Methodology for the Sector Diagnosis Applied to Metal-mechanical Enterprises of Risaralda*

[English version]

Metodología para el diagnóstico sectorial aplicada a las empresas metalmecánicas de Risaralda

Metodologia para o diagnóstico setorial aplicada às empresas metalmecânicas de Risaralda

Received 31 August 2023. Accepted 28 February 2023

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› *How to quote:*
López-López, D. C et al., (2025). Methodology for the Sector Diagnosis Applied to the Metal-mechanical Enterprises of Risaralda. *Ánfora*, *32*(58), 321-348. https://doi.org/10.30854/anf.v32.n58.2025.1119
Universidad Autónoma de Manizales. L-ISSN 0121-6538. E-ISSN 2248-6941.

* Article derived from Ph.D. thesis "Quality as Strategic Conduct in the metal-mechanic SMEs of Risaralda, Colombia," within the project "Causal relationships between 'Chain Reaction' Postulate from W. Edwards Deming and the Theory of Industrial Organization." Funding: Universidad Católica de Pereira- code DII-017-015. Declaration of interests: The authors declare that there are no conflicts of interest. Data availability: All relevant data can be found in the article.

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Abstract

Objective: To formulate and apply a sector analysis methodology to generate regional and local growth and development strategies in different economic sectors. **Methodology**: A review of methodologies of sector diagnosis and identification of select opacities in obtaining and validating findings in reports. A seven-stage methodology articulates activities from the construction of data collection instruments, their administration and analysis to the treatment of findings from sector analysis and their diagnosis. **Results**: The methodology was validated through a case study at metal-mechanical SMEs in Risaralda, Colombia. Their conditions of the economic and market context were analyzed to characterize business conglomerates. **Conclusions**: Elements for business competitive advantages and established peculiarities that weaken their competitive and productivity strategies were identified. A sector diagnosis that considers specific peculiarities for clustering was conducted that allows the recognition of leadership traits from business competitiveness and can be replicated within or outside a single economic sector. Finally, the need for regional spaces such as observatories, laboratories, and discussion tables for sector study and proposals for government entities to establish and strengthen university-business-state-society partnerships is highlighted.

Key words: sector analysis; sector diagnosis; diagnostic methodology; productive sectors; economic sectors (obtained from the ISOC thesaurus of Economics).

Resumen

Objetivo: plantear y aplicar una metodología de análisis sectorial para generar estrategias regionales/locales de crecimiento y desarrollo en distintos sectores económicos. **Metodología**: se realiza una revisión de metodologías sobre

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diagnósticos sectoriales e identificación de algunas opacidades en obtención y validación de hallazgos en informes. A partir ello se propone una metodología de siete etapas que articula actividades desde la construcción de instrumentos de acopio de datos, su administración y análisis, hasta tratamiento de hallazgos que derivan del análisis sectorial y su diagnóstico. **Resultados**: se validó la metodología propuesta a través de estudio de caso en PYMES metalmecánicas de Risaralda, Colombia, con la cual se analizaron las condiciones del contexto económico y de mercado en el que se desenvuelven para, así, caracterizar conglomerados empresariales. **Conclusiones**: Se identificaron elementos que constituyen ventajas competitivas empresariales y se establecieron particularidades que debilitan sus estrategias de competencia y productividad. Gracias a ello, se hace un diagnóstico sectorial que considera particularidades específicas para la clusterización, que permite el reconocimiento de rasgos de liderazgo que elevan la competitividad empresarial y puede ser replicado dentro o fuera de un mismo sector económico. Finalmente, se evidencia la necesidad de espacios regionales como observatorios, laboratorios y mesas de discusión para estudio sectorial y elaboración de propuestas para entes gubernamentales que establezcan y fortalezcan alianzas Universidad-Empresa-Estado-Sociedad.

Palabras clave: análisis sectorial; diagnóstico sectorial; metodología diagnóstica; sectores productivos; sectores económicos (obtenidos del tesauro ISOC de Economía).

