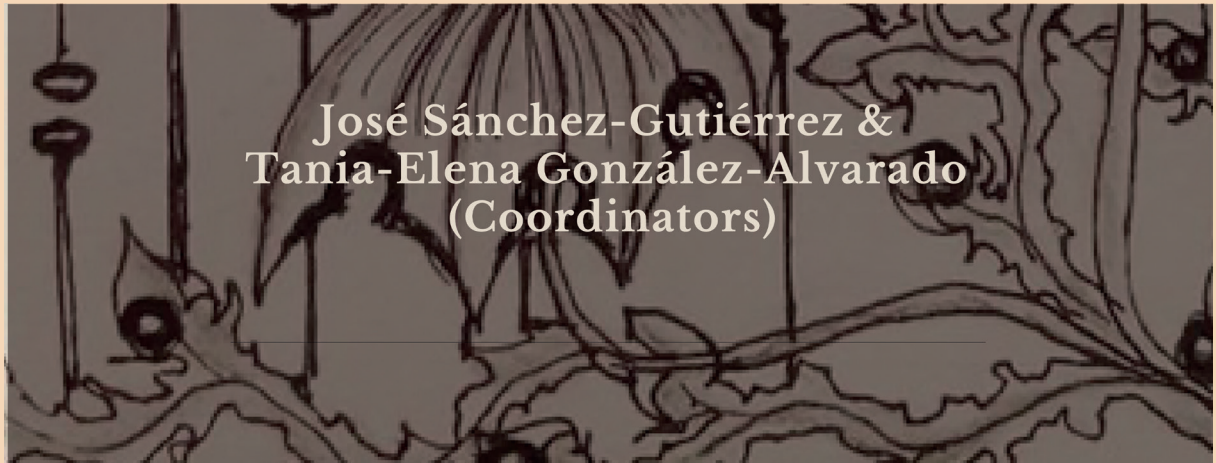
Universidad de Guadalajara

Environmental, Social and Governance Strategic Approach for Competitiveness



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CONTENTS

Prologue

Competitiveness is sustainable only when it considers the three dimensions: environmental, social, and governance. It is especially relevant in face of constant advances. Business development and transformation practitioners and scholars should carefully consider this new and enhanced approach. Thus, the first chapter of this book analyses how companies contribute to the changes in the environment and, in turn, how the environment impacts companies and makes them evolve.

Grid-group culture theory, stemming from Mary Douglas, explains different cultural modalities to conceive complex realities.

This theory helps to understand the reaction of the individual or economic agents to innovation as well as climate crisis. In this way, a logical introduction is given to the content of the volume. The first three chapters refer to the issues of ESG. Consequently, next chapters focus on the economic agents' adaptation to the environmental challenges. There are examples of the hierarchical or institutional approach, as well as of individualistic, collective and fatalist attitudes.

This book brings together research works from various universities, both European and Latin American, and as always there is a hope, that it can contribute to a worthy cause of enriching the competitiveness knowledge.

