Future scenarios of the metal mechanical. Sector municipality of Tuluá and its area of influence. Horizon 2018 – 2028

Escenarios futuros del sector metalmecánico. Municipio de Tuluá y su zona de influencia. Horizonte 2018-2028

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Abstract

This research article presents an analysis of the strategic perspective of the metal-mechanic sector of the municipality of Tuluá and its area of influence: Andalusia, Bugalagrande, Riofrío, San Pedro, Trujillo, Restrepo, and Yotoco. The purpose of this study revolves around three axes: 1. Identify possible and probable future scenarios for the metal-mechanic sector of the central region of Valle del Cauca; 2. From the identified scenarios, the betting scenario to which the sector should be routed is defined; 3. According to the opinion of experts and key actors, strategies to improve competitiveness in the metal-mechanic sector are determined, seeking to generate a positive impact on the environment of the central region of the Valley and enriching its development for its insertion in the international context This study applies the methodology proposed in the "strategic foresight toolbox" and involves other methods such as governance and uncertainty analysis, as well as sectoral analysis elements, especially those related to productive linkages. This investigation was carried out in two phases: diagnostic and prospective. In the diagnosis, a documentary analysis was carried out, consultation with key actors and experts; applied tools such as brainstorming, the Regnier abacus, structural analysis, and for the design of the scenarios the detailed analysis of the results was used in order to propose the exploratory scenarios and propose the betting scenario, which is focused in a solid formation of human capital.

Keywords: engineering sector; strategy; foresight; governance and uncertainty scenarios Tuluá.

Resumen

Este artículo de investigación presenta un análisis sobre la prospectiva estratégica del sector metalmecánico del municipio de Tuluá y su zona de influencia: Andalucía, Bugalagrande, Riofrío, San Pedro, Trujillo, Restrepo y Yotoco. El propósito de este estudio gira alrededor de tres ejes: 1. Identificar los escenarios de futuro posibles y probables del sector de la metalmecánica de la región central del Valle del Cauca; 2. De los escenarios identificados, se define el escenario apuesta, al cual debe encaminarse el sector; 3. De acuerdo con la opinión de expertos y actores claves, se determinan las estrategias de mejoramiento de la competitividad en el sector metalmecánico, buscando generar un impacto positivo en el entorno de la región central del Valle y enriqueciendo su desarrollo para su inserción en el contexto internacional. Este estudio aplica la metodología propuesta en "la caja de

herramientas de la prospectiva estratégica" e involucra otros métodos como los análisis de gobernabilidad e incertidumbre, así como elementos de análisis sectorial, en especial los relacionados con los encadenamientos productivos. Esta investigación se realizó en dos fases: diagnóstica y prospectiva. En la diagnóstica se llevó un análisis documental, consulta a actores claves y expertos; se aplicaron herramientas como el "brainstorming", el Ábaco de Regnier, análisis estructural, y para el diseño de los escenarios se utilizó el análisis detallado de los resultados con el fin de plantear los escenarios exploratorios y de estos proponer el escenario apuesta, el cual se focaliza en una sólida formación del capital humano

Palabras clave: sector metalmecánico; estrategia; prospectiva; incertidumbre; gobernabilidad; escenarios; Tuluá.

Introductión

In the first place, it is fundamental to identify what the concept of strategy consists of from the point of view of several authors: Ohmae (1985) formulates the essentials of the strategy to create a competitive advantage; without one, the other does not exist. The main purpose of strategic planning is for the company to effectively achieve a competitive and sustainable competitive advantage: "strategic planning offers the construction of the future, even if it is unpredictable" (p.195). For Mintzberg, Ahlstrand, and Lampel, (2008), the strategy is a word that has been taking several turns in the mind of the strategist and that today is used by managers with more self-determination and effect. It is also valued as the apex of managerial activity. These authors suggest that the definition may vary according to the school of strategic thinking with which the strategy is addressed, or as a coherence of behavior over time, which would be assimilated to a pattern. Thus, the strategy can be considered a plan (look to the future) or can be considered a pattern (evaluate past behavior).

According to Godet (1993), the relationship between foresight and strategy is not a product of chance, but the result "of the need and will of some men since the beginning of the eighties". Although the two participate in the same challenge "anticipate acting", their references and praxis are different. The author raises a strong relationship between these two concepts, which are complementary and to achieve success in the process of articulation must "incarnate in everyday reality" and give movement to real collective intelligence. For this reason, for the anticipation to solidify into effective strategic action, these three golden rules (anticipation, appropriation, and action) must be incorporated, vertices of the Greek triangle (Godet, 1993, p. 187).

The uncertainty, as a factor to be taken into account in the anticipation, is increasing. The frequent and abrupt changes of the environment cause a high distrust of the unfolding of future situations in which there is no control over its occurrence. This situation generates that the organization must assume assertive decisions, and it is here when the strategic perspective presents the fundamental tools in order to positively impact the system and this way reduce the effect of uncertainty (little or no control), to increase the level of certainty to the effect of the strategies implemented (Astigarraga, 2016).

On the other hand, a scenario leads to the reflection of multiple points of view of how the organization is going to be conducted and carried out in the future. In the same way, the possibility that situations that are complex to solve can be presented as far as possible, the formulation of the scenario is one of the strategic forms of forecasting. As Baena (2015) states, "For every complex phenomenon there is a multiplicity of futures that move between probable, desirable, undesirable and each one has similar possibilities of realization" (p. 41).

The strategy and the prospective are elements that go hand in hand and its construction responds to duly articulated and cohesive processes that can guarantee to any organization the greatest possible use to act in the most precise way and obtain the best that the environment of the organization can procure.

The perspective provides the possibility of knowing what is the context in which policies, culture, technology, among other internal and external factors of a sector or organization will be developed in the future. The strategy is the map that allows progress to benefit the desirable future. According to Godet and Durance (2011), the action without objective does not make sense and the forecast provokes the action. That is the reason why foresight and strategy are generally inseparable, hence the expression of "strategic foresight". (p.23)

The objective of this study is to design the future scenarios facing the metal-mechanic sector of Tuluá and its influence zone in the horizon of 2018 - 2028, which allows anticipating and preparing the actions, precisely, with lower doses of risk and uncertainty.

To better understand the future situation of this metal-mechanic sector, a study was carried out in some of the companies that provide metal-mechanic solutions; This prospective exercise is based on the analysis and study of the multiple variables that surround the organizations and influence them with greater notoriety, in order to determine potential management scenarios that allow the maximization of the opportunities that the environment facilitates. As proposed by Gándara and Osorio (2017), system futures will depend on the evolution of the interaction of internal variables, as well as on the influence of external variables on them, and even on the influence that internal elements exert on the external elements. In this way, it is necessary to know the organization of today with all its events and what would be expected to be tomorrow from the strategic perspective of its direction (Sanabria, 2005).

According to Godet (1993), the future is not written, it must be built and much of the future moment is a product of past actions. This future is not only explained by past times, but also by the representation of the future that is indicated in the present time. For the author, competitiveness is not ensured by productivity: In addition, quality, and innovation that needs behavior, decision and creativity at each level of the organization are indispensable. For this reason, certainty arises that the main factor of competitiveness and excellence is the human and organizational factors. But how can we better know their changes and prepare them to face the uncertainty generated by the dynamic market, but is it through prospective knowledge of the environment? This is the way to analyze and plan better decisions, avoiding leaving the solutions at random.

The metal-mechanic Industry comprises a diverse set of manufacturing activities that, to a greater or lesser extent, use among its main inputs products of the steel industry and / or its derivatives, applying to them some type of transformation, assembly or repair. Likewise, the electromechanical and electronic branches are part of this industry, which have gained a singular dynamism in recent years with the advancement of technology. The Metal-mechanic Industry constitutes a fundamental link in the productive fabric of a nation. Not only for its technological content and added value but also for its articulation with different industrial sectors. Virtually all countries with advanced industrial development have consolidated metal-mechanic sectors. It provides machinery and key inputs to most economic activities for its reproduction, among them, the manufacturing industry, construction, the automotive complex, mining, and agriculture, among others. It also produces durable consumer goods that are essential for daily life (Unión Industrial Argentina., 2008).

Latin America is the fourth region in the world in the consumption of rolled products with an estimated 70 million tons for 2014. It is estimated that the consumption of rolled products in Latin America reach 72 million tons in 2016 and approaching 80 million tons in 2020. Exports of steel and metal-mechanic products from Colombia have preferential access to the main consumer markets in Latin America and below the average charged to other countries in the region.

The Colombian metal-mechanic industry is one of the most important and promising in the country since it exports more than 363,000 tons per year, which represents about 14 % of national industrial production and 13 % of employment within the industrial GDP. After entering the program in December 2011, the metal-mechanic industry (responsible for the transformation of steel into intermediate goods, such as flat-rolled steel,

pipes, metal structures, and wires, to the development of industrial machinery and goods, such as elevators and boilers), represented by the Fedemetal Chamber of the ANDI, gained a space as a world-class sector with great potential to meet the growing global demand for its products.

The Department of Valle del Cauca is one of the most important regions for the national economy, especially in the Industrial sector, where metal-mechanic companies are located. Valle is only below Antioquia (third place), Bogotá (second place) and Santander (first place), in fourth place with a participation of 12.5 % of the national industrial production. (National Administrative Department of Statistics [DANE], 2015).

In the municipality of Tuluá and its area of influence, it is constituted by a population of 133 establishments in the metal-mechanic sector (See Table 1).

Table 1.

Total companies in the metal-mechanic sector of Tuluá and its area of influence

Número of companies by size	Total companies (2017)	Total manufacturing industries (2017)	Total companies in the metal-mechanic sector. (2018)
Micro	8.972	981	129
Small	327	28	4
Medium	80	10	0
Big	34	10	0
Total	9.413	1.029	133

Source: Chamber of Commerce Tuluá (2018), an adaptation of the authors.

The data in Table 1 correspond to the commercial establishments that have the following economic activities in force in the Uniform International Industrial Classification (ISIC code) and for which said establishments are dedicated to the following metal-mechanical tasks: manufacture of metal products for structural use; manufacture of tanks, tanks, and metal containers, except those used for the packaging or transport of goods; manufacture of steam generators, except hot water boilers for central heating; manufacture of arms and ammunition, forging, pressing, stamping and rolling of metal; powder metallurgy; Treatment and coating of metals; machining; manufacture of cutlery, hand tools, and hardware and manufacture of other metal products n.c.p. (National Administrative Department of Statistics [DANE], 2012). The prospective workshops were conducted with management, administrative and operational personnel linked to companies registered in the Chamber of Commerce; Likewise, suppliers and customers were consulted.

