complexity, as shown in Table I.

TABLE I.
DISTRIBUTION OF CLASSES WITH EXIT ATTRIBUTES [18].

Egress Attribute	Class	
Detect, design, formulate, propose and manage solutions to engineering problems, applying the principles of Engineering Sciences, for the strengthening and/or innovation of organizations.	▪ Differential Calculus ▪ Integral Calculus ▪ Probability and Descriptive Statistics ▪ Inferential Statistics I	▪ Inferential Statistics II ▪ The Entrepreneur and Innovation ▪ Production Management I ▪ Production Management II
Perform systems modeling for the analysis and interpretation of data in engineering design processes, for continuous improvement within world quality standards.	▪ Business Economy ▪ Economy Engineering ▪ Macroeconomic ▪ Linear Algebra Environment ▪ Process Engineering	▪ Organizational Design ▪ Quality Applied to Business Management ▪ Fundamentals of Business Management
Adequately design applied experimentation models, analysis and interpretation of data; using engineering judgment to obtain objective conclusions.	▪ Fundamentals of Physic ▪ Fundamentals of Chemistry, ▪ Linear Algebra	▪ Operations Research ▪ Suply Chain Strategic Management
Use new IT in the organization to propose and optimize communication processes.	▪ Executive Application Software ▪ Marketing	▪ Marketing Information Systems ▪ Digital Marketing
Manage comprehensive quality systems exercising leadership and ethical commitment, applying basic engineering tools; considering engineering solutions in global, economic, environmental and social contexts.	▪ Fundamentals of Business Management ▪ Directive Abilities I ▪ Directive Abilities II	▪ Ethics Seminar ▪ Sustainable Development
Recognize the permanent need for additional knowledge and could locate, evaluate, integrate and apply this knowledge appropriately.	▪ Fundamentals of research ▪ Legality of Companies	▪ Seminar Research I ▪ Seminar Research II
Integrate, direct and develop work teams for improvement, continuing to analyze risks and uncertainty for the integral growth of organizations.	▪ Social Dynamic ▪ Business Costs ▪ Business Accounting ▪ Business Budgeting Instruments	▪ Finance in Organizations ▪ Finanzas en las organizaciones ▪ Occupational Health and Safety Administration Business Plan
Promote the comprehensive development of human capital that meets the needs of the organization within the global context.	▪ Human Development ▪ Laboral Legislation	▪ Human Capital Management

IV. Results

A survey was carried out using the Likert scale to 33 students, half of them are students who are in specialty degrees, where they have covered subjects that contribute to the development of their analytical thinking, the other half corresponds to graduates no older than one year, to evaluate their perception of graduation skills and attributes.

The results were analyzed using Cronbach's Alpha coefficient, which showed a reliability of 0.60. It is worth mentioning that the instrument included eight questions focused on graduation attributes.

With an average of 3.36, students perceive that they have at least a little idea about knowing how to design, formulate, propose and manage solutions to engineering problems, the majority agree.

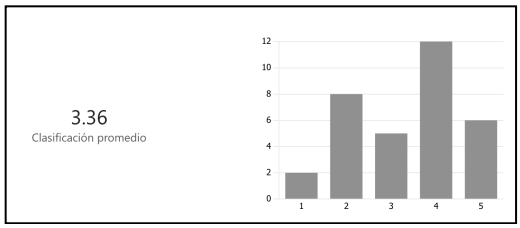

Figure 3. Perception of engineering students about designing, formulating, proposing and managing solutions to engineering problems, Source: Own elaboration (2024).

Regarding the use of standards for continuous improvement within a world-class quality framework, the average was 2.27, where the majority perceived not having knowledge with the application to systems modeling for the analysis and interpretation of data in the processes of engineering design.

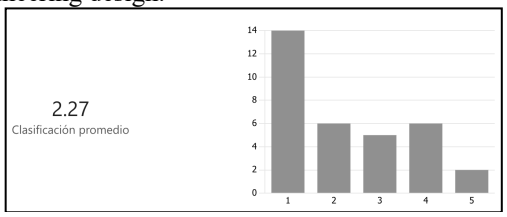

Figure 4. Average result on the use of world quality standards. Source: Own elaboration (2024).

At the same time, questions were asked about how easy it is for respondents to manage comprehensive quality systems by exercising leadership and ethical commitment, applying basic engineering tools.