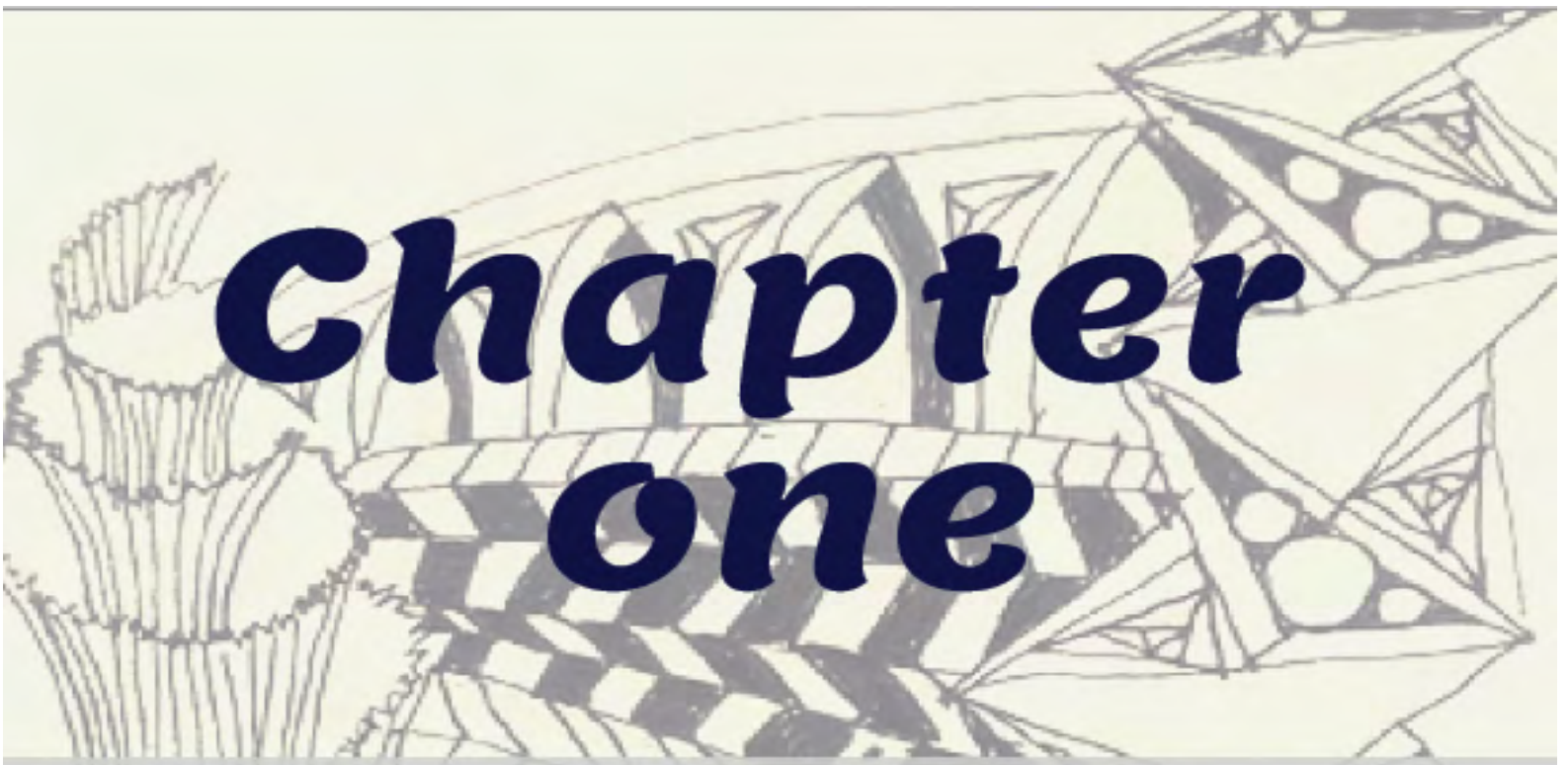
Furthermore, the studies are based on empirical real-life evidence from enterprises, universities, governments and institutions. All of these organizations are part of the competitive environment.

The authors are from the Colombia, Poland, Spain and Mexico. All of them are experts in Economic and Business Sciences. The universities that participate in this Project are: University of Insubria, Universidad Complutense de Madrid, Universidad Iberoamericana Torreón, Universidad Autónoma de Coahuila, Pontificia Universidad Javeriana, Universidad Autónoma de Aguascalientes, Universidad Externado de Colombia, Insti tuto Politécnico Nacional, Instituto Tecnológico de Tehuacán, Instituto Tecnológico de Pinotepa, and Universidad de Guadalaja. This publication was created following

the best practices of scientific edition. Turnitin was applied to favour the originality. The editorial team carefully analysed the quality and integrity of the contents. Every chapter was selected, evaluated, and modified with the support of double anonymized review.

Editors and authors hope that this book will contribute to the advancement of theoretical and practical knowledge

José Sánchez-Gutiérrez, PhD



Chapter one

ESG and Competitiveness: A Critical Reflection

González-Alvarado, Tania-Elena; Kubus, Renata and Sánchez-Gutiérrez, José

ESG and Competitiveness: a Critical Reflection

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Introduction

Within the capitalist system, companies' dynamics are expressed by the term "business". Companies constantly create business ventures to increase competitiveness (Ogunsiji & Ladanu, 2017; Dzwigol, Dzwigol-Barosz & Kwilinski, 2020). These dynamics in business contribute to the system's logic and, in turn, are influenced by the system itself. Both feed each other (business logic of the system), causing the millions of economic agents in the world to shape the economic system. For this reason, there is a need to understand competitiveness through the Sustainable Development Goals (SDGs). (UN, 2015, 2016)

The SDGs illustrate the system saturation and the ways to amend it and to assure its continuity. As this is a system, part of the solution lies in the way companies act and interact (as the system elements). Therefore, building and maintaining competitive businesses is very important to sustainability (Lahti, Wincent & Parida, 2018).

Climate change has a wide-ranging impact on ecosystems, societies, and economies. It also increases pressure on livelihoods and food supplies, including food from the fisheries and aquaculture sector (WTO, 2009; FAO, 2012).