Regarding the behavior of metal-mechanic companies, these economic activities are studied specifically, however, their analysis is in the sector to which they belong and which corresponds to Manufacturing Industries (Chamber of Commerce Tuluá, 2017).

According to the Government of Valle del Cauca (2016), the central region of Valle del Cauca is made up of 13 municipalities, including Tuluá and its area of influence (Andalucia, Bugalagrande, Riofrío, San Pedro, Trujillo, Restrepo, and Yotoco) and It has areas in the Central and Western Cordilleras of varied climates, which make it a potential dialyzer for the performance of various agricultural, manufacturing, livestock, industrial and mining activities, among others. To satisfy market demands, these activities need directly and indirectly from the metal-mechanical production chain in the supply of products that allow the transformation of raw materials or that are part of it; products such as office supplies, tools for the home, hardware, primary machinery, industrial, agricultural, aluminum items, metal packaging, metal furniture, machinery for other industries, among others. This sector stands out for its high potential in products and services, both local and for the national and international market (Servicio Nacional de Aprendizaje SENA, 2012).

It is in this panorama that the formulation and analysis of the prospective of the metal-mechanic sector for the central region of Valle del Cauca become important, through which the current reality and the multiple future reality can be understood to which it can evolve in different ways the sector. However, the Colombian metal-mechanic industry, and especially that of Valle del Cauca, today faces great difficulties that force changes and future challenges. These difficulties are related to global competitiveness, with the use of new materials and new manufacturing processes; Likewise, there is a challenge to the great demands in terms of quality and innovation in new materials that replace metallic materials with others based on graphene (consisting of carbon layers) and plastic, among others (Máttar and Cuervo, 2016).

Added to the above, according to Tofail *et al*., (2018), the strong industries in the United States and about 11 % of the 100 metal-mechanic manufacturing companies, have incorporated 3D printing for mass production of individual parts or integrated products, while it is estimated that 42 % of US companies declared that by 2020 they would use selective laser sintering (SLS), 3D Printers, for a large part of their operations. More companies are expected to continue in the range of thermoplastic and polymeric materials such as lactic acid poly (PLA) or acrylonitrile butadiene styrene (ABS), photosensitive resins, ceramics and can expand to many more metals, ceramics and reinforced thermoplastic composites with carbon nanotubes and biological fibers among many others, which become substitutes for a wide variety of products and metal-mechanic parts.

Methodology

The methodology used for the development of the prospective exercise of the metal-mechanic sector in the municipality of Tuluá and its Influence area is based, generally, on the construction of scenarios. According to Godet (1993), the construction of the scenarios must be formulated under the conditions of relevance, coherence, transparency, and plausibility, looking for them to represent "the reality, destined to illuminate the present action with the light of the possible futures" (p. 18).

In order to achieve the purposes, the current situation of the metal-mechanic sector at the national and regional level was taken as a starting point, to later set the future scenarios and, in this way, formulate the betting scenario and the strategies for its achievement.

The research was developed in two phases: the first, diagnostic and the second, strategic perspective. In the two phases, strategic management tools and prospective tools and methods were used. In Figure 1, the methodological instruments applied throughout the prospective process are presented.

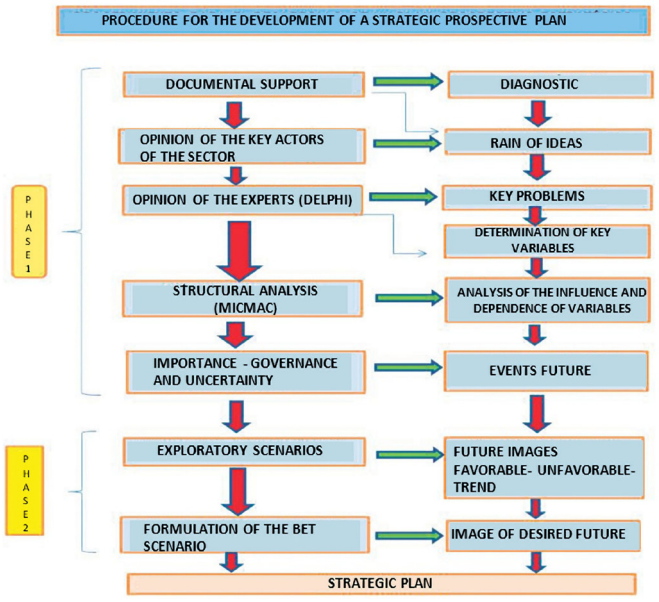

Figure 1. Prospective methodology
Source: authors, adapted by Betancourt (2015).

Fase 1. Diagnóstic Fase

The analysis of the metal-mechanic chain for the municipality of Tuluá and its area of influence (see Figure 2), starts from the concept of the importance of productive linkages for the competitive improvement of a sector: the chains and clusters according to Porter (1999) are "geographical concentrations of interconnected companies, specialized suppliers, service providers, related sector companies and related institutions that compete, but also cooperate" the author also states "a cluster is a geographically dense group of companies and related institutions belonging to, a specific sector united by common and complementary features "(p. 203). It is also convenient to take into account the approach of Pallares (2004), which refers to productive chains or clusters as a set of companies that are directly or indirectly interrelated commercially; Support entities that range from producing and processing firms of raw materials and inputs to those that provide distribution and delivery services to final customers. One of the objectives of this chain is to generate added value, processes of rationalization of costs and create synergies that contribute to having the final products appropriate to the needs of customers and adjusted to the prices they are willing to pay for a product (Betancourt, 2014). For the development of this analysis, we first went to the documentary analysis consulting texts, research and articles about the metal-mechanic sector. Secondly, the sector stakeholders were consulted through brainstorming, with the objective of knowing the variables with which the prospective exercise would be developed. In addition to the above, the Delphi was held or consultation with experts from the metal-mechanic sector, in order to highlight the influence of the experts' opinion and to know some acquiescences in concrete situations of the metal-mechanic sector at the regional and national level, strengthening the contributions in the construction of the results of uncertaiy and governability.

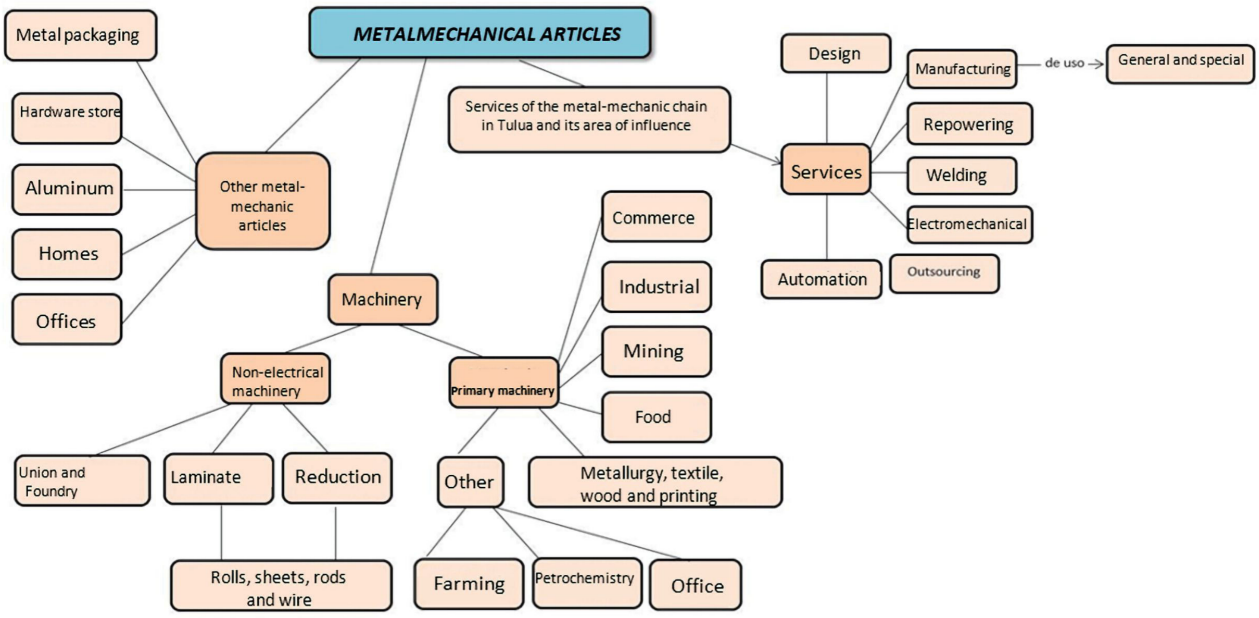

Figure 2. Metallurgical chain of Tuluá and its zone of influence
Source: own elaboration, adapted from metal-mechanic National Department of Planning (2007).

Next, the Regnier Abacus was elaborated, which allowed the revelation and representation of the opinions, as well as the perception of the actors that interact daily with the metal-mechanic environment, on each one of the variables proposed by the brainstorming (Régnier, 1989).

Thirdly, the analysis of motility and dependence was performed using the MICMAC software (Cross-Impact Matrix - Multiplysis Applied to a Classification), in which the direct and indirect relationships between the system variables were identified, to facilitate the analysis of its evolution. (Godet, 2000).

Fourth, the diagnostic phase with the importance and governability analysis (IGO) was closed, a technique that according to Mojica (2005) allows studying the characteristics and conditions of the actions with which the betting scenario is constructed. "With the importance of the relevance of the actions is verified and with governability, the control or domain that the organization has over each one is verified" (p. 275) Through the IGO analysis, the level of management that the system has was determined on the variables, complementing the information with the analysis of the importance and uncertainty (II). The uncertainty, according to Olavarrieta (2011), is defined in the encyclopedic global dictionary on prospective as a state in which there is limited knowledge, in which it is impossible to accurately describe an existing result or a state in the future, or more than one possible result From analysis II, key information was derived to examine the variables of which there was little knowledge as to their impact on the system In the diagnostic phase it is concluded that there is not much clarity about the actions that are undertaken since there is difficulty in formulating forecasts based on them and there is not enough information available for its approach. The results of governance and uncertainty are presented in the IGO matrix and the I.I. (Figures 6 and 7).