Resumo

Objective: propor e aplicar uma metodologia de análise setorial para gerar estratégias regionais/locais de crescimento e desenvolvimento em diferentes setores econômicos. **Metodologia**: realiza-se uma revisão de metodologias sobre diagnósticos setoriais e identificação de algumas lacunas na obtenção e validação de achados em relatórios. A partir disso, propõe-se uma metodologia de sete etapas que articula atividades desde a construção de instrumentos de coleta de dados, sua administração e análise, até o tratamento dos achados derivados da análise setorial e seu diagnóstico. **Resultados**: a metodologia proposta foi validada por meio de um estudo de caso em PMEs metalmecânicas de Risaralda, Colômbia, com o qual se analisaram as condições do contexto econômico e de mercado em que atuam, a fim de caracterizar conglomerados empresariais. **Conclusões**: foram

identificados elementos que constituem vantagens competitivas empresariais e estabelecidas particularidades que enfraquecem suas estratégias de concorrência e produtividade. Graças a isso, realiza-se um diagnóstico setorial que considera particularidades específicas para a clusterização, permitindo o reconhecimento de traços de liderança que elevam a competitividade empresarial e que pode ser replicado dentro ou fora de um mesmo setor econômico. Finalmente, evidencia-se a necessidade de espaços regionais como observatórios, laboratórios e mesas de discussão para estudo setorial e elaboração de propostas para entidades governamentais que estabeleçam e fortaleçam alianças Universidade-Empresa-Estado-Sociedade.

Palavras-chave: análise setorial; diagnóstico setorial; metodologia de diagnóstico; setores produtivos; setores econômicos (obtidas do tesauro ISOC de Economia).

Introduction

The exploitation and enhancement of advantages of economic activities, as well as the recognition and intervention of their disadvantages, enable the formulation of strategies for regional and national development. This requires a grouping and analysis of productive activities to a categorization of sectors, based on an understanding of the economic phenomenon that characterizes them and the intrinsic potentialities in the region or country of interest to be studied. In this regard, establishing methodologies for the diagnosis of economic sectors is necessary.

While there is research that demands sector analysis, the literature aimed at documenting and systematizing the methodology or proposing a scientific-based design is insufficient. Most of the reports focus on diagnosis results, with a raw description of the methodology to obtain such findings. It creates difficulties for validating results of sector research or bias in them. This is reflected in the specificity of several existing sector diagnostics which without a standardized methodology, hinder progress in the generation of regional and local growth and development strategies to favor a large number of sectors and activities.

The importance of documenting and systematizing the methodologies to make diagnoses is clear. It becomes interesting to academics, sector leaders, and national communities. This paper arises as part of the experience from the doctoral thesis "Quality as Strategic Conduct in the metal-mechanical SMEs of Risaralda, Colombia."

A sector analysis methodology is proposed based on knowledge management. It is a seven-stage work path that allows a diagnosis based on strengths and weaknesses of a sector within the economic and market context. It was validated through a case study of metal-mechanical SMEs in Risaralda, Colombia.

This article argues the usefulness of sector diagnosis for development plans, programs, and business organizations within an environment of complexity and current turbulence. It also describes the expansion waves of this research in recent decades, reviews methodological approaches for sector analysis from literature review, and concludes with an analytical structure on the conceptual theoretical foundation of metal-mechanics in Risaralda.

The methodological proposal includes both the type and method that encompasses the sector analysis, as well as a path to be followed presented in detail below. The case study that diagnosed the state of metal-mechanical SMEs in Risaralda, Colombia, conclusions and recommendations for future sector analyses are also presented.

Sector Analysis in Planning

The analysis of economic phenomena demands grouping economic activities according to their common characteristics. This has led economic science to resort to sector categorization, as a tool to collection, analysis and monitoring of productive activity of a country or region. An "economic sector" is a grouping of productive activities that share common characteristics and differ from other groups. According to classical economics, there are three economic sectors: primary, secondary, and tertiary. However, new technologies and new forms of economic activity have led to new productive sectors, such as quaternary and quinary. Although there is no full consensus, the latter are seen as extensions of tertiary sector "technologies" (Aced-Toledano & Miquel, 2020).