Competitiveness is sustainable while the company develops the capacity to produce indefinitely at a rate that does not deplete the resources it uses and requires to function and does not produce more pollutants than its environment can absorb. (Berkes, Colding & Folke, 2008)

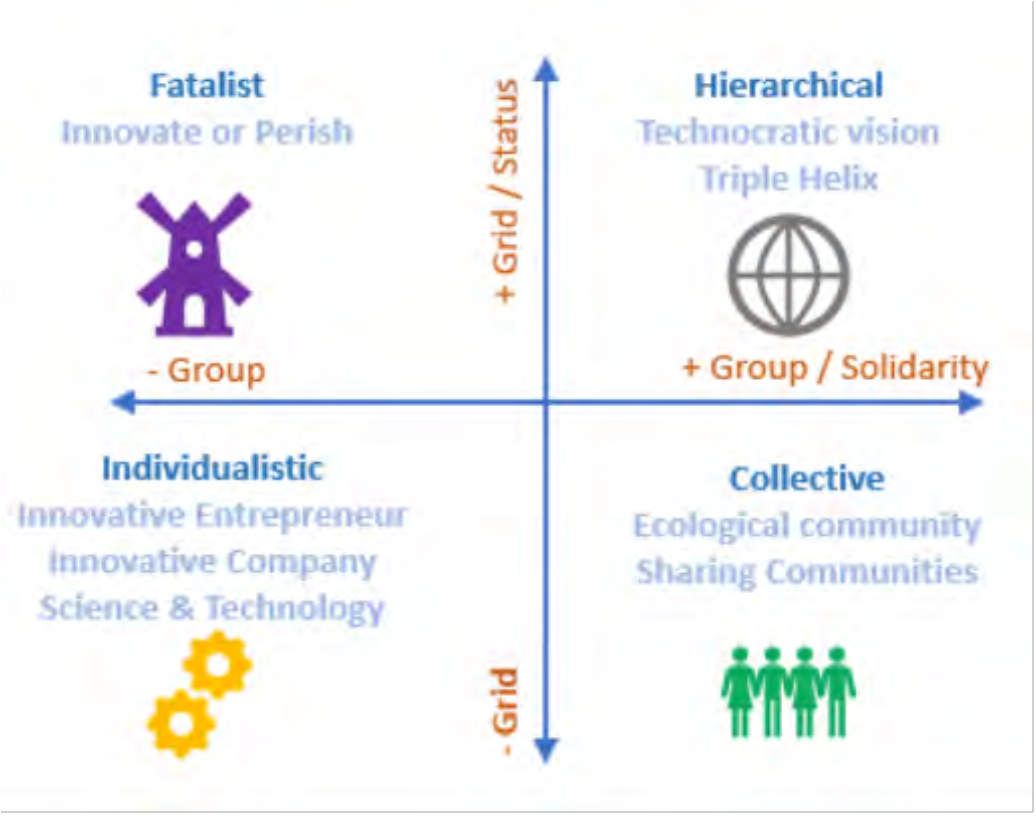
The decisive element for the company is its capacity for analysis and transformation, considering that it is immersed in an ever-changing system. It requires the ability to learn from reality, a critical vision for constructing

sustainable competitiveness (Martín & González, 2016). It is considered that dimensioning the environment, society, and governance (ESG) contributes to this critical vision. These three dimensions emphasize collaboration and encourage collective action and responsibility. It is so mainly because of the impact of individual actions of stakeholders.

ESG AND GRID-GROUP CULTURE THEORY

Grid-group culture theory based on the idea of Mary Douglas (Douglas, n.d.) from the intersection of solidarity towards the group and status or society position determination provides an insightful and comprehensive picture. (Figure 1)

Figure 1. Grid-Group Culture Theory: Innovation Approach



Source:: Kubus (2020).

This theory offers different cultural modalities to conceive complex realities. The arrangement of elements within the dimensions is not definitive and may vary between apparently equal entities and within them.

It is expressed through quadrants, defined by two scales previously advanced. The first scale, the gradient of the group, is determined by the level of perception of the linkage of the constituents of the collective or group, manifested in terms of solidarity. Another dimensional axis is formed by the degree of the hierarchy of the group, how individuals assume and can vary or exchange their roles within it. It implies the determination exercised by the group's structure, and the status within it.

Thus, the spaces created would give rise to four types of attitudes and ways of perceiving reality:

- The fatalistic one, also called atomized subordination implies superior forces or destiny that govern the position in the group and that is not easily influenced by its individual members
- The individualist attitude embraces the 'self-regulatory' dynamics where the good of the individual leads to the good of the system as a whole, in style of the invisible hand of the market
- The hierarchical one that entails the need for institutional and geopolitical governance
- Egalitarian factionalism has the vision of 'a commons' management, where a shared and collective vision of solidarity is required.
- Afterwards, the dimension of a hermit, generally distanced from culture, has been added (Stolz, 2014).
- An exciting reading of this dimensioning is given by the natural environment behavior perception against the perceived status quo.
- In the case of the hierarchical view, there is a perception of an implied order, but with a threshold, or critical point after which the issues can escape from management capabilities and lead to a sudden change in the environment (for instance, 2º global warming).
- In the vision of egalitarian factionalism, the environment is perceived as fragile, changing that can only be protected thanks to the collective effort. Individualism attitude allows to find a place within a given environment thanks to individual ability to survive and look for the (innovative) ways to get ahead that in turn can move forward the system itself. Meanwhile, the fatalistic vision implies a field of greater forces, where little or nothing affects the status quo, the impulse exerted by the individual is found meaningless.