Fase 2. Prospective and Strategy

In the first place, the method of scenarios applied in the study of the metal-mechanic sector in the municipality of Tuluá and its area of influence was based on the results obtained in the different perspective techniques applied in phase (1) and recommended by The Authors Godet (2000) in its "box of prospective tools" and by Medina and Ortegón (2006), in its "Manual of prospective and strategic decision". All the previous results provided a broad basis for the construction of scenarios, attempting to provide them with the greatest possible coherence in orderly anticipation that is constituted from the hypotheses and projected on a specific horizon (Gabiña, 1999).

In the second instance, we proceeded to the identification of the scenarios: probable exploratory, three scenarios were formulated the optimist (favorable), the pessimistic (unfavorable) and the trend, later the probabilities of future occurrence were analyzed according to the estimate of the experts and according to the behavior reflected in each of the variables, according to the results of the tools applied in terms of dependence, independence, perception, control, importance, and uncertainty among others. From the above, it was possible to identify the complementary derivations and explore the future scenarios on the metal-mechanic sector in the municipality of Tuluá and its Influence area.

In the third place, the "Bet" scenario was proposed based on the exploratory scenarios (optimistic, pessimistic and trend). Once the results were obtained through the prospective tools, the bet was determined; but also analyzed the favorable, unfavorable and trend consequences envisaged in the exploratory scenarios, in order to define the desired future photography or bet. The prospective process leads to a possible future near future as part of the construction of the most beneficial long-term future. "In perspective, the actions of the present are worked on based on the probable and possible future, without losing a known past and present with relative sufficiency (Miklos and Tello, 2007).

Results of the diagnosis of the metal-mechanic sector

Results of the Brainstorming: the brainstorming, allowed to collect ideas from a group of people that have a wide impact in the metal-mechanic sector, as directors of high and middle hierarchical level of organizations belonging to this sector. A free and vigorous debate was held in order to select the most confluent variables for the metal-mechanic sector, discarding those that were indifferent to the actors involved (Betancourt, 2014). Taking into account the experience of the directors of the companies in their daily occurrence, 25 variables of greater concurrence are considered and generate greater uncertainty both present and future. These variables obtained through the tool are Technology, Research, Infrastructure, Suppliers - Raw Material, Price of Product, Human Capital, Market Segment, Quality, Financing, Management, Legal, International Trade, Strategic Alliances, Innovation, Culture, Politics, Geography, Demography, Environmental Impact, Advertising and Market, Institutions, Competition, Organizational Culture, Labor Climate, and Social Impact.

Results of the DELPHI: for the application of this perspective methodology, interviews were conducted with six professionals who in one way or another were considered experts to give an opinion on the current and future status of the Metal-mechanic sector in the Valle del Cauca region and nationally and internationally. The selection of experts was carried out "according to criteria of experience, position, responsibility, access to information and availability" (Bas, 2002, p. 109). A structured interview was made of 10 questions consistent with the most relevant variables, according to the expert's criteria. The 10 questions are listed below:

1. What are the current and future challenges facing the metal-mechanic sector?

2. How do you see the competitiveness currently in the sector and which ones do you think are the variables with the highest incidence for the development of the same?

3. From your experience, what do you think are the main opportunities and threats of the metal-mechanic sector in Colombia and internationally in the medium and long term?

4. To what strategic factors, the metal-mechanic industry must bet on its human talent and does the sector count on people qualified to face the challenges of this industry?

5. From the competitive point of view, how is the Valle del Cauca compared to the other departments in this sector and which ones are the variables with the highest incidence for the development of the same?

6. When it comes to agreeing on a project, customers in the sector place greater emphasis on price or quality?

7. The financial conditions of the moment facilitate the financial leverage of the sector?

8. How does Free Trade Agreements affect the metal-mechanic sector?

9. How can strategic alliances be used to enter international markets?

10. Regarding the legislation that concerns the Colombian metal-mechanic sector, Do you believe it's favorable or unfavorable for the sector and the employer and why?

In order to know the appreciations of the development of the metal-mechanic sector, the central ideas expressed by the experts were included (see Table2).

Table 2.

DELPHI, Mesh of reading, according to the strength of the idea of the experts

Qstn 1	Answer
1	One of the main challenges is to be able to offer the client low prices, good quality, and on-time delivery. In addition to being able to compete with international actors in relation to the price, since the talent exists and the technologies used are sufficient, this added to the fact that in the country there is abundant quality human talent, even in relation to neighboring countries. One of the biggest problems facing the sector is the low development of technology in the country. It does not stand out for focusing efforts on the development of technology that enhances metal-mechanic.

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	Technology is understood as innovative and massive solutions for solving structural problems in society that allow progress in national strategies that promote the selective protection of domestic companies and especially of products that the country has the capacity to produce Safeguards for the sector, anti-dumping measures, selective tariffs, state purchases and subsidies must be taken into account for the promotion of a public policy that is a central axis in the defense of national production, without neglecting quality. Because the international standards that are required at the level of aspects such as welding, structural requirements must be certified, that is, guarantee safety, safety and durability, and this is done under standardized processes and/or certificates, and at this point, Colombia is very incipient in terms of standards and personnel with qualified skills.
2	The competitiveness of the country is high and there is a lot of technology to promote more development, the elements of greater incidence to keep growing are either in the establishment of trade policies between the guild not to compete with the price, or in the fact of finding values for the lower provision than the current one. The competitiveness in this sector is still growing. Even though efforts have been made; At the level of some institutions, work has been done in the development of labor competencies. No exclusive development plans have been executed in this sector that dynamize it and place it in a competitive position at the local and national level. The variables that most affect are quality, qualified personnel, interinstitutional support, absence of a sectoral development plan, public policies that promote and invest in the sector, the exchange factor also considerably affects the competitiveness of the metalworking sector.
3	The threats of the sector are: the great technology and machining mega centers existing in Asian countries where labor is very low and the strengths of Colombia are its versatility and its great capacity to work in reconstructive processes, things that are not They can be made in continuous production lines or with CNC equipment for the repair and reconstruction of machinery. The most notable threat lies in those international competitors that can offer more economic, a case, in particular, is the large structures that arrive through the port of Buenaventura, especially coming from Korea and India, most notably in India, because apparently, their economic labor provides the possibility of obtaining these more economical elements. In terms of opportunities, the economic opening is a factor that can be well exploited so that the local and national industry becomes known. Another opportunity is the construction sector since previously the constructions were made on concrete, now the new constructions are made on metal structures, this new modality must be exploited and enhanced by the metal-mechanic sector to leverage its sector since it is well known, construction in Colombia is one of the most important sectors that stimulate the Colombian economy and that moves points in the GDP.
4	Strengthen work methods, optimize work equipment and train in greater use of tools and cutting speeds to speed up machining times. Bet on designing solutions to massive needs. This considers investing in innovation and increasing tolerance to error. We must as an industry take more risks so that the sector looks more dynamic and oriented to develop value. In the future, it would be aimed at having people trained in cutting-edge technologies, electronic engineers and engineers in the steel industry, technical and professional bilingualism and everything that has to do with innovation, and training people at a technical level aimed at the development of what it can be produced within the chain of subsectors of the metal-mechanic sector; what is called "chaining forward and backward".

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5	Given the number of mills, the stronghold in the Valley is metal-mechanic aimed at Agro-industry. We are strong in that sense, a lot of machinery and products are exported to other countries, especially Central and South America. The Department of Valle in front of Antioquia and in front of Cundinamarca presents a delay in terms of the size and size of the metal mechanic industry. This stagnation is because our industry is focused on large parts and spare parts for the sugar industry, while in the aforementioned departments have production centers more tending to what has competition in online manufacturing and advanced CNC technologies. Another important point of the region is the sophistication and diversification of production and exports pillars of long-term growth. In Valle del Cauca there is not a complete and dynamic development plan of the sector, there is a lack of a north where the actions must be directed. These actions are not linked to a sectoral table that endorses and supports the sector. In the Valley, there is a low culture of associativity. Valle del Cauca is missing more union for the sector to meet and formulate and implement the development plan that aggregates SMEs and large industry so that the metal-mechanic sector is competitive.
6	In the field of metal mechanics both factors are relevant, what should form the package of services is high quality, high precision and low cost, the three alternatives are essential to establish a market strategy in the sector. For the industrial sector it is important to have a balance between quality and price, precisely because of the FTAs that have made many multinationals take over the sector, capital companies (Argentine, Mexican and Brazilian). A thorough review must be made to the subsectors of the productive chain, because it is this sector that most develops the countries, due to the integration of the sectors that it shelters (transport construction, communications) and the subsectors involved.
7	Leverage and credits are currently at a high cost and support is scarce with soft loans and downtime for the metal-mechanic industry to advance and grow in the country. Although you should not ignore some institutions that support not only the metal-mechanic sector but other sectors, among them are: Proexport, Fondo Emprender, Bancoldex, government-level programs such as Marca País. The IDB Group Inter-American Development Bank offers direct financing and technical assistance to small and medium-sized enterprises (SMEs) in its 26 borrowing member countries in Latin America and the Caribbean. We also support financial institutions to extend the granting of loans to small and medium enterprises, as well as projects that encourage and strengthen the development of SMEs.
8	We are deeply affected by the low labor costs and high technologies applied in the machining service that industrialized countries have, which is why it is necessary to strengthen our production systems and machining centers to match the development gap technological. However, the FTAs should be seen as an opportunity to strengthen the sector and make known the products developed in this industry and be used for Colombia to do business internationally.
9	You can merge companies in the sector. For example, Valle del Cauca with companies in Antioquia where there is more training or other areas that can carry out greater innovation or quality. Another strategy is to set up high-tech machining centers in the free zones, to produce and this must go hand in hand with the steel company so that it can prosper in terms of machining and industrialization; There must necessarily be Source and the Sources are the steelmakers to produce parts in series that is what allows the creation of new work fronts and new production lines.
10	Very unfavorable, due to the credits and the amount of Rules that must be met. It is much more expensive to sustain all these legal variables than to produce products for the sector

Source. DELPHI, Mesh of reading, according to the strength of the idea of the experts.