The complexity of the economic phenomenon has required deepening this classification. Differentiating even more for economic activities is common, depending on their specialization. The International Standard Industrial Classification (ISIC) of all economic activities is accepted as international reference for grouping productive activities. Other United Nations agencies established classifications for occupation, employment, expenditure, education, tourism, and environmental statistics, using ISIC conceptual and methodological components, including the Classification of the Functions of Government (COFOG), International Standard Classification of Education (ISCED), International Standard Classification of Occupations (ISCO), and Tourism Satellite Account (TSA) (National Administrative Department of Statistics [DANE], 2020).

Each country or region chooses a sector of activity based on its economy, potential in science and technology, and understanding of development as a social phenomenon. This involves defining and implementing plans and programs for their growth and development which creates conditions to harness and enhance competitive advantages to compete in markets with high demands and constant changes.

The importance of sector diagnostics for managers of developing plans and programs is highlighted, as they provide data and analysis for designing policies and strategies at macroeconomic and sector levels, and considering both intra and intersectoral aspects is important (Lopez et al., 2021).

Understanding the sector in which it operates is essential for a business organization. Although until the first half of the 20th century, enterprises were conceived as closed systems, as of the General Theory of Systems[1] they

1 Proposed by the Austrian physiologist Karl Ludwin von Bertalanffy in 1969, it argues that systems in their diversity (family, animal, social, business) are integrated by elements in constant interaction and within a framework of rules, myths, and history.

are open systems. The enterprise and its various components interact with macroeconomic areas, competitors, distributors, suppliers, and customers. There are two levels of classification of the environment. The general classification refers to the socio-economic area in which the enterprise carries out its activity. Another specific classification frames the set of factors outside the organization that directly influences part of the economic sector. Therefore, a detailed understanding of the specific sector is crucial to competitive strategy development and business goals achievement.

The sector analysis allows enterprises to gather data related to the competitive environment, competitors' status and leadership, customers purchasing power, and suppliers market power, rules and laws of interest of their specific economic environment, among other main issues for decision-making in business management. This analysis makes determining the dynamics and degree of competition in the sector possible, visualizing trends, opportunities and constraints in a framework of competitiveness and growth, and preventing threats. In this way, the analysis is an instrument that guides the development of more proactive strategies in the exploitation and enhancement of opportunities and addressing threats (Berg, 2006).

The understanding of productive sectors in an environment of complexity and turbulence serves in understanding where they want to go, and where they need to evolve and transform (Garza & Solares, 2018). From this identification, sector research increased interest in strategic management and economic development disciplines, so that economics and management, marketing, and other related areas include research lines of sector analysis. Three waves of expansion have been observed in recent decades: one from 1960 to 1980, another between 1985 and 2000, and the last started in 2001 (Alarcón, 2020).

The first wave was driven by theoretical and conceptual foundations of "Structure-Conduct-Performance" model Theory of Industrial Organization. In this approach, the enterprise's competitive advantage has spatially linked its position within the industry, as well as in analytical tools such as the Boston Consulting Group's matrix published in 1973 (UNIR Revista, 2021), which remains a widely used tool in corporate planning.

In the second wave, Porter's competitive strategy emerged. It dominated sector studies and focused on the idea that industry governs individual enterprises' competitive strategies (Porter, 2015). The economic perspective of sector studies began to be replaced by the administrative perspective.

The third wave of sector studies emerges in the new millennium and is characterized by the definition of new technology- or knowledge-based sectors, the importance of sector studies for strategic management, postgraduate research in case studies, and the growth of statistical data sources with big data and

statistical and multivariate analysis techniques. These factors have driven sector research of a computational type and with dynamic models like the dominant ones today (Alarcón, 2020).

However, in parallel with this traditional economic-rational approach, the perspective of cognitive school as an alternative of sector analysis has been developed (Sáez & González, 1999). This part of the concept of "cognitive groups," is understood as mental groups of enterprises guided by managers when analyzing competition in their activity sector and facing strategic problems. The question lay in that the environmental perceptions, rather than their characteristics identified objectively and as the product of a rational economic analysis, are aspects that must be considered in the process of formulating a strategic plan (Weick, cited by Sáez & González, 1999).