Long-term issues are positioned mainly in the hierarchical quadrant with a strong vision of relationships between the different elements, such as health or defense sectors. Science or business, in general, are in general located within the individualistic quadrant, with mechanisms such as price setting through the market or scientific status through peer review. These procedures in turn allow economics or science to advance.

The groups of hippies or hackers, also open-source communities, would be within the field of egalitarian vision.

Military groups responding to superiors' orders without understanding or agreeing with their goals can be representative of fatalistic vision. However, the defense sector will be positioned in the hierarchical quadrant if it implies following a conscious and shared vision.

Each quadrant presents different ways of perceiving reality, preferences for management or governance, different forms of pressure and punishment to align behaviors, different communication models, and different response capacities in the face of adversity.

The forms of reward and punishment to align behaviors would imply incentives and financial resources allocation to align behaviors within the individualistic model. In the hierarchical model, there are chains of command that can use recognition or status within the group, coercion, consideration of betrayal, and expulsion. In an egalitarian case, love, empathy, and compassion define the reward. There would be all and none of these forms within the fatalistic world.

Peer-to-peer communication in egalitarian or collective vision is vibrant, but it depends on its size because of the bandwidth issues, growing with the group dimensions. Hierarchy works with bottom-up and bottom-down communication, giving it more speed and less ambiguity. In the individualistic vision, market signals or scientific prestige would be applied. In the fatalistic dimension, information bubbles would frequently form.

In the case of reality perception, the hierarchical group will see it through the conflict of interests, the egalitarian one through management of groups and people, the individualistic group through interests and incentives, while the fatalist one will generally be at the expense of the superior forces.

What is interesting is that these worldviews, while competing, are also and necessarily complementary. As it has been seen, depending on the context, there can be an oscillation among different quadrants. They are all right, and at the same time, none of them has an absolute vision. Nevertheless, it is necessary to see all these dimensions together in order to address complex issues that represent our reality.

Apart from the previously mentioned individualistic vision where everybody acts in its interest in this way contributing to the common good, at the opposed high end of solidarity and structural implications it introduces the hierarchic vision.

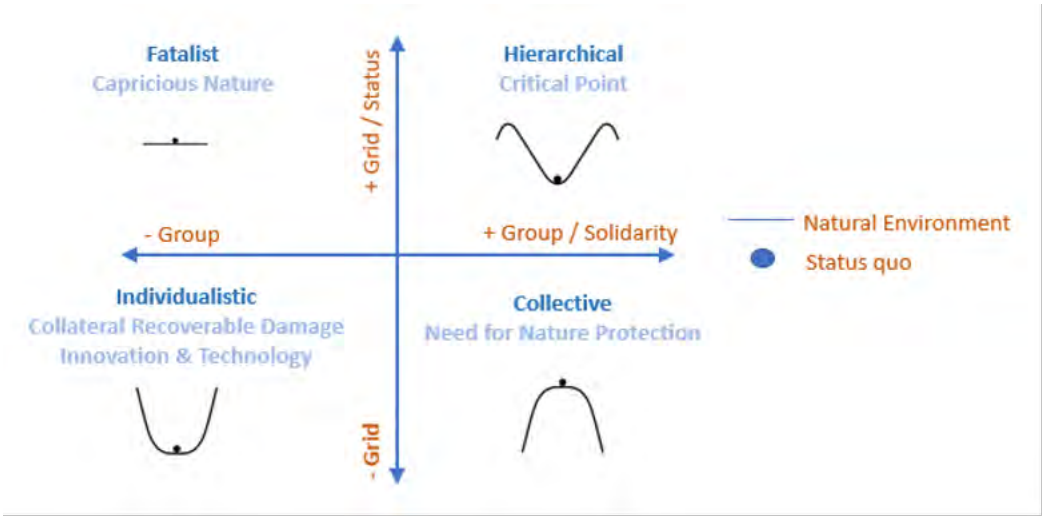
This outlook is similar to the one implicit in the European Union policies, with its triple helix approach of actors such as **Government** providing the physical and legal infrastructures for productive activities of **Industry** and research and education activities of **Academia** (Galvao et al., 2019; Gkoumas & Christou, 2020; Quartey & Oguntoye, 2021). Recently European Union includes as well the **Society** (Kubus, 2020), which in grid-group culture schema is especially present on the Collective quadrant, characterized by high solidarity but low organizational structuring and determination. The fatalist vision is left as a warning for a structural disempowerment.

Moreover, the ***sustainability*** question approach can also be structured throughout this vision, providing for an overall picture of different positioning regarding the **Natural Environment** (González et al., 2018).

From the currently reigning individualistic perspective, nature has the full capacity of renewal, companies are to be centered on the profit generation and the environmental damage is just a collateral damage of this process. It can anyway be amended through technology and innovation. In principle, the natural environment issues are to be dealt with only when the society raises its strong concerns.