MIC-MAC results (Structural analysis). The structural analysis is one of the starting points of this prospective study, this method offers the possibility of describing a system with the help of Cartesian matrices which relates all its constituent elements. One of the central objectives is to make visible the main influential and dependent variables, and therefore the essential variables of the system studied with the help of tables and graphs, which allow the modeling of the problem to be addressed. This is a structuring tool for collective reflection, which is carried out with the help of the Lipsor software from the toolbox of strategic foresight (Godet, 2000).

Technically, the application of the tool provides a qualification in a vertical and horizontal way (see Tables 3 and 4).

Table 3.

Qualification of motor skills and dependence

Variables	Mic Mac Application	
	Motricity	Dependence
1. Technology	High	High
2. Investigation	High	High
3. Infrastructure	High	Low
4. Provides raw material	High	Low
5. Price of the product	High	Low
6. Human capital	High	High
7. Market segment	High	Low
8. Quality	High	High
9. Financing	High	Low
10. Direction	High	Low
11. Juridical	Low	Low
12. International Trade	High	Low
13. Strategic alliances	High	Low
14. Innovation	High	High
15. Culture	High	Low
16. Politics	Low	Low
17. Geography	High	Low
18. Demography	Low	Low
19. Environmental impact	High	Low
20. Advertising and market	High	Low
21. Institutions	High	Low
22. Competition	High	Low
23. Organizational culture	High	Low
24. Working environment	High	High
25. Social impact	Low	Low

Source: the authors.

Table 4.

Variable qualification matrix

	1: Tech	2: Inves	3: Infrastr	4: raw-mat	5: Pre-pro	6: Hum-cap	7: Mer-seg	8: Qua	9: Finan	10: Direcc	11: Jurid	12: Inter-com	13: Strat-Allia	14: Innova	15: Cult	16: Politic	17: Geograf	18: Demograf	19: Envirom	20: Publi-Mer	21: Institu	22: Compet	23: Org-cult	24: Work-env	25: Soc-Imp
1: Tech	0	3	3	2	3	3	2	3	P	0	0	3	2	3	0	2	0	0	2	3	0	3	2	1	2
2: Inves	3	0	1	3	2	3	3	3	1	3	1	3	2	3	2	2	1	P	3	P	1	3	3	3	2
3: Infrastr	2	P	0	1	1	1	3	2	P	2	0	3	2	0	2	0	0	1	2	P	2	3	3	2	0
4: Raw-mat	3	3	0	3	3	2	3	3	3	2	1	3	2	3	2	0	1	0	P	2	2	3	0	0	0
5: Pre-pro	3	2	2	0	0	3	3	3	P	2	0	3	3	1	0	0	0	0	2	P	1	3	3	3	0
6: Hum-cap	2	3	2	3	3	0	1	3	2	3	2	3	0	3	3	0	0	1	2	P	0	P	3	3	2
7: Mer-seg	3	3	3	3	3	3	0	3	3	3	3	3	2	3	0	0	0	0	2	3	2	3	3	2	2
8: Qua	3	3	3	3	3	3	3	0	2	3	2	3	3	0	1	0	0	0	2	3	0	3	2	2	0
9: Finan	3	3	2	3	3	3	2	2	0	3	1	3	2	3	0	0	1	1	2	3	2	2	3	2	0
10: Direcc	3	3	3	2	2	3	3	3	3	0	2	3	3	3	1	2	1	1	3	3	2	3	3	3	2
11: Jurid	0	2	1	2	2	3	3	1	1	3	0	3	2	1	0	0	0	0	3	2	3	2	3	3	0
12: Inter-com	3	3	3	3	3	2	3	3	P	3	3	0	2	3	2	3	2	2	2	2	0	3	P	1	1
13: Strat-alli	P	1	P	2	2	0	3	3	1	3	2	P	0	P	1	1	2	1	1	2	1	3	1	1	0
14: Innova	3	3	3	3	3	3	3	3	3	3	1	3	3	0	0	0	0	1	2	3	1	3	3	2	2
15: Cult	2	0	0	1	1	3	0	2	0	2	0	2	1	0	0	1	3	1	2	2	1	2	3	0	1
16: Politic	0	0	0	2	2	0	1	0	1	2	2	3	0	0	0	0	1	0	1	0	2	0	0	0	0
17: Geograf	0	0	2	3	3	2	3	0	1	P	0	3	3	0	P	0	0	1	2	2	0	3	2	1	0
18: Demograf	0	0	0	0	0	2	2	0	0	2	0	P	0	P	0	0	0	0	3	2	0	1	0	0	1
19: Envirom	3	P	1	P	P	2	2	3	1	2	3	3	1	3	2	0	0	0	0	P	3	P	3	1	3
20: Publi-Mer	P	3	2	3	3	0	3	P	0	3	1	P	1	3	1	0	2	0	0	0	1	3	3	1	2
21: Institu	0	0	3	0	0	3	1	1	2	3	3	2	1	1	0	0	1	0	1	0	0	1	0	0	1
22: Compet	3	3	P	3	3	P	3	3	0	3	0	3	3	P	0	0	2	0	3	3	0	0	0	0	0
23: Org-cult	2	3	1	P	P	3	P	P	1	0	3	P	0	P	2	0	0	0	3	P	1	3	0	3	1
24: Work-env	2	3	2	2	2	3	1	3	2	3	0	2	0	P	2	0	0	0	0	2	0	P	3	0	2
25: Soc-Impac	2	2	2	0	0	3	0	2	0	0	0	2	0	3	3	0	0	2	3	3	2	3	2	3	0

Ponderación: 3 Strong; 2 medium; 1 Weak; 0 Null

Source: the authors.

The direct influence of the MICMAC is observed in the results (see Figure 3)

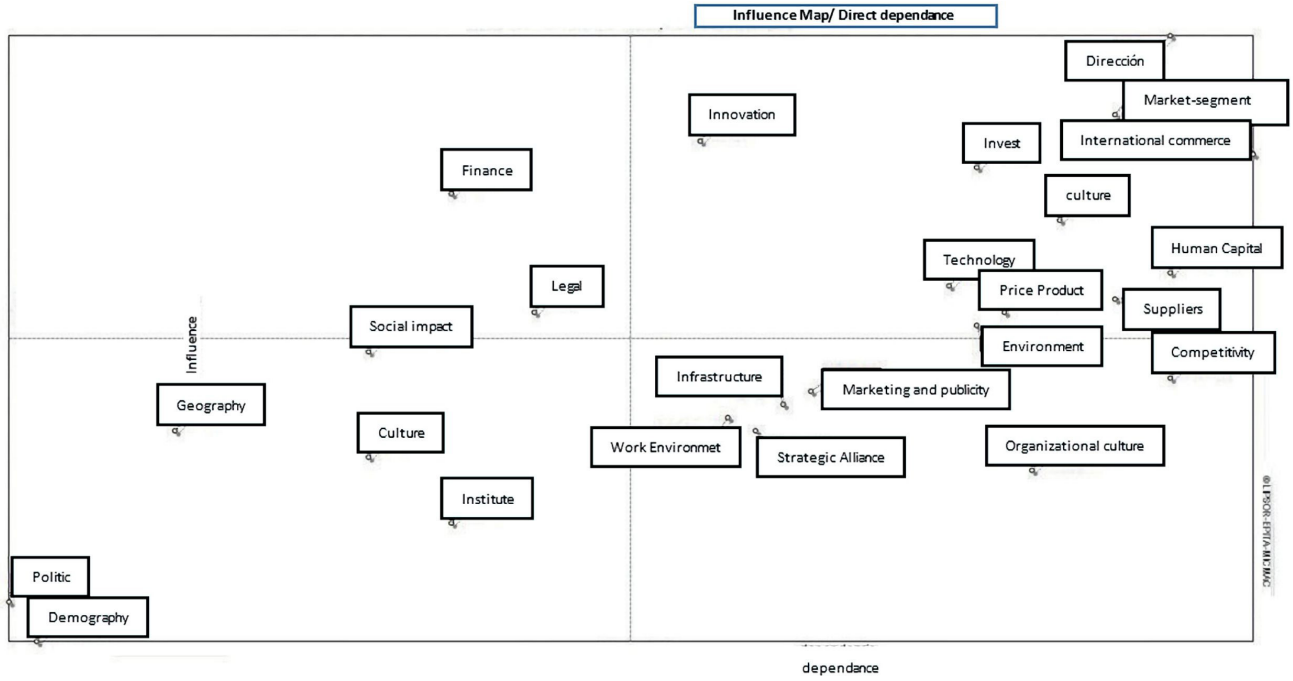


Figure 3. Direct influence map
Source: the authors.

Analysis of the direct influence

The results show that the financing and legal variables are in the segment of greatest influence (power area), this means that these variables affect the others, in the sense that each project undertaken for the metal-mechanic sector in the municipality of Tuluá and its area of influence requires financial planning to meet the requirements of new clients.

In the exit zone with low mobility and high dependence are the variables of work climate, advertising and marketing, strategic alliance, infrastructure, organizational culture and competition, which are influenced by the variables of the conflict zone since they depend on the current management style of companies in the sector, being equally affected by the variables of innovation, research, quality, and technology.

Changes of continuous improvement are currently being implemented in order to solve problems related to the process of transformation of raw materials and their offer to the final customer, where the variables intervene: human capital, market segment, product price, raw material, international trade, and environmental impact. The labor factor (qualified operational labor force) must be taken into account in the implementation of new services and higher quality products for the business segment.

In the area of autonomous problems or false variables, the environmental variables were presented, which are highly influenced by factors external to the organization: politics, demography, geography, culture, social impact, institutions.

In the graph, you can see that demography is a variable that affects some companies that are dedicated to providing the service directly to the consumer, but that is of little relevance for companies that specialize in the design and manufacture of raw materials in the sector since some of the potential customers are large companies in the industrial sector. This variable is only moderately affected by other variables because as changes occur in the market segment, production needs to increase and this, in turn, will require more frequent services from metal-mechanic companies (See Figure 4).