Understanding the mental processes of managers and decision-makers is essential. It is a task undertaken by the cognitive school with Herbert Simon as its precursor. It focuses on four aspects of strategy: perception, how they gather data; conceptualization, how the strategy is formulated; reconception, how it changes or why it does not; and strategic style, how strategists differ in their cognoscitive orientations (Simon, 1982).

Clearly, there are several theoretical tools to be incorporated in the design of sector analysis methodology. For this research, considering the tools that are applied in sector studies aimed at improving decision-making and business success is important. Those tools are: knowledge management and organizational learning, Porter's Five Forces model, strategic planning, and the mental processes analysis of business managers to identify the strategic groups in the economic sectors (Beltrán et al., 2015; López et al. 2021).

According to the above discussion, business success depends on the ability of organizations to adapt to changes in a competitive environment which includes technology, globalization, economic uncertainty, cultural, and social changes. Therefore, sector analysis is useful in identifying and understanding these transformations and adapting to them proactively. Betancourt (2014) argues that companies must recognize that they compete in a variable and dynamic environment and that they must consider the sector characteristics to structure an effective competitive strategy. Hence, the importance of identifying theoretical tools that need to be incorporated in the design of a sector analysis methodology.

Methodologies for Sector Analysis

Once the importance of research on economic phenomena is understood, some approaches to sectoral analysis methodologies can be outlined. Beltrán and Casasbuenas (2015) propose the design of a new sector diagnosis methodology in Colombia. It starts by recognizing the economic sectors in the country: primary, secondary, tertiary, quaternary, and quinary. After that, 10 variables are taken into account for the design development. General aspects, value chain, competition, macroeconomic factors, human capital, business, research, development, innovation, environment, normativity and problems, opportunities and prospects. Each one derives from other levels.

López et al. (2023) review literature to compile different sectoral diagnosis methodology. The conclusion is that the methodology proposed by ARCOSES2 (López et al., 2021) has certain advantages over shortcomings identified in the literature and shows insufficient information to apply this methodology in Colombia.

As a complementary and aligned approach to this research, other methodological approaches for sector analysis that include quality as a new reference should be considered. The quality-centered sector diagnosis in Colombia is a matter of great importance for the country's economic and social development. While there is progress in the implementation of standards and in continuous improvement of enterprise quality, there are still challenges and opportunities for improvement in all sectors. Technology, sustainability, and corporate social responsibility are key trends in this sector diagnosis.

There are various quality-centered sector diagnosis methodologies in which quality standards focus on identifying the most important standards for the sector and analyzing how to implement and comply with them. This includes assessments and audits to verify if interest standards are being met.

Other methodologies such as process evaluation focuses on analyzing productive transformations of the sector and improving quality, identifying their critical points, implementing quality protocols, performing tests and quality controls, among others. Some of these are: Customer analysis to ascertain in detail the needs and requirements of sector customers to improve quality of products or services by doing surveys, interviews and other market research methods. Also included is continuous improvement based on the Plan, Do, Verify, Act (PDVA) cycle. Opportunities for processes and products improvement are

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identified, actions are implemented, results are measured and standardized, in a continuous cycle process.

The quality-based diagnostic methodologies can be applied together or separately, depending on the sector specific needs and the scope of the diagnosis. Any of them must be focused on satisfying the customer and meeting their expectations to improve the competitiveness and offer better services or products to consumers.

Analytical Structure for the Case Study

Productivity and competitiveness gaps of SMEs in the department of Risaralda, Colombia, compared to other large global companies, have prevented their positioning within the interest markets, mainly, in those whose quality standards exceed their current strategic capabilities.

To close these gaps, this research achieved the establishment of an analytical structure based on the Deming Chain Reaction (DCR) model, Strategic Conduct (SC) of Structure-Conduct-Performance (SCP) paradigm of the Theory of Industrial Organization (TIO) and the understanding of Quality as Strategic Conduct, as the theoretical-conceptual support for the relationship between quality and competitiveness.