It is somehow complementary with the reactiveness of the fatalist point of view, which considers nature as capricious and independent of human actions. From the collectivist perspective, instead, the natural environment needs a careful consideration and care. This last point of view, in turn, complements the hierarchical vision of critical or no return point. Due to the environmental crisis, collectivist and hierarchical vision seem to permeate the European Union, however it is reticent to strongly redirect the free market and oppose the neoliberal standpoint.

Figure 2. Grid-Group Culture Theory: Natural Environment Approach



Source: Kubus (2020).

Indeed, in the current configuration, it seems, that the individualistic vision is for success-oriented free market and the hierarchic outlook is mainly for the government levels. The competitiveness and innovation have an interpretative flexibility and are prone to the social shaping due to the contextual factors of amplified framework.

In order to allow this level playing field, the difference in the characteristics and structures of each actor that determine its participation in the power play need to be carefully balanced when and where required by government and academia bodies, industry lobbies but especially social and environmental entities with their strong solidarity ethics.

All things considered, these competing but also complementary perspectives indicate a need for a careful innovation ecosystem outlook. It should embrace the multilevel perspective as well, with the strong highlight on the society mindset and landscape level influencing the sociotechnical regime and niche levels (Geels, 2005).

ESG CRITERIA, INDICATORS, AND PRINCIPLES FROM BUSINESS PRACTICE

The term dimension can mean "importance of something". Based on this meaning, the environmental, society, and governance dimensions are implied in the actions of companies. In other words, these three are essential for the decision-making and actions of companies.

Regardless of whether the strategists are aware of these dimensions, the actions derived from their decision-making will affect reality. It can lead to another meaning of dimension: facet, side or aspect of something. The company's actions lead to environmental, social, and governance outcomes.

Unfortunately, in the short term, the company's negative effect on the environment, society, or governance often goes unnoticed —especially when decision-making refers to a highly competitive and speed-rewarding environment (for instance, time-to market aspect).

Adverse effects may be detected much later when the damage is irreversible or very significant from a systemic perspective—considering that a system is a "set of elements that are related to each other in an orderly way and contribute to a certain common objective."(Elinor Ostrom, 1990).

The company is an open system that is a part of other larger and more complex systems. The environment, society, and governance are three overlapping systems in which the company is immersed. This immersion of the company in these three systems is based on the dimensions that are usually described when criticizing or evaluating the actions of companies and their degree of responsibility for said actions.

From the perspective of adaptive systems (Preiser et al., 2018; Roundy, Bradshaw & Brockman, 2018), all systems are interconnected, and inevitably influenced by each other. Thus, the company impacts the environmental, social, and governance systems; but these three in turn influence the company. The impact on the company in principle can be detected and controlled by the strategists. However, not all impacts are necessarily detected, and therefore not all are controlled. Furthermore, in many cases even if an influence can be detected it can be out of reach or control.

This situation helps to understand the ambivalence of corporate social responsibility and how a company can be certified by CSR bodies, even if it sells products harmful to health or pollutes some other regions of the world. Understanding the influence that larger systems (society is perhaps the most perceptible one) have on the company explains this contradictory situation.

The company certified as socially responsible covers some aspects that allow it to achieve the distinction, but in other aspects, it is forced to adapt to the system's logic. Even when there is a will to detect all the impacts that the largest systems have on the company, there is always a large proportion of unknown influencing factors.

The question is: what are we doing so that theoretical advances increase knowledge about the effect of the environment, society, and governance in the company? From a theoretical perspective, there are multiple studies on this (Aboud & Diab, 2018; Yoon, Lee & Byun, 2018; Duque-Grisales & Aguilera-Caracuel, 2021), but few present or derive prescriptive models that support companies in practice and allow them to control their negative influence on the three systems.

This is probably why, when approaching ESG systems from business practice, the company is taken as the issue center—the company as the cause of everything negative that stems from the logic of the other three systems. It is a partial and wrong position, the company keeps a degree of responsibility for what happens outside it, but not all responsibility can to be assumed by the business.

Despite this, a prescriptive approach that starts from the company is justifiable. It is justified because the aspects that the strategist controls are described in this approach. It convinces by offering greater operational efficiency, brand value, cost of capital, and risk management, and as a result, ESG is an increasingly valued aspect when choosing an investment (PWC, 2022; S&P Global, 2022).

Considering that it is the strategist and, therefore, the company who have to control, direct and measure their influence on the environment, society, and governance helps to modify decision-making, actions, and even organizational culture. It awakes the company members awareness of these elements. The company members, the people, are part of the other three systems. Outside the company, they have other roles and their actions feed other systems (consumers, investors, neighbors, relatives, among many others). However, there is more to that.

ESG systems are more extensive and maintain their own inertia (Moradi et al., 2021; Albert, 2018; Choi & Yi, 2018; Seyed, Poorbehroozan & Ghorban, 2021). This inertia forces the company to direct its actions towards their adaptation. It is a situation that can turn off or weakens decision-making, even when formally considering ESG criteria. It occurs because the criteria are prescriptive. They provide an adequate mechanism to make strategists aware of ESG systems, but they are not enough.