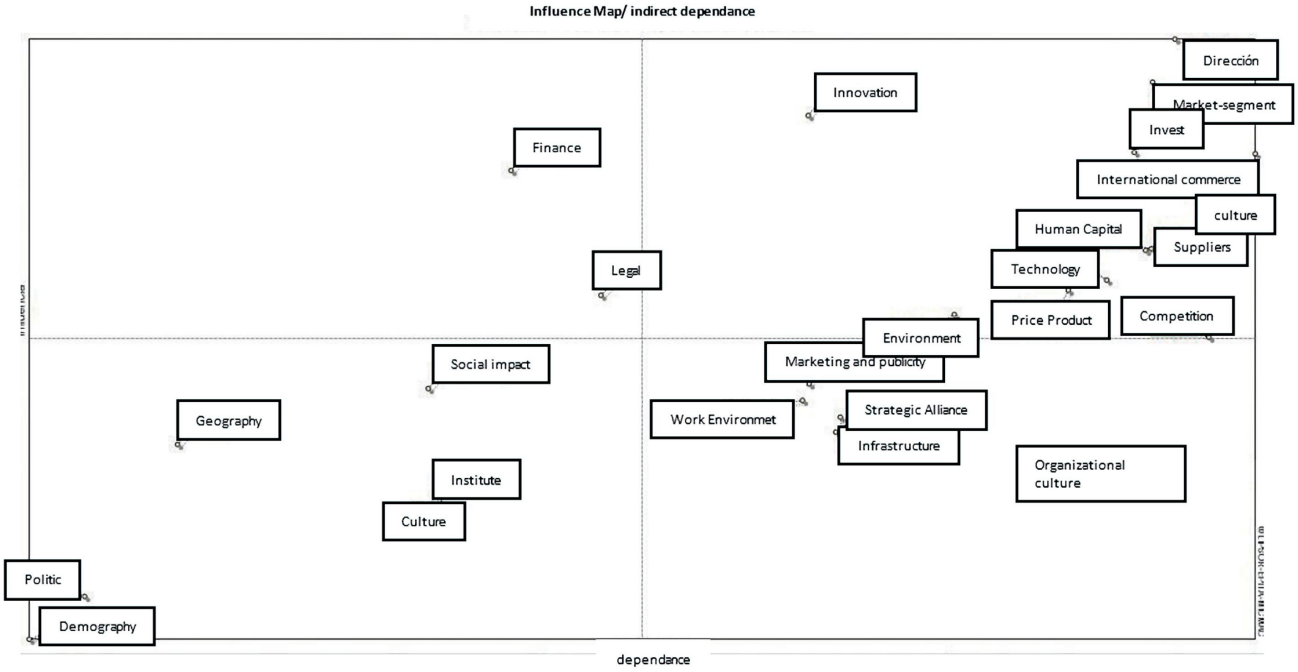


Figure 4. Indirect Influence Map
Source: the authors.

Analysis of indirect influence

In this map we can find the variables that had greater mobility within their area: the organizational culture, which acquires a little dynamism, gaining more power, but remains within the area of autonomous problems. The competition, which was on the map of direct influence in the area of departure, later acquires more influence located in the conflict zone. The international trade variable decreases its dependence and the variable segment of the market acquires mobility towards the power zone, this means that it increases its motricity. In contrast, the research, quality and technology variables lose dependence within their area. The legal variable moves within its same power zone with a tendency toward the conflict zone, this indicates that it continues to have a great influence on the others, but without losing sight of the fact that indirectly they will be influenced by other variables.

In the conflict zone, we can also identify the innovation variable, which is losing independence because its tendency is to move away from the power zone. Within the same area of autonomous problems, we observe that the social impact variable is mobilized, which moves away from the power zone, losing influence over the others and the political variable, which moves towards the exit zone, losing dependency.

Abacus by Regnier

The results obtained by the Regnier abacus for companies in the Metal-mechanic sector are presented below, according to the consultation made to the actors. In Table 5, the results of the present situation are shown, according to the qualification made by the actors and that result in the abacus presented in Table 6. In Table 7, the results of the future situation are observed, according to the perception of the actors and that result in the abacus that is presented in Table 8.

Table 5.
Results of the present situation according to the consultation of the actors

How do you think that the following variables reflect the current situation of companies in the mechanic mechanical sector nowadays?

- Very favorably or positively: 5
- Favorably or positively: 4
- Between favorable and unfavorable: 3
- Unfavorably or negatively: 2
- Very unfavorable or very negatively: 1

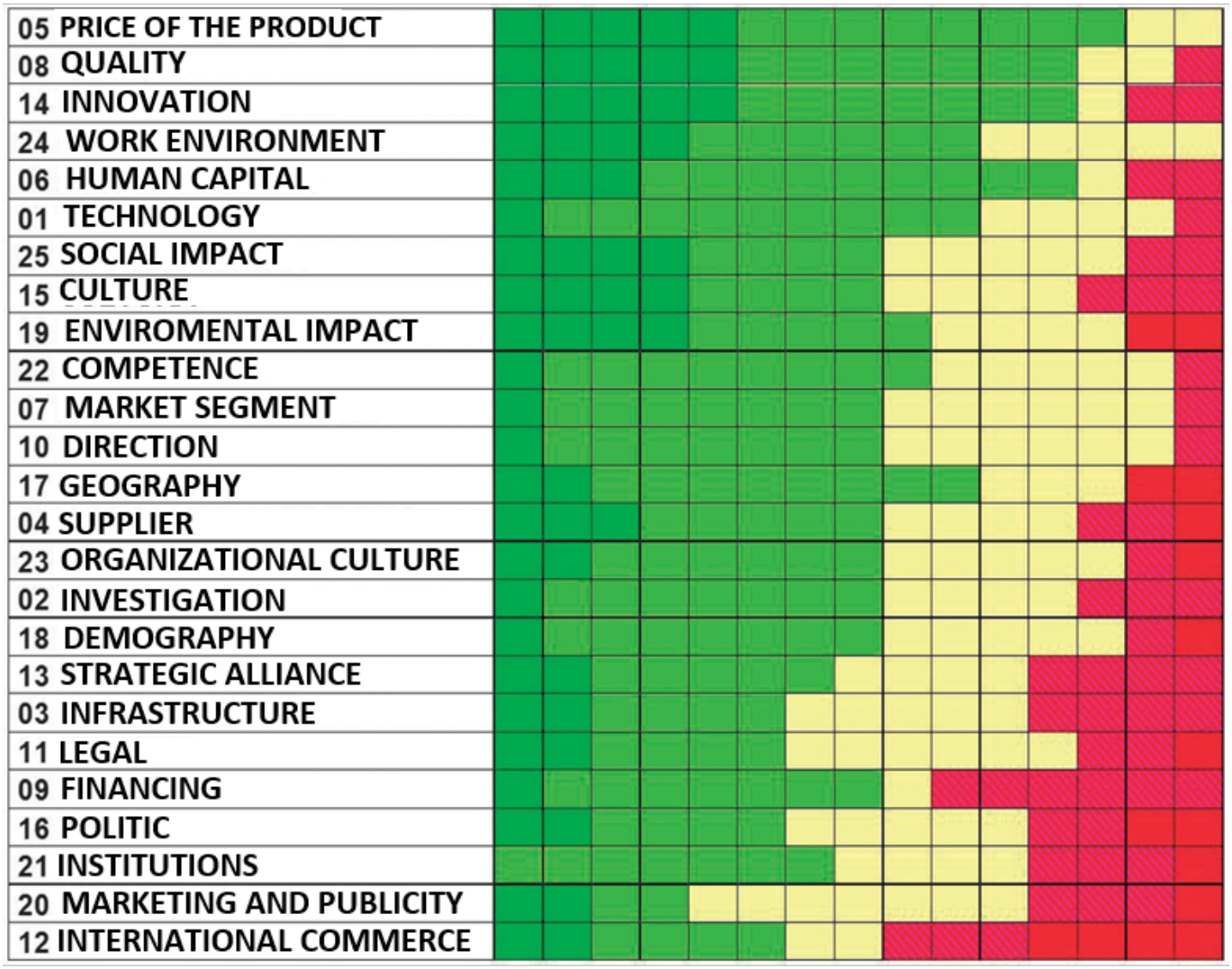
Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Actors															
1. Technology	4	3	4	4	4	3	4	4	3	3	4	4	4	5	2
2. Investigation	3	3	4	5	4	4	4	4	2	3	2	4	3	4	2
3. Infrastructure	3	3	5	4	3	5	2	4	2	2	3	4	4	2	3
4. Provide-Raw Material	4	4	5	5	3	3	3	4	3	2	4	5	2	1	4
5. Price of the product	4	4	5	5	5	4	3	5	4	4	3	5	4	4	4
6. Human capital	4	4	4	4	4	4	5	5	3	4	4	5	4	2	2
7. Market segment	3	4	4	4	4	3	4	4	4	3	3	5	3	3	2
8. Quality	3	4	5	5	5	4	2	4	5	4	4	5	4	3	4
9. Financing	3	4	5	4	4	4	2	4	2	2	2	4	4	2	2
10. Direction	3	4	4	4	4	3	2	4	3	4	3	5	4	3	3
11. Juridical	3	3	4	4	5	3	3	4	1	3	2	5	4	2	3
12. International trade	2	3	4	5	4	3	5	4	1	2	1	4	2	1	1
13. Strategic alliances	2	4	5	5	4	3	3	4	2	3	2	4	4	2	3
14. Innovation	4	4	5	5	4	5	5	4	4	3	4	4	5	2	2
15. Culture	4	4	4	5	5	3	3	5	2	3	2	5	4	2	3
16. Politics	3	3	4	4	4	3	2	5	2	3	1	5	4	1	3
17. Geography	4	3	4	4	5	3	3	4	4	4	1	5	4	1	4
18. Demography	3	3	4	4	4	3	2	4	3	4	3	5	4	1	4
19. Environmental impact	1	3	5	5	4	3	4	4	4	3	3	5	5	1	4
20. Advertising and marketing	1	3	5	5	3	2	3	4	2	2	3	4	3	3	3
21. Institutions	1	3	4	4	4	3	2	4	3	4	2	4	4	2	3
22. Competition	3	4	4	5	4	4	3	4	2	4	3	4	3	3	4
23. Organizational culture	4	4	4	5	5	3	3	4	2	3	3	4	4	1	3
24. Work environment	4	4	5	4	5	3	3	4	3	4	3	5	5	4	3
25. Social Impact	4	3	5	5	5	3	3	4	2	3	2	5	4	3	4

Source: the authors.