Considering engineering solutions in global, economic, environmental and social contexts, there is an average of 3.52, which is why the majority of students express that it is difficult for them to address this attribute in their professional activity.

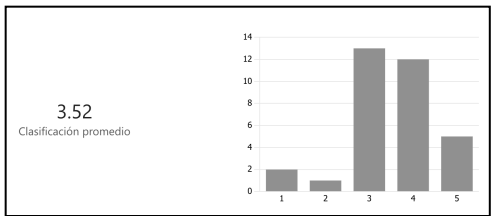

Figure 5. Result of the attribute that measures leadership and comprehensive systems. Source: Own elaboration (2024).

Similarly, one of the items addresses the possibility of having resorted to means other than a career to strengthen skills (courses, certifications, etc.), finding that 88% of respondents stated that they had used additional methods to improve areas of opportunity and professional performance. Regarding the use of technology, 76% of those surveyed perceive adequate mastery to carry out activities that involve the use Information technology. Finally, a diagnosis is made on the sample's perception regarding their soft and hard skills. 25% show interest in improving soft skills such as communication and leadership, while 75% consider it necessary to further strengthen their hard skills, such as knowledge and specialized career techniques.

A. Micro-, Small, and Medium sized Enterprises Context

The case study presents the current situation of a business that in recent years, during the period of the pandemic caused by the COVID-19 virus, from 2019 to 2022, has experienced a notable negative impact on its sales due to incorrect decisions, executed without adequate prior analysis. The effects of the pandemic require, through a bibliographic review, a compilation of the context of this crisis and its effects, especially in the Latin American area, foreseeing medium-term effects such as lower economic growth [22]. This business began as a family workshop more than 40 years ago, currently located in the north of the state of Mexico, in the municipality of Naucalpan de Juárez. An analysis of their financial information was carried out using Minitab software to compare sales trend results. Throughout this period, the company has undergone some modifications in design, personnel, and processes. However, it has not been able to face various situations that have arisen, such as the economy, crime, politics, and technological changes in the region where it is located, which have caused it to work in an unfavorable scenario in the process of its decision-making.

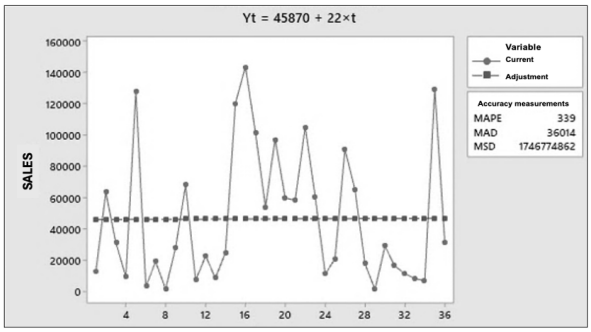

Figure 6. Linear trend model of the company, own elaboration.

This linear trend analysis revealed that MSMEs experience significant fluctuations in their annual income, showing very marked peaks. Although a slight improvement is observed with a MAPE of 339 in Fig. 6, the general trend is stable, with a slight increase driven by a marginal variation rate of 22 Mexican pesos per period. However, this increase, although not negative, is not considerably positive either.

In addition, a diagnosis of the current situation of the company was carried out, thus providing the basis for the application of the soft systems methodology.

Considering that decisions are based more on experience than on the identification of business opportunities, risk prevention or strategy development, it has resulted in significant negative impacts on the company's revenue. A decrease in production capacity, failures in resource management, artisanal processes that are partly obsolete, and ineffective quality systems have been observed. The lack of measurements and controls has left the economic unit in an unfavorable position in the face of the technological and social changes facing Mexico and the rest of the world.

B. Systemic Context: Industry and University

Systems engineering proposes the vision in which every element is part of a larger system, and various subsystems are generated that interrelate with each other, based on their entropy levels, and pointing out that the performance of one has an impact on another. In this way, two open systems can be identified: the university and the industry.

Once the two systems that correlate have been found, it is important to point out that Systemic Thinking is integrative, both in the study of the problems and in the conjectures that arise in the study. Systems engineering proposes the vision in which every element is part of a larger system, and various subsystems are generated that interrelate with each other, calculating their entropy levels, and pointing out that the performance of one has an impact on another [23].

The SSM allows information to be approached from a holistic perspective, thus comparing the perceptions of the agents involved in such system, as in Fig. 4. It begins with the representation of models (stages 1 and 2), following the SSM as a way of "expressing" the broadest image, not of what is considered a "problem" but of the situation where a problem is perceived [24].