Reducing the perception and reality of the three systems to a set of rules (ESG criteria) is only effective in a mechanistic and predictable world. However, unfortunately, the reality is unpredictable, dotted with highly complex multi-dimensional functioning.

That is why in business practice, reference is made to criteria construction and application. A criterion is a judgment or discernment. To discern means distinguishing something from something else, pointing out the difference between them. The ESG criteria help the strategist discern or distinguish the dimensions in their decision making, the results achieved, as well as their assessment.

Therefore, they become a set of rules that when given high importance can guide decision-making. The strategist considers them a rule to the extent that he is convinced that they affect the value of the company and the perception of investors about business expectations. The companies have started from the three criteria to form their indicators. The SIKA (2022) indicators are shown in the annex to the chapter. They are based on the three types of criteria:

a) Environmental criteria are related the company's activity and its impact on the environment, both direct and indirect. It is not just about considering operating costs. It has to do with the ecological footprint of the members of the company and the environmental cost of its operations: pollution and consumption of water, electricity, air, and other natural resources. The question is how much a company contributes to the generation of carbon dioxide and global warming. Humans cannot avoid the impact, but they can mitigate it. One way to mitigate it is to understand the processes and the transformations it implies, to look for alternatives in generating and using resources. It should lead as well to cycles and their times and disinvolvement comprehension. The indicators are greenhouse gas emissions, renewable energy, energy efficiency, resource depletion, and chemical pollution. Tables 1 and 2 of Annex I show SIKA's environmental indicators in the last four years. There the annual indicators are compared, and the mitigations in the environmental impact are shown.
b) Social criteria are related to the company's activity within society, especially those stakeholders that maintain a direct relationship (employees, shareholders, customers, suppliers, creditors, or population of the locality where they operate). The company-society relationship is complex if the mindsets or imaginaries, both collective and individual, and the social constructions are considered. In reality, the social commitments that the company presents are not always those that society needs. Society can believe that it needs something, but it is possible that it does not need it, even though it demands it from the company and the company corresponds to satisfy the

demand. In the same way, it is possible that the company, together with society, disregards what is needed. Only once the impact is sufficiently high on both, they proceed to assimilate the error and look for ways to correct it. Unfortunately, many times society points to the company as the only responsible for the mistake or deviation in its activities, even when both parties have played a leading role. The nature of the company many times stems from the society exerting pressure to divert commitments towards what is perceived and not what is needed. The company is interested in improving its brand image, attracting talent, and building customer loyalty. Thus, the company will do what society expresses as an expectation towards its role as a socially responsible company, although society can also be wrong. The indicators are health, education, human rights, workers' rights, and controversial business practices. Tables 3 and 4 of Annex I show the social indicators of SIKA (2022). SIKA exposes more social criteria indicators than the Environmental and Governance criteria.

c) Governance criteria relates to power systems of the company. This criterion considers the decision-making power that senior management employees have and that can contravene the interests of the shareholders. ~~The situation that was learned in the nineties of the last century is expected not to happen again~~. It includes the power of the internal customer, that can weaken the one of the external customers (e.g. agency issues). In this way, the criteria of governance address how the company is managed and the degree to which the external or the company's own rules and regulations, comply with them. The indicators are the quality of management, the culture, and the risk profile of the company and, in particular: accountability, governing bodies, transparency, and lobbying. Table 5 of Annex I shows the SIKA indicators (2022).

The expectation with these three criteria is that strategists' decision-making considers their costs and benefits. It is expressed in the following questions: What is the environmental, social, and governance cost or benefit? How to link the environmental benefit with the social benefit and governance? Which dimension should be given more importance?

When it comes to these questions, there are endless answers, as many answers as each reality requires. Therefore, it is not surprising that the business community considers principles that are the basis of the answers. The principles are as follows (RSS,2022).

Principle 1: Investment and processes

Incorporate ESG issues in investment analyzes and decision-making processes.

Principle 2: Practices and Policies

Be an active owner and include ESG issues into ownership practices and policies.

Principle 3: Adequate Disclosure

Seek adequate disclosure of ESG issues by the invested entities.

Principle 4: Acceptance and implementation

Promote the acceptance and implementation of the Principles in the investment sector.

Principle 5: Work together

Work together to increase the effectiveness in applying the Principles.

Principle 6: Reports and progress

Each of those involved will issue reports on their activities and progress concerning the application of the Principles.

From the company perspective, the vision of ESG helps to build a more sustainable system. However, the pressure exerted by the global system can be stronger than the company's pressure on the system. For this reason, it is crucial to approach ESG from a global perspective.