From this perspective, Deming (1989) argues that there is a relationship in which quality favors increasing enterprise's productivity levels and, thereby, its competitiveness. It was understood as a chain reaction that begins with the follow-up philosophical procedures of quality discipline, as good practices to control the variability of processes and standards achievement that markets demand. Castaño and Gutiérrez (2011), Chase and Aquilano (1994), De Meyer and Wittenberg-Cox (1994), Evans and Lindsay (2008), Gutierrez (2010), Gutiérrez (2014), Heizer and Render (2009) and Medina (2007), Gutiérrez (2009), Rincón (2001) and Tamayo et al., (2015) point out a relationship between both customer requirements, their satisfaction, and financial performance with DCR.

Therefore, studying both the markets and companies' interaction makes sense, as well as government intervention forming on their structure and functioning that, according to Coloma (2005), Raible (2013) and Tirole (1988), has historically been addressed by TIO, which uses the ECD paradigm for the particular behavior analysis of these markets (Coloma, 2005). SC are conceived as ways of acting that allow companies to improve their competitive position or restrict competition decisions (Ramírez & Unger, 1997; Taddei & Robles, 2002).

In addition, different studies endorse the relationship between quality and SC (Brah et al., 2002; Camisón & Boronat, 2004; Contreras et al., 2018; Elhuni & Ahmad, 2014; Hernández et al, 2018; Hoyos, 2019; Huerta et al., 2016; Khan, 2010; Lee & Phuyal, 2013; Noronha, 1999; O'Neill & Al, 2016; Santos & Álvarez, 2006; Talib & Al, 2010; Urmann, 2013, Wayhan et al, 2010; York & Miree, 2004). Those and the rest of the analytical structure that underpinned this research, allowed establishing an understanding of the concept of "quality" as Strategic Conduct, seen as "the management based on quality, which the enterprise directs as a mechanism to improving its position in the markets and/or limit competition" (López, 2022, p. 45).

Thus, and according to these authors, quality as one of the factors evaluated by the customer at purchase time can be considered an intangible resource of the enterprise's worth in improving its competitiveness. It affects both its costs (market structure) and efficient use of its resources and capabilities (performance), TIO proposes.

Methodology

A sector analysis begins with scientific knowledge that is achieved only to the extent that a rigorous process is maintained. Therefore, the type and method are of particular relevance, because the tools, instruments, and protocols to be used are established, and the analytical perspective under which it will proceed and the depth to be reached in gathering data, conducting an analysis and reaching a conclusion.

The type of study refers to the depth of scientific knowledge intended in the sector analysis, as exploratory, descriptive, relational, explanatory, predictive, or applied (Méndez, 2009). It will indicate the data to be gathered and the analysis level to be carried out. The method refers to the procedure to be followed during the sector study. Méndez (2009) proposes as "observation, inductive, deductive, analysis, and synthesis" (pp. 238-242).

Once the type and method are determined for the sector analysis, this methodological proposal establishes the steps to be followed through techniques and instruments to the treatment of findings. Each one proposes activities, sub-activities and their breakdown, as shown in Table 1.

Table 1. *Methodology for Sector Analysis.*

Stage	Activity	Sub-activity	Breakdown
1. Techniques and Instruments	Data Gathering Technique	Semi-structured Interview	
	Data Gathering Instrument	Research Constructs	1) Construct 1 2) Construct 2 3) Construct n.
		Variables	1) Variable 1 2) Variable 2 3) Variable n.
		Guiding Questions	
2. Population and Sample / Unit of Analysis and Observation	Population Universe	Population Universe Definition	
	Population Framework	Population Framework Definition	Subdivisions within the Population Framework
	Samples	Sample Type	Sample Technique
3. Sources	Secondary Sources	References of Theoretical - Conceptual Framework	Theoretical Framework-Specific References
	Primary Sources	Actors/Sample Expert	Filters to Clean Actors Database/Sample Experts
			Filter 1 - Criterion Definition 1 Filter 2 - Criterion Definition 2 Filter 3 - Criterion Definition 3 Filter n - Definition Criterion.