Table 6.
Regnier abacus showing the results of the present

Perception of the present

Muy Favorable	5
Favorable	4
Duda	3
Desfavorable	2
Muy Desfavorable	1



Source: the authors.

Table 7.
Future results according to the consultation of the actors

How do you think that each of the following variables reflects the current situation of companies in the metal-mechanic sector, will they have a positive or negative impact over the next 10 years?

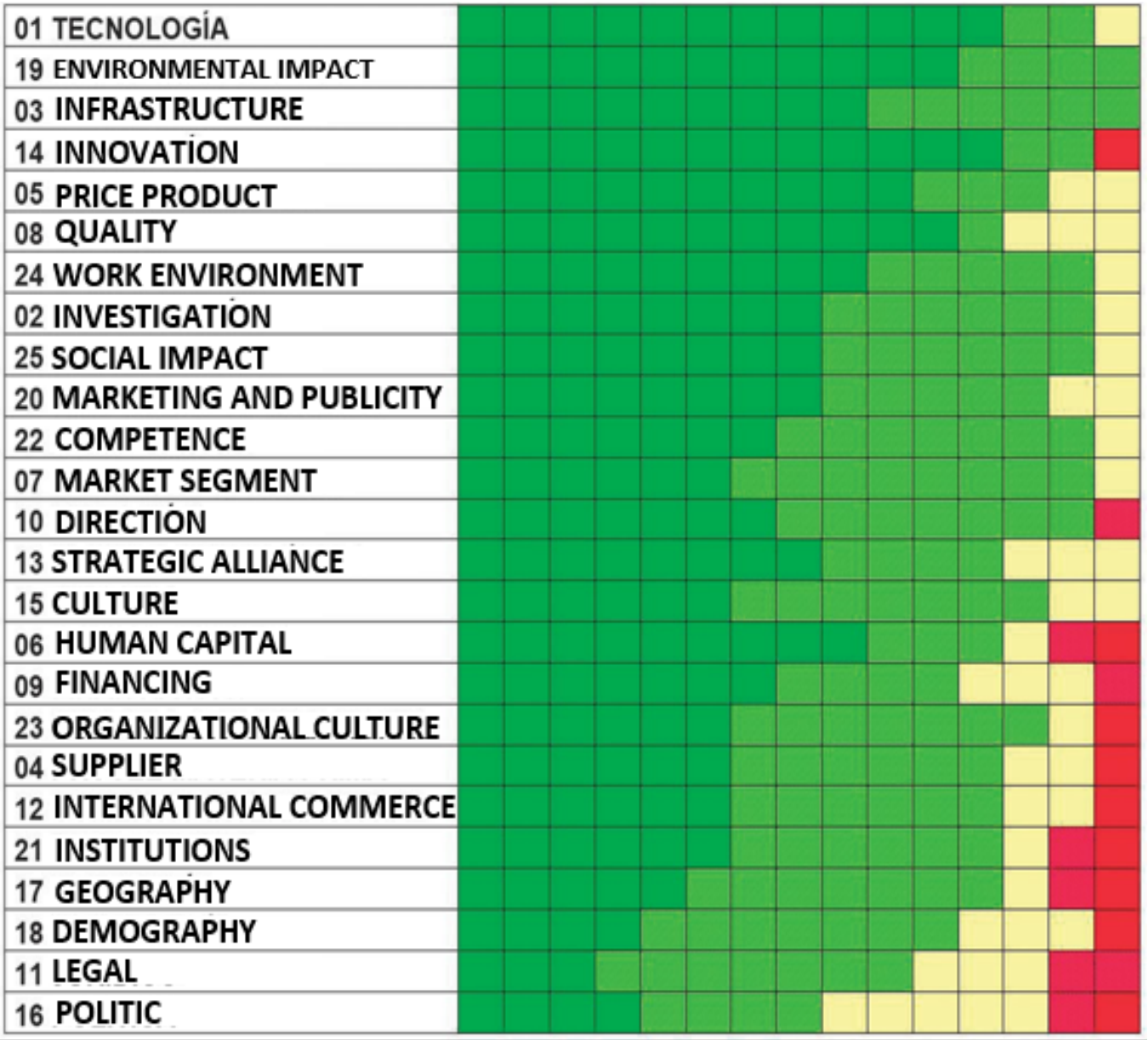
Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Actors															
1. Technology	5	5	5	5	5	4	5	5	4	5	5	5	5	5	3
2. Investigation	4	4	4	5	5	5	5	5	4	5	4	5	5	4	3
3. Infrastructure	4	4	5	5	5	5	4	5	5	5	4	5	5	4	4
4. Provide-Raw Material	4	5	5	4	5	4	3	5	5	4	4	5	5	1	4
5. Price of the product	5	4	5	5	5	5	3	5	5	5	4	5	5	4	3
6. Human capital	4	5	4	4	5	5	2	5	5	5	5	5	5	1	3
7. Market segment	4	4	4	4	5	4	4	5	5	5	4	5	5	3	4
8. Quality	4	5	5	5	5	5	3	5	5	5	5	5	5	3	3
9. Financing	4	5	5	4	5	5	3	5	3	5	3	5	4	2	4
10. Direction	4	5	5	4	5	4	2	5	5	5	4	5	4	4	4
11. Juridical	4	4	4	4	5	3	3	4	3	5	4	5	4	2	2
12. International trade	4	4	5	5	5	4	4	5	3	5	3	5	4	1	4
13. Strategic alliances	4	5	5	5	5	4	4	5	3	5	4	5	5	3	3
14. Innovation	5	4	5	5	5	5	5	5	5	5	5	5	5	1	4
15. Culture	4	4	4	5	5	3	3	5	4	5	4	5	5	4	4
16. Politics	3	3	4	3	5	3	3	5	4	5	2	5	4	1	4
17. Geography	5	3	4	4	5	4	4	4	5	5	2	5	4	1	4
18. Demography	4	3	4	5	5	3	3	4	4	5	4	5	4	1	4
19. Environmental impact	4	4	5	5	5	4	5	5	5	5	5	5	5	5	4
20. Advertising and marketing	4	4	5	5	5	3	4	5	4	5	5	5	5	3	4
21. Institutions	4	4	5	5	5	3	2	5	4	5	4	5	4	1	4
22. Competition	4	4	4	5	5	4	3	5	5	5	4	5	5	4	4
23. Organizational culture	4	5	4	5	5	4	3	5	4	5	4	5	4	1	4
24.Work environment	5	5	5	4	5	4	3	5	5	5	4	5	5	4	4
25. Social Impact	4	4	5	5	5	4	4	5	5	5	4	5	5	4	3

Source: the authors.

The results obtained by the Abacus against the perception of the future are shown below (see Table 8).

Table 8.
Regnier abacus showing the results of the future

Perception of the future



Source: the authors.

The weighting of present and future results (see Tables 9 and 10).

Table 9.

Of optimistic results, both of the present and the future

Variable	Operation	Result
05 PRODUCT PRICE	25 + 5	30
14 INNOVATION	15 + 10	25
01 TECHNOLOGY	25 + 0	25
08 QUALITY	20 + 0	20
19 ENVIRONMENTAL IMPACT	20 + 0	20
03 INFRASTRUCTURE	15 + 0	25
24 LABOR CLIMATE	10 + 0	10
06 HUMAN CAPITAL	5 + 0	5

Source: the authors.

Table 10.

The weighting of negative results, both of the present and the future

Variable	Operation	Result
21 INSTITUTIONS	(-15) – (-25)	-40
12 INTERNATIONAL TRADE	-25 + 0	-25
20 ADVERTISING AND MARKETING	-20 + 0	-20
17 GEOGRAPHY	-20 + 0	-20
18 DEMOGRAPHY	-15 + 0	-15
16 POLITICS	(-10) (-5)	-15
11 LEGAL	-10 + 0	-10
09 FINANCING	-5 + 0	-5

Source: the authors.

Pictogram Results of Regnie's Abacus (see Figure 5).

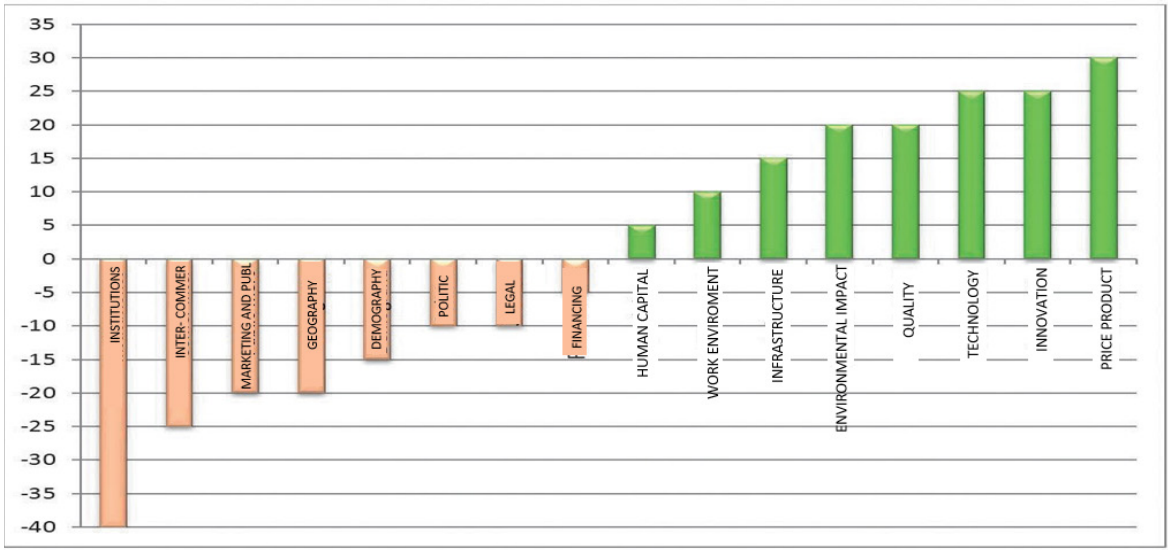


Figure 5. Pictogram with extrapolation of negative and positive trends according to Regnier's abacuses of both the present and the future

Source: the authors.