SOVEREIGN ESG

Strategists make decisions that require assessing the environmental, social, and governance risks and opportunities associated with their investments. This perspective on a global 'Better Data' system helps channelling financial flows towards more sustainable activities. The investment strategies are to be aligned with the Sustainable Development Goals to the extent of the ESG criteria consideration when analyzing the global environment. In this way, the company can be on the right track to develop sustainable competitiveness. For this purpose, the World Bank (WB, 2022) created a database that offers sovereign ESG data. They increase transparency around the sustainability performance of countries.

The database is based on the Global Program on Sustainability (GPS). This foundation provides governments and investors with information and tools to improve their understanding of sustainability criteria (WB, 2022).

The Sovereign ESG Data Framework incorporates data relevant to achieving the Sustainable Development Goals. The data content is organized into topics that the World Bank considers crucial for financial sector representatives while assessing the contribution of investments or policies to sustainable development (WB, 2022).

The World Bank groups the indicators based on the three criteria. However, they have slight variations compared to those included in the business perspective. This variation is due to two different visions. In one perspective, the ESG is based on the company's impact on the environmental, social, and governance dimensions. The ESG outlook is based on the global scenario and, therefore, the indicators are grouped in a way that make it easier to visualize the

environmental, social, and governance aspects by regions, countries, or localities. In this second and final vision, the company comes under ESG pressure. According to the World Bank (WB, 2022), the criteria show the sustainability of a country's economic performance and are defined as follows.

a) Environment. It addresses natural resources' endowment, management, and complementarity and their risk or resilience in the face of climate change and other natural hazards. This criterion considers the internalization of environmental externalities created by economic activity. It also represents access to sustainable energy and food security, i.e. crucial factors for a stable long-term economic growth. The corresponding indicators are emissions and pollution, the provision and management of natural capital, energy use, and security, environment/climate risk, and resilience and food security. Table 6 of annex 2 shows some of these indicators by region.

b) Social. It describes the effectiveness in meeting the basic needs of the population and poverty reduction, management of social and equality problems, and the investment in human capital and productivity. It also includes demographic criteria relevant to stable long-term economic growth. The indicators are as follows: education and skills, employment, demographics, poverty and inequality, health and nutrition, and access to services. Table 7 of Annex 2 shows some of the indicators by region.

c) Governance. Describes the institutional capacity to support long-term stability, growth, and poverty reduction. This category also represents the strength of a country's political, financial, and legal systems and their ability to address environmental and social risks. The indicators are human rights, government effectiveness, stability and the rule of law, economic environment, gender equality, and innovation. Table 8 of Annex 2 shows some of these indicators by region.

Unfortunately, the database is incomplete. It presents limitations for decision-making in the short term. It can lead to biases in decision-making. However, the absence of indicators does not necessarily mean the absence of actions in favor of the environment, society, or governance.

Conclusions

Companies are under pressure to respond to competition with new and innovative economic activities. Activities that do not exhaust the system in its three areas (social, ecological, and financial). Sustainable competitiveness requires entrepreneurial activity to build or transform businesses to mitigate poverty, climate change, and the adverse effects of economic crises.

Especially developing countries bear the main burden of the effects of climate change as they strive to overcome poverty and promote economic growth. However, climate change can be an opportunity to contribute to economic development within the framework of sustainability as long as this vision is not fatalistic.

The vision of ESG and RSC from the company outlook is helpful to avoid the fatalistic vision and build a more sustainable economic system. However, the pressure exerted by the global system is strong and not all can be changed by the companies only. Therefore, and in practice any contribution of the ESG approach will only be seen in the very long term. Furthermore, it needs to be adopted as a universal three-dimensional vision.

References

Aboud, A., & Diab, A. (2018). The impact of social, environmental and corporate governance disclosures on firm value: Evidence from Egypt. *Journal of Accounting in Emerging Economies*.

Albert, D. (2018). Organizational module design and architectural inertia: evidence from structural recombination of business divisions. *Organization Science*, *29*(5), 890-911.

Bristow, S. (2021). *Empresa y cambio climático: El aumento de la sensibilización pública crea una oportunidad significativa.* Nueva York: Naciones Unidas. Link: https://www.un.org/es/chronicle/article/empresa-y-cambio-climatico-el-aumento-de-la-sensibilizacion-publica-crea-una-oportunidad

Berkes, F., Colding, J., & Folke, C. (Eds.). (2008). *Navigating social-ecological systems: building resilience for complexity and change.* Cambridge University Press.

Choi, H., & Yi, D. (2018). Environmental innovation inertia: Analyzing the business circumstances for environmental process and product innovations. *Business Strategy and the Environment*, *27*(8), 1623-1634.

Douglas M (n.d.). *A History of Grid and Group Cultural Theory 7*. University of Toronto. Link: http://projects.chass.utoronto.ca/semiotics/cyber/douglas1.pdf

Dzwigol, H., Dzwigol-Barosz, M., & Kwilinski, A. (2020). Formation of global competitive enterprise environment based on industry 4.0 concept. *International Journal of Entrepreneurship*, *24*(1), 1-5.