Stage	Activity	Sub-activity	Breakdown
4. Fieldwork	Conduct Interviews	Recording in Audio and Video	
		Transcription of Interviews	
5. Data Treatment	Operationalization of Variables	Definition of Indicators by Variable	
		Grouping of Indicators by Hierarchical Levels	
	Coding	Code Assignment and Memo Descriptor by Indicator	
	Tabulation	Response Frequency Setting	
6. Data Analysis	Code Response Association		
	Obtaining Non-numerical Data		
	Qualitative Evaluation	Qualitative Analytical Model	Relationships between Research Variable and Response Frequencies
	Numerical Data Extraction		
	Quantitative Evaluation	Quantitative Analytical Model	Data Visualization
			Grouping of Data
7. Finding Treatment	Results Interpretation		
	Presentation of Results		

In stage one, techniques and instruments to gather information are determined; after processing, the information will become data for the subsequent sector analysis. This methodology proposes semi-structured interviews because they respond to the requirements of obtaining primary information from the managers of the enterprise to be studied, foster that the subject freely express the quantity and depth of information provided, and allows relative flexibility in its format and question order (Bernal, 2010). Vela (2008) ensures that the interviewer guides the discussion on the items to obtain data that will feed the

collection instrument designed for this purpose. The question formulations will guide fieldwork based both on theoretical-conceptual constructs that underpin the research with a view toward solving sector problems, and focused on research variables that represent the sector characteristics or dynamics that are intended to be observed.

The second stage sets out the elements from data required for the sector analysis. If possible, the population and sample are determined for probabilistic studies, in which, the population universe contains the total of possible elements of research interest; such as people, objects, and measurements, among others. The population frame is established from a list, enumeration, or inventory that contains all the elements of population interest, and the sample is taken from the population for the required measurements performance (Anderson et al., 2008; Gutiérrez & De la Vara, 2008; Pérez, 2005; Scheaffer et al., 1987). Otherwise, a unit of analysis and observation should be determined for non-probability studies, the minimum division of population, or interest population (Pérez, 2005).

The third stage consists of documents and facts with the information of the sector starting from secondary sources such as books, periodicals, and/or texts prepared by third parties out of the study sector, and primary resources, such as those collected, directly, orally, or written. Reviewing relevant bibliographic references and direct consultation with enterprise managers as the actors and/or experts within the sector becomes important.

In stage four, semi-structured interview is conducted. The methodology establishes the need to record via audio and/or audiovisual tools and transcribe and then analyze the discourse.

In stage five, the data collected in the fieldwork is processed and then converted into data that enables analysis according to the objective. This demands the coding, categorization, and tabulation of data through appropriate statistical techniques and presentation of information from the data using tools such as tables, diagrams, graphs, etc. The methodology warns of the importance of ensuring that the system used responds to an analysis of both qualitative and quantitative content to control inferences throughout the sector study and be reproducible and valid within the context of the sector.

This implies operationalizing the variables to determine how the construction of the study will be observed and measured according to the objectives. This may require indicators by variable, hierarchical groupings, and codes and their descriptions to data tabulation to facilitate the interpretation and analysis of results.

In stage six, data is interpreted through a deductive-inductive exercise that argues its usefulness within the interested framework of sector study. This may involve comparison, association, correlation and/or validation of the results against the constructs and objectives to obtain knowledge of the sector dynamics studied. This methodology proposes that to be conducted it be associated with the response frequencies obtained during the interview with the codes established in the operationalization of variables; the next step is a first evaluation of the non-numerical data found through a quantitative analysis model, and subsequently that the numerical data from the quantitative analysis be evaluated which permits the visualization and clustering of the data.

Stage seven presents the development of activities in response to the objectives that enable the interpretation and presentation of results.