Abacus analysis: as shown in Figure 6, the qualification of the survey by the actors is very optimistic: the internal actors perceive a stable and warm environment, in which they show a good working environment, a good development of innovation, considering their very positive social impact, especially that observed in the same families of employees who work for the metal-mechanic industry. In general, the perception of the stability of companies is optimistic, although the actors who are in the intermediate and operational level do not negotiate with medium and large companies, they perceive that prices, quality, technology, and innovation are aggregated values by which companies in the sector are able to compete with others from different regions of the country and even with international companies. They see the ubiquity as a negative factor since they feel little accompaniment from institutions such as the Chamber of Commerce, Sena, among others since from their point of view, these are strong in the capital city of Valle del Cauca (Cali).

IGO (importance - governance): next, Table 11 will show, in which the actors rated the importance and governability for each variable. It was rated on a scale of 1 - 5 where 1 is the lowest value and 5 the highest value.

Table 11.
IGO Classification

Variables	Governance X	Importance Y
1. Technology	4	10
2. Investigation	8	9
3. Infrastructure	7	7
4. Provides raw material	8	9
5. Price of the product	5	7
6. Human capital	8	8
7. Market segment	-8	2
8. Quality	10	10
9. Financing	5	10
10. Direction	10	10
11. Juridical	-10	5
12. International Trade	-2	-2
13. Strategic alliances	10	8
14. Innovation	8	7
15. Culture	-9	-4
16. Politics	-7	2
17. Geography	8	8
18. Demography	-10	1
19. Environmental impact	8	5
20. Advertising and market	9	2
21. I nstitutions	8	9
22. Competition	-9	7
23. Organizational culture	6	10
24. Work environment	6	8
25. Social impact	8	5

Source: the authors.

Classification IGO matrix (see Figure 6).

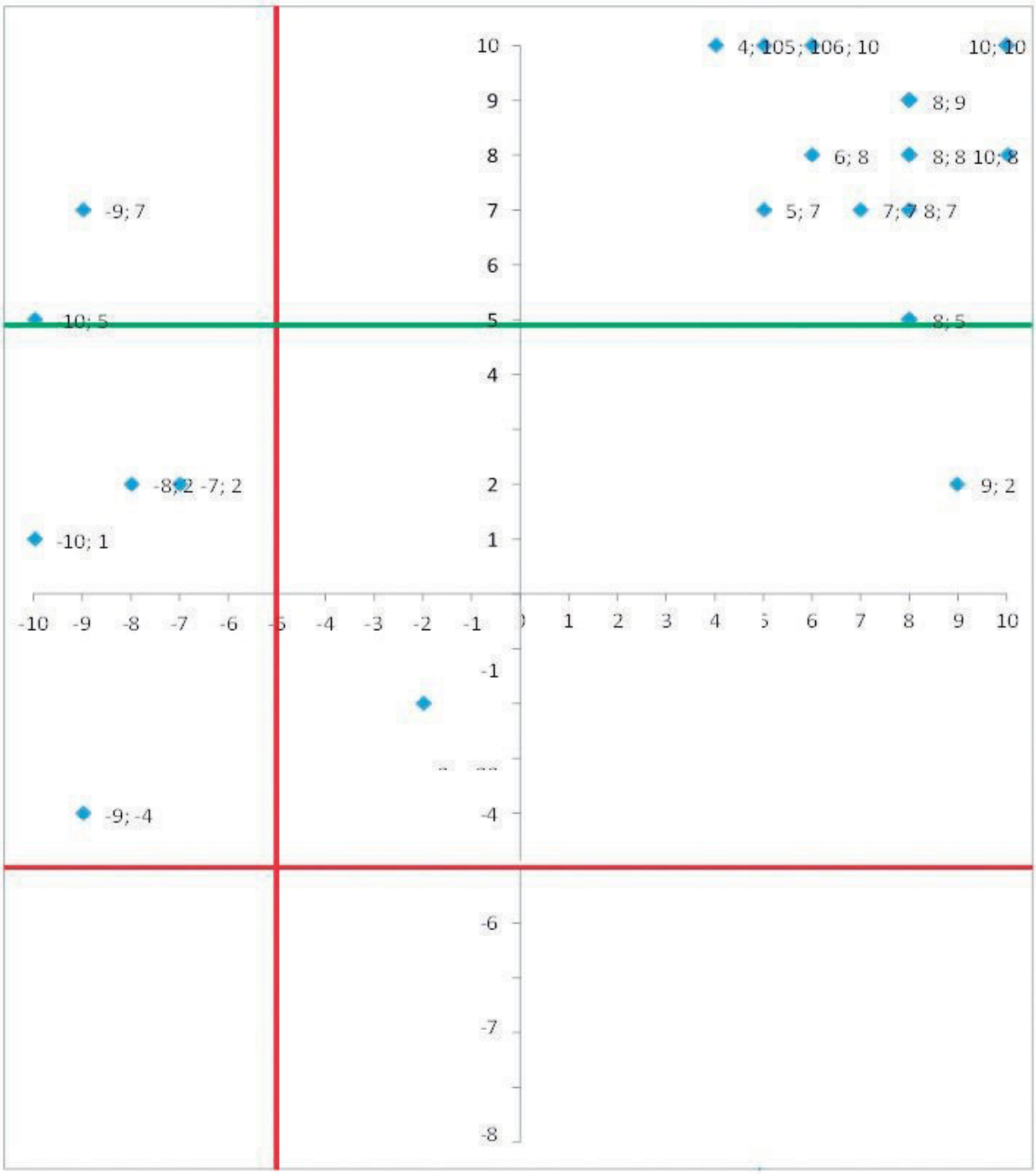


Figure 6. IGO Classification
Source: the authors.

IGO variable Classification (See Table12)

Table 12.

Classification of the governability of the variables according to IGO

VARIABLES	HIGH	HALF	LOW
Technology		X	
Investigation		X	
Infrastructure		X	
Provides raw material		X	
Price of the product		X	
Human capital	X		
Market segment	X		
Quality		X	
Financing		X	
Direction			X
Juridical		X	
International Trade		X	
Strategic alliances	X		
Innovation		X	
Culture	X		
Politics		X	
Geography			X
Demography	X		
Environmental impact			X
Advertising and market			X
Institutions			X
Competition	X		
Organizational culture		X	
Work environment		X	
Social impact		X	
TOTAL	**6=24 %**	**14= 56 %**	**5= 20 %**

Source. the authors.

Analysis IGO: a very high number of variables, twelve (12) to specify, are in the range of being very important, but at the same time very governable; The nature of the metal-mechanic companies show that a very good part of their operative and commercial potential depends on their own administrative model and the decisions they make in this regard. However, being in such a technical and specialized market, the quality of the work that goes forward is particularly relevant and this necessarily depends on the technique used and the recognition of the client in this area. It also identifies that the local action range is and could be sufficient future to supply the offer presented by the organization, and although the globalization of business may seem an attractive opportunity in the case of this industry, its role, at least for Tuluá and its area of influence is attractive but at present, it does not assume such remarkable relevance.

At companies' management level there is a sustained interest to develop the businesses, because no element is assumed as of low importance, and attention is paid to all the variables. The elements are tried to be kept under control and continuous observation. The variables that fall in the region of few governable,

respond specifically to those that are unmanageable, characteristically of subjects and institutions foreign to the company and strangers to the industry, but not to the sector; even so, these are recognized by the organization as important. Broadly speaking, it can be established that companies in the sector have significant possibilities to strengthen their proposal in the future and this option depends on the strategic level who must make decisions, make investments, select projects and advance administrative applications that guarantee their clients the highest possible satisfaction, product of the optimal service and quality productivity, accompanied by the provision of service guarantees, as has already been done the date?

(Importance - Uncertainty): each variable was classified according to its level of uncertainty, between high, medium and low (see Table 13)

Table 13.

Classification of uncertainty according to the actors

No.	Variable	Uncertainty (eje x)	Importance (eje y)	No.	Variable	Uncertainty (eje x)	Importance (eje y)
1	Technology	3	10	14	Innovation	-5	7
2	Investigation	-5	9	15	Culture	6	-4
3	Infrastructure	2	7	16	Politics	5	2
4	Prove-mat-pri	4	9	17	Geography	-8	8
5	Price-product	4	7	18	Demography	8	1
6	Human capital	8	8	19		-7	5
7	Segment-market	5	2	20	Advertising-market	-7	2
8	Quality	-5	10	21	Institutions	-8	9
9	Financing	4	10	22	Competition	-8	7
10	Direction	-9	10	23		8	10
11	Juridical	2	5	24	Work environment	2	8
12	International Trade	-2	7	25	Social impact	2	5
13	Strategic alliance	5	8			-1	

Source: the authors.

Map I.E (Importance - Uncertainty) (ver Figure 7).

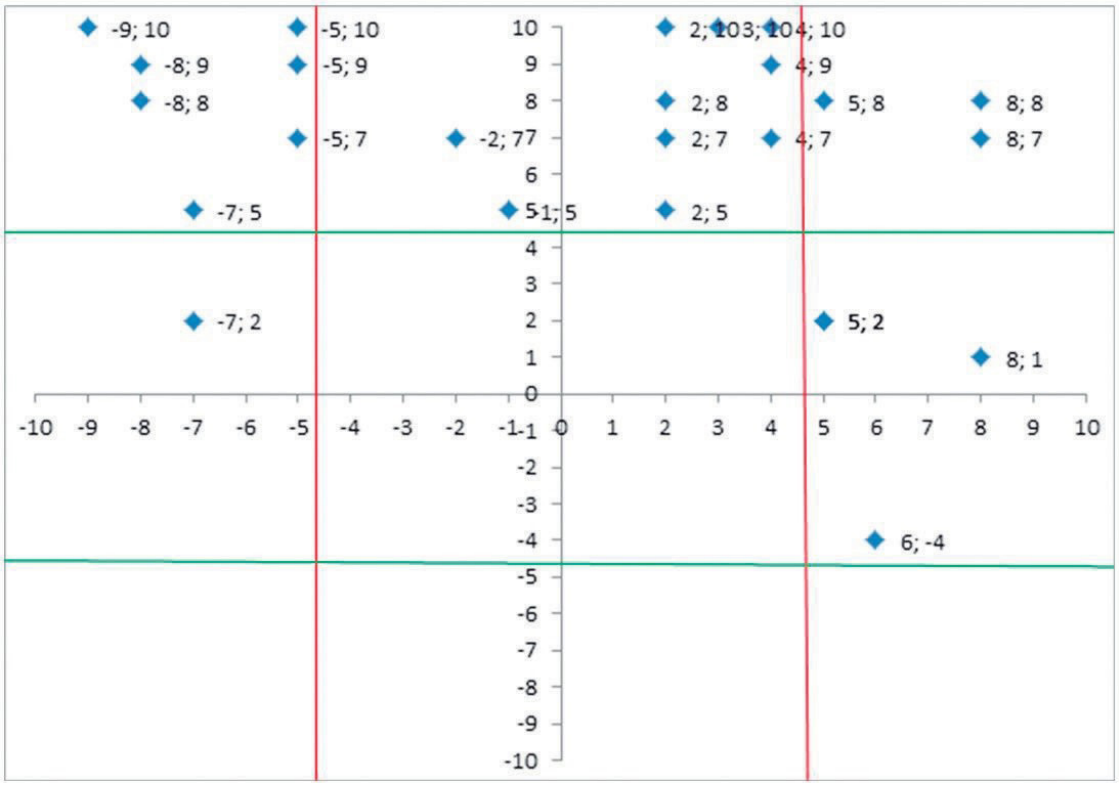


Figure 7. Uncertainty and importance map
Source: the authors.