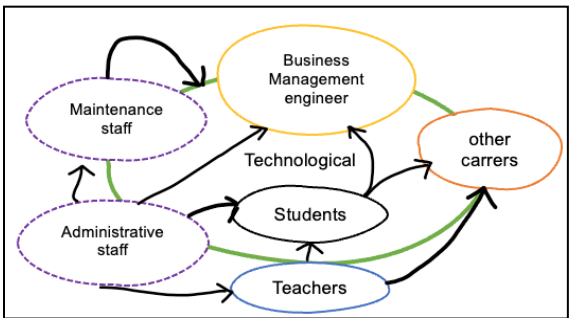

Fig. 5. Representation of the first stage of the SSM of the unstructured problem applied to the university as an internal system. Own elaboration.

As a first step, the stage that represents the current model of the unstructured problem is constructed, which in the case of the university, those involved within the school system, indicated with systems science as an open system, in which other elements called subsystems, in such a way that they can alter the total system. For this study, the following are identified: students, teachers, administrative staff, maintenance staff.

On the other hand, the agents that intervene outside the system are the social community, the industry, other institutions and the government. In this case, the second stage is represented with the systems present within the first system and the identification of its level of entropy, as indicated in Fig. 8.

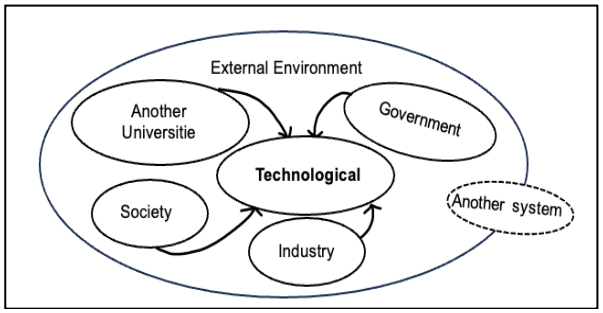

Fig. 6. Model of the university as an open system in the external environment. Own elaboration.

Each of them influences the situation of the company positively or negatively, according to their levels of entropy that each agent or subsystem intervenes in the main one. Now, according to the methodology of soft systems, the possible root cause of the problem is determined, modeled in the three stages where the root definitions are built and verified, which refers to the object of the case study, so it is sought to align them to a "Weltanschauung," or worldview, expressed in six factors (CATWOE). This is shown in Table II.

TABLE II.
CATWOE APPLICATION TO DETERMINE THE ROOT CAUSE.

CATWOE FACTORS	University (TESCI)	Industry (MIPyME)
Customers (C)	Businnes Managment enginering students	Potencial market
Actors (A)	Teachers	Employees
Transformación (T)	Acquisition of new skills using systemic thinking	Improving business decision making with the skills of future engineers
Weltanschauung (W)	Evaluate the new skills obtained from the S.S.M. and systems thinking	Ability to execute alternative solutions to detected problems
Owners (O)	Management levels of the central department of the university	Businessmen
Environmental constraints (E)	Regulations	Mexican laws

According to the methodology, the definition of the conceptual model was developed, where the role that the future engineer plays can be seen in Fig. 9. This is the response to the requirements demanded by growing companies and then establish what are the minimum activities necessary to carry out described by the model. The relationships that must exist between the various activities were also established, resulting in the final conceptual model.

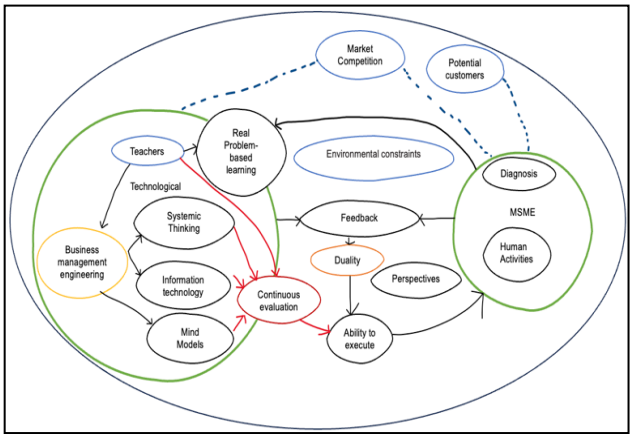

Fig. 7. Final conceptual model of the root definition. Own elaboration.