Duque-Grisales, E., & Aguilera-Caracuel, J. (2021). Environmental, social and governance (ESG) scores and financial performance of multilatinas: Moderating effects of geographic international diversification and financial slack. *Journal of Business Ethics*, *168*(2), 315-334.

Dzwigol, H., Dzwigol-Barosz, M., & Kwilinski, A. (2020). Formation of global competitive enterprise environment based on industry 4.0 concept. *International Journal of Entrepreneurship*, *24*(1), 1-5.

FAO. (2012). *Consecuencias del cambio climático para la pesca y la acuicultura.* Documento Técnico N. 530. Rome: FAO, 238 pp.

Frank W Geels (2005). Processes and Patterns in Transitions and System Innovations: Refining the Co-Evolutionary Multi-Level Perspective. *Technological Forecasting and Social Change*, 681.

Galvao, A., Mascarenhas, C., Marques, C., Ferreira, J., & Ratten, V. (2019). Triple helix and its evolution: a systematic literature review. *Journal of Science and Technology Policy Management*, *10*(3), 812-833.

Gkoumas, K., & Christou, M. (2020). A triple-helix approach for the assessment of hyperloop potential in Europe. *Sustainability*, *12*(19), 7868.

Kubus, R. (2020). *Innovation Ecosystesm in the EU*. PhD thesis. UNED, Spain. http://e-spacio.uned.es/fez/eserv/tesisuned:ED-Pg-UniEuro-Rkubus/KUBUS_Renata_Tesis.pdf

Lahti, T., Wincent, J., & Parida, V. (2018). A definition and theoretical review of the circular economy, value creation, and sustainable business models: where are we now and where should research move in the future?. *Sustainability*, *10*(8), 2799.

Martín, M., & González, A. (2016). *Negocios internacionales y estrategias empresariales para la sustentabilidad*. México: Universidad Nacional Autónoma de México.

Moradi, E., Jafari, S. M., Doorbash, Z. M., & Mirzaei, A. (2021). Impact of organizational inertia on business model innovation, open innovation and corporate performance. *Asia Pacific Management Review*, *26*(4).

Ogunsiji, A. S., & Ladanu, W. K. (2017). A theoretical study of performance measures in the strategic and corporate entrepreneurship of firms. *International Journal of Life Sciences (IJLS)*, *1*(1), 49-57.

Preiser, R., Biggs, R., De Vos, A., & Folke, C. (2018). Social-ecological systems as complex adaptive systems. *Ecology and Society*, *23*(4).

PWC. (2022). *Environmental, Social and Governance (ESG): Turn ESG theory into action*. United Kingdom: PWC. Link: https://www.pwc.com/gx/en/issues/esg.html?WT.mc_id=CT3-PL300-DM1-TR2-LS4-ND30-

TTA9-CN_the-new-equation-esg&gclid=Cj0KCQjw6J-SBhCrARIsAH0yMZhpHj64PVC9Yxos38n9BSEMq8C1YlKubd05SogEA4d6HfSUdGG1qcUaAlr8EALw_wcB&gclsrc=aw.ds

Quartey, S. H., & Oguntoye, O. (2021). Understanding and promoting industrial sustainability in Africa through the Triple Helix approach: a conceptual model and research propositions. *Journal of the Knowledge Economy*, *12*(3), 1100-1118.

Roundy, P. T., Bradshaw, M., & Brockman, B. K. (2018). The emergence of entrepreneurial ecosystems: A complex adaptive systems approach. *Journal of Business Research*, *86*, 1-10.

RSS. (2022). *Criterios ASG y ESG: qué son, significado, indicadores y principios*. Mexico: RSS. Link: https://www.responsabilidadsocial.net/criterios-asg-y-esg-que-son-significado-indicadores-y-principios/?amp

Seyed Naghavi, M. A., Poorbehroozan, A., & GhorbanAlizadeh, R. (2021). Organizational Inertia as a Barrier to Change: The Application of Grounded Theory to Understand Organizational Inertia. *Organizational Culture Management*, *19*(2), 251-280.

SIKA. (2022). *ESG Key indicators*. Switzerland: SIKA. Link: https://www.sika.com/en/about-us/sustainability/sika-sustainability-strategy/esg-key-indicators.html

S&P GLOBAL. (2022). *Expert insights for ESG decision-making.* New York: S&P Global. Link: https://www.spglobal.com/marketintelligence/en/campaigns/esg-analysis?utm_source=google&utm_medium=cpc&utm_campaign=ESG_Search_Google&utm_term=&utm_content=585347924137&_bt=585347924137&_bk=&_bm=&_bn=g&_bg=136721296929&gclid=Cj0KCQjw6J-SBhCrARIsAH0yMZiy0O7Hn78FgRL5ZHbx-_2UOML1pqx32oFsM5hMOaEwm4ubiE26MXkaAjtkEALw_wcB