Analysis of uncertainty and importance: in a global interpretation, it is promising the fact that more than 50 % of the important variables are of low uncertainty, that is, most of the important variables can be predicted and this is very much in line with the governability that can be run over them. Although it should be noted that the following variables: human capital (8.8), competition (8.7), strategic alliances (5.8), raw material suppliers (4.9), financing (4.10) and product price (4.7) are the variables that present the greatest uncertainty for the system and their degree of importance is high. This is because these variables do not depend directly on the organization since the changing market can put for or against any situation in some of them that affect the entire organization.

Scenarios

Optimistic scenario: we are in 2028, ten years after the meetings of the metal-mechanic companies met to assess the situation of the companies.

Today we see that the organizations have achieved an excellent positioning in the market, thanks to the fact that great developments have been made in the field of innovation, in the renovation and diversification of services. The established dynamics have allowed applying new technologies demarcated by the quality issue, this leads to being competitive with the price and therefore to an expansion of the companies nationally and internationally. This process that started ten years ago, allowed to have many investments, to work very hard for a pleasant organizational climate generating a cordiality culture within the metallurgical companies of the municipality of Tuluá and its area of influence. In addition, companies in the sector have been recognized for a high-quality process to reduce the environmental impact caused by manufacturing processes.

Finally, a lot of work had to be done on the subject of training in order to have qualified and competent personnel that allowed us to face the new challenges demanded by a global market.

Pessimistic scenario: the main objective of this study was the development of prospective scenarios for the development of metallurgical companies by 2028, which facilitate strategic planning and enable the generation of a frame of reference for the development policies of the organization.

The pessimistic scenario would mean that companies in the metal-mechanic sector will face challenges that are framed and that depend on the maturity and strategic planning that companies have developed since its inception since many of the variables analyzed depend on the work of the management from the same. If the management is not clear that the adoption of a strategic plan as an internal policy of the organizations is a key factor, competitiveness and productivity will be affected, as there would be no stability and reliability in the processes, the ability to respond and the quality would be a shock due to the lack of standardization and normalization of internal processes.

Another challenge faced by metal-mechanic companies is the shortage of human talent with the necessary skills to carry out the activities required by the projects that are generated in companies in the sector. There is no consolidated institutional model for development and that fosters strategic alliances (State/ productive sectors/Community/Knowledge Society) so that the region has the coverage and quality of physical infrastructure and services for promotion and generation of knowledge that allows the optimal development of the different socio-economic sectors.

If companies in the metal-mechanic sector do not have a strategic plan, variables such as technology, quality, and financing will be strongly affected, since the organization must consolidate, in addition to an economic robustness through strategic alliances, the adoption of management systems that will allow you to measure, control and continuously improve your processes. If you have a strategic plan, companies will be able to respond more and more to the demands of new projects that are generated both nationally and internationally.

Companies in the sector should not neglect the labor climate variable, because it can become a potential factor of internal conflict. The company must guarantee the working conditions, infrastructure, security and availability of sufficient personnel so that the perception of the climate does not affect the performance and productivity of the personnel in charge.

The volatility of the dollar will continue to be a determining factor in the margin of profitability of products and services offered by companies in the metal-mechanic sector, therefore their processes must be competitive.

In conclusion, if there is no strategic management plan on the part of companies in the metal-mechanic sector, the projection to achieve the goals will be negatively permeated, since at present their response capacity does not respond with agility that is required and the processes are not standardized, a situation that would affect the lack of control, monitoring, and continuous improvement, in addition to the definition of roles and functions of the personnel that is part of the companies of the sector, is not clearly supported under defined procedures. The perception of the climate that managers have compared to that of collaborators is different, and the demand for qualified personnel becomes a factor that strongly affects companies in the metal-mechanic sector.

Tendency scenario

We are in 2028, the companies in the metal-mechanic sector, located in the municipality of Tuluá and its area of influence, have been characterized because since its inception the people who run them, have worked hard

in the qualificatión and positioning of the same in the sector, achieving since 2018 an important boom in its structures. It has been thought about the implementation of a strategic plan for companies in the sector.

Companies have managed to overcome great difficulties that have arisen over time, the most relevant being those concerning personnel, such as the lack of qualified personnel for specialized tasks in cutting tools, precision and software management, to respond EFFICIENCY in the multiplicity of machining services. Despite all this, companies manage to overcome this difficulty through support with institutions including SENA, as well as strategic alliances with other companies.

After achieving a balance in the aforementioned aspects, the companies had to fight to avoid the rotation of the trained personnel, this due to the high growth of the sector, a situation that until now, has forced companies to work hard in its Organizational Culture, Social Impact, Environmental Culture, and Work Environment, with the aim of creating greater commitment in its employees and that they feel more comfortable with their work. Companies have been implementing more comprehensive strategies: better salaries, integrations, training according to profiles, knowledge management in order to capture the best practices and processes.

Another factor that managers have had as a challenge and that has marked a differentiation with other companies of the competition and that also correspond to other regions inside and outside the same department; they are the sale price of the product, the quality, the technology that is used in their products, this as a result of great efforts to strengthen and consolidate the research processes, always seeking that the end of this is Innovation. It has not been easy to change the paradigm for companies in the municipality of Tuluá and its area of influence since funding has been very low, it has worked through alliances, targeted advertising to the business segment and opening to international markets cautiously, the latter being a factor in the post-internal strengthening stage. To meet the conditions of international markets and in search of an expansion of markets with adequate infrastructure to meet international demand, companies in the metallurgical sector of Tuluá and its area of influence must implement a strategic plan for the next 10 years, 2028-2038.

Betting scenario for the Municipality of Tuluá and its area of influence in the metal-mechanic sector for the year 2028: with the help of the scenarios described above, the most relevant variables are extracted to perform the betting scenario, thanks to this we can locate ourselves in a present set by the variables and analyze how it would behave in the future.

In the municipality of Tuluá and its area of influence, small and medium-sized companies of the metal-mechanic sector are located, a territory that has become of great importance and support for the large SMEs of the Department and north-western Colombia due to its proximity, being an important factor to attend the different needs of the particular market to the metal-mechanic sector. Hence the importance of increasing technology and research in different processes, both administrative and productive, in order to offer services and products of good quality and just in time. The prospective and strategic study thinking in the horizon of 2028 seeks to contribute to the strengthening and organizational growth of companies in the sector, where a systematic and multidisciplinary approach will be used to analyze the different internal and external variables. The scenario betted for the year 2028, points to good training in human capital, with good technical and technological training, supported by institutions such as SENA, Universities, Compensation Funds, Chamber of Commerce of Tuluá-Valle among others. It is very important that all these actors help in the education and technical training of collaborators of the companies dedicated to the metal-mechanic sector, these companies bet on human capital based on technical knowledge taking advantage of present and future technologies, acquiring new work techniques to be able to have Competitive prices with a good quality of the finished product. Increase strategic alliances, both capital and knowledge, to serve new markets and to supply more needs. One of the pillars of this study is to project the companies to a prominent position in the metal-mechanic sector for the horizon 2028 in the municipality of Tuluá and its area of influence, with incidence in the north-western and south-western Colombian regions, this being one of the inflections of the strategic prospective study that lead to the discernment of the current and future conditions of the environment, with the purpose of proposing a

strategic direction that allows to consolidate the present strengths and to give guidelines in the current problems as well as those that constitute a later threat and generate greater uncertainty among which are the competition, the suppliers of raw materials, the price of the product, the financing among others that are shown in the IE matrix, in order to provide greater certainty in the construction of new opportunities for companies in the metal-mechanic sector of the municipality of Tuluá and its area of influence.

Conclusions

According to the opinion of the experts (Delphi), strategic guidelines must be specified, incorporating programs and projects that allow small metal-mechanic companies in the center of Valle del Cauca-Tuluá and the area of influence to improve their competitiveness. These programs and projects should be oriented to the training of skilled labor, strengthening of the productive chain, managerial training of managers and executives of companies in the sector and consolidation of strategic alliances between the different links of the chain, as well as the strengthening of methods and work processes, especially in machining, which allows a better use of labor, tools, equipment, and materials, seeking the optimization of operating times, the quality of the product, the elimination of setbacks and improve times of customer response.

According to the Delphi, the experts consulted estimate that the most significant perspective to achieve technological changes in the metal-mechanic sector of Tuluá and the central region of Valle del Cauca, which impacts productivity, quality, and innovation, is the investment in knowledge. This investment includes not only the training of human talent with high-level labor skills but also consolidating a culture of innovation, strengthening the productive chain, establishing a strong relationship with the University, SENA and technical and technological institutions, generating a renewed leadership of the sector that will allow it to be a valid interlocutor with the government in the design of public policies that benefit him from international competition, contraband and FTAs.

Strengthen the value chain of companies in the sector: their primary activities, their logistics processes, inventory management and storage, transport and distribution, operational processes, standardization and productivity, marketing and customer service. Also, adjust and improve support processes such as those related to the structure of companies, planning and control activities, the application of quality standards, procurement and human management.

They also consider the actors that it is essential to develop strategic activities headed by managers and executives of companies, as well as technology management and financial management, among others.

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