Various studies indicate the scarcity of programs aimed at developing capabilities in science, technology, and innovation, as well as productive articulation and insertion into value chains. Therefore, the implementation of these activities requires a review of the organization in terms of needs, characteristics, information systems that support business processes, roles and responsibilities of the actors involved in the information systems, as well as the nature of the information handled by them [25]. It is crucial to model potential change scenarios together with relevant actors.

In the context of stage four, conceptual models are defined as objects, which reveal non-systematized and specific activities for each element. In the case of the university system, especially in Business Management Engineering, the restrictions of the environment and competition are identified both in the market and among other possible applicants in the industry. In addition, the subsystems are intended to evolve through continuous feedback, thus preparing future engineers to execute and satisfy the needs of the environment.

Another important point that must be mentioned is that the survival possibilities of MSMEs are greatly reduced due to the limitation of all their resources and many of these are considered *de facto* companies [26], which are the ones that can derive from the noncompliance with the legal mandate required by the constitution, also called irregular companies and which is the current situation of many Mexican companies. This is an area of opportunity, which allows the university to provide the company with engineers capable of addressing dynamic situations, with a high sense of adaptability that can influence various systems and their relationships.

V. DISCUSSION AND CONCLUSIONS

A. *Discussion*

The transformation of the worldview refers to two scenarios in the industry, the first in the sense of continuing to manufacture its products with the same process and the same conditions, since the tendency is to recover the investment, without a large profit margin, but without any tendency to improve. The second is to participate in an open system that allows duality between the university, where it can find the human factor necessary to address the opportunities of the environment and prepare for future adversities will allow having a more appropriate holistic vision to improve the gaps of a small company, such as the analysis of its sales, which although it does have financial and accounting control, there is no relationship between decision making and compliance with internal or external requirements using innovative strategies.

It is important to guarantee the use of tools that favor the insertion of engineers strategically and practically, since they will be responsible for promoting an important sector in Mexico: micro-, small, and medium-sized industries.

Despite the efforts that have been made through the establishment of technical assistance programs for the sector, many difficulties persist that condition its permanence and growth in the market.

When students are trained in systems thinking, their engineering skills increase, due to the generation of better supported solutions according to the problems. Proposals will have to be more effective, while being created in a shorter time. Disciplinary barriers that restrict responses to hackneyed solutions or imported from other contexts would be removed. And the particular opportunities offered by the environment would be taken into account. The results of the engineering activity would be holistic. That is, they would not focus only on the technical or economic performance of the solution, but would simultaneously seek to contribute to the ecological, health and human environment.

B. Conclusion

Some of the problems that were found in the analysis of the company is the deficiency in addressing situations based on an administrative, leadership and decision-making approach with a theoretical basis, so it is important to consider that as it is a business classified as a MSME, being able to transcend using its resources is a slow alternative, so by being willing to consider aligning its activities under a duality with higher level universities, it can take advantage of the innovation of graduate learning and prospect the type of human capital that want to have, reducing training and investment time to provide a series of competencies or attributes that they should possess.

On the other hand, the university requires a particular approach in companies, since, as has been demonstrated, graduates do not feel as strengthened in several of the attributes that the career offers, so this need can be transformed into an opportunity to maintain their constant updating and innovation in study programs, updating students on real problems focused on the complexity of the relationship that exists between systems and their equifinality and synergy, providing the student with better analytical capacity, since, as has already been mentioned, the systemic approach highlights the usefulness of viewing each situation as part of a whole and the interaction it can have when intervening with other types of elements or systems.

It is worth mentioning that this study contributes to the analysis of a system integrated by areas that make up different subsystems and that, by applying the Soft Systems Methodology, it is possible to visualize the elements that compose it and the organizational transformation process required for continuous improvement. On the other hand, it is recommended to structure activities that allow better control over the performance of their functions and promote the perspective of activities that have not yet been able to satisfy demand, as well as look for people with the capacity to evaluate alternatives for strategic change. The limitations of both systems are based mainly on the complexity of the regulations, and the political issue, which falls mainly on the country's educational organizations, and the other hand, the MSME is dedicated to a very specific industrial sector, combined with technological advances and preferences. From the market.

A proposal or alternative is to start with strategic groups, where the specialty of the career begins from the sixth to the eighth semester, so that in the development of their professional residencies they can exercise systemic thinking as an already consolidated strategy, parallel to this, develop this strategy in the dual education that is in contact with the business sector to align objectives systemically.

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