Results

Diagnosis of Enterprises in the Metal-mechanical Sector in Risaralda

For the case study of the metal-mechanical sector of Risaralda, Colombia, the seven stages for sector analysis methodology were executed, one by one. The semi-structured interview for data collection for stage 1 was chosen; SMEs registered with Chambers of Commerce under ICO codes 24, 25, 28, 29 and 30 for stage 2; managers and/or managers of enterprises as primary sources for stage 3. In stage 4, the interview was conducted and recorded in audio and video. As part of stage 5, a system was created to encode and categorize information from interviews according to established research variables. In stage 6, qualitative and quantitative analysis models were applied to highlight data clusters. Finally, in stage 7, conclusions were drawn and recommendations given.

Characterizing them in relation to their quality stages and as business conglomerates and analyzing the relationship between quality and SC as shown below was possible.

Characterization of Enterprises in Relation to Their Quality Stages

In the quality stage enterprises implement elements to increase product, service and/or process quality. In the case study, Inspection, Control, Assurance and Quality Management stages were established.

It was concluded that most of the enterprises implement elements from the Inspection stage, followed by the Control and Assurance stages, while there was no evidence of implementing elements in *Quality Management* stage.

Characterization of Enterprises as Business Conglomerates

Table 2 shows the results of enterprises based on both qualitative and quantitative analytical models and research variables.

Table 2. *Characterization of Enterprises as Business Conglomerates.*

Variable	Results
Interview Strategic Capacity	The highest formal academic level is a professional undergraduate degree. Most of the positions correspond to a hierarchical management level. A large number have little experience to allow understanding the enterprise they manage. There is high and low strategic decision-making experience. Most professionals held a middle-level position in another enterprise before the current one. A self-teaching form of achieving informal knowledge for decision-making prevails.

Variable	Results
Characterization	Operational positions are predominant, the percentage of administrative and managerial staff is low. Most positions are registered as manufacturers of metal products, except machinery and equipment. There are no significant differences between family and commercial enterprises. Many enterprises have had the same owner since their creation. There are no medium-sized enterprises and most are old-fashioned. Products and services directed to other manufacturers in industry and construction. Manufacturing processes focused on manufacture and assembly. Most of their raw materials come from the domestic market. Sales to the local and regional market and no enterprise in the international market. Most enterprises have not required innovations, but others do to meet quality requirements. Most enterprises use word of mouth to make themselves known.
Description of Productive or Service Rendering	Prevalence of machinery distribution under functional scheme or by groups. In most cases, posting any kind of job listing it is not a habit. Most of them have no modern machinery, others have them for quality requirements.
Productive Reliability or Service Rendering Based on Quality	Many do not have inspection records, the ones that do, do not use them afterward. All enterprises use instruments for measuring metrological area lengths. Many enterprises train their employees in quality only at the beginning but training is not constant. Most respondents think that quality offers competitive advantages. The majority of respondents share their opinion of quality with their collaborators. Many of them are interested in quality certifications, but others are not, none are certified.

Variable	Results
Capacity to Produce Products Differentiated in Quality and Guarantee	The majority follow customer specifications and few set their own. Purchase orders determine the line of production or service rendering. Customer dissatisfaction has to do with failures in the final product or service, followed by design. Respondents usually offer warranty or re-processing to deal with customer non-conformities.
Capacity to Produce Their Products Differentiated in Volume and Cost	In many enterprises there is useless capacity. Most respondents are unaware of installed capacity and productivity levels. In general, they have not faced capacity problems in meeting customer demand, those who do reject the order.
Capacity Sell Products Retail	Most enterprises sell according to their cost structure, very few sell according to the customer's price. A high percentage subcontracts transportation service, very few enterprises have their own. Some use quality as an argument for selling or getting new customers.
Competence	All agree that competition is increasing over time. Some distinguished from their competitors by high quality or image. Few cannot differentiate much in the price of their products or services. Most of the respondents stated that sales decrease due to the pandemic. A significant proportion remained stability or increased their sales.

Variable	Results
Other Competitiveness Strategies	Most respondents innovated with successful competitiveness strategies of internal process and, to a lesser extent, they diversified their products and services. Very few use advanced technology or unconventional practices. Lack of capital to invest, scarcity of raw materials and informal competition are the main competitive difficulties. In less proportion, the lack of specific professional profiles in the market and opportunities to expand.
Competitive Alliances	Most respondents do not generate partnerships with third parties due to mistrust. Some are associated with chambers of commerce, committee associations or universities. Most restrict customer relations to business. Some mentor clients or are mentored by them. They demand tax incentives, entry barriers to informal competition, prices control of materials and inputs, and transparency in procurement processes to improve their competitiveness from governmental financial facilities.

Relationship between Quality and Strategic Conduct in Enterprises

During the development of the case, special behaviors were observed in eight of the 11 research variables in some of the enterprises. Table 3 shows the particularities and empirical evidence of the relationship between the quality stages and the enterprises competitiveness, generically, between Quality and SC.

Table 3. *Special Results in Enterprises.*

	Enterprises												
Principal Research Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
Quality Stage					✓								
Strategic Capacity					✓			✓					
Characterization								✓					
Productive Description/Service Rendering				✓									
Productive Reliability/Service Rendering Quality-based				✓									
Capacity to Sell Products Retail								✓					
Competence					✓								
Other Competitiveness Strategies								✓					

Enterprises 4, 5, and 8 show differentiating behavior in several variables that suggest leadership in their sector. Enterprise 4 stands out for its *Productive Description/Service Rendering and Productive Reliability/Service Rendering based on quality*; enterprise 5, in its *Quality Phase, Strategic Capacity and Competitiveness*; and enterprise *8, in Strategic Capacity, Characterization, Products Retailing Capability and other competitive strategies.* They can be considered as case studies or good practice to be followed by other enterprises in the same or other sectors.

Discussion

Case Study Findings

The outstanding behaviors observed in three of the thirteen enterprises would validate the relationships such as | quality stage → competitiveness | and | quality → SC|. As a result, it deduces the competitive advantage that enterprises have when they improve their ability to more advanced stages of quality. This would allow the differentiation of enterprises products and/or services based on quality that market recognizes as high.

The importance of establishing strategies to strengthening decision-making and SCs of undertakings consideration and the others belonging to the metal -mechanic sector in the region should be noted. TIO could originate internally as part of the actions to improve competitiveness. It could start through initiatives by the metal-mechanical sector or by government interested in supporting them. According to this, participation in the Regional Competitiveness Plan of Risaralda 2032[3] would constitute an SC in both directions.

Conclusions

A sector diagnostic methodology is proposed and implemented not limited to a specific productive sector, but that can be extended to any other sector. This tool provides a deep understanding of dynamics and challenges of a particular sector and is also adaptable and scalable for application in different business and geographical contexts. This contributes to the generation of transferable knowledge and to the development of flexible approaches that can be adapted to the specific needs of different communities and economic sectors.

A diagnostic study was conducted for the metal-mechanical sector of the department of Risaralda which revealed that the sector analysis methodology presented has the ability to identify elements that constitute the competitive advantages of enterprises within an economic sector, and particularities that weaken the competition strategies of each evaluated enterprise.

3 This plan identifies specific metal-mechanical challenges for Risaralda in 2032, by identifying the critical factors, bets, cross-sectors that contribute to addressing the challenges, new sector actors and sector information in general.

The use of this tool helped to identify clusters within the analyzed sector. The sector analysis methodology provided a detailed understanding of individual characteristics of companies, and enabled visualization and grouping that share similarities and significant links. This clustered approach represents a valuable tool to identifying areas of specialization, collective strengths, and opportunities for collaboration between related enterprises. A significant element to be identified is the ability to apply this methodology to other sectors where similar patterns could be revealed. The methodology facilitates the development of specific strategies, and synergy stimulation between different business clusters.

This research highlights the urgent need to create spaces such as observatories and laboratories for sector study. It also emphasizes the importance of establishing sector tablelands in such a way to facilitate the understanding of various sectors to identify improvement areas, strategic decision-making and proposals of solutions. These collaborative spaces constitute valuable tools for strengthening partnerships within the framework of four-fold spiral "University-Business-State-Society." In this way, it contributes to more effective interaction between several actors to promote joint initiatives for sustainable development of regional business.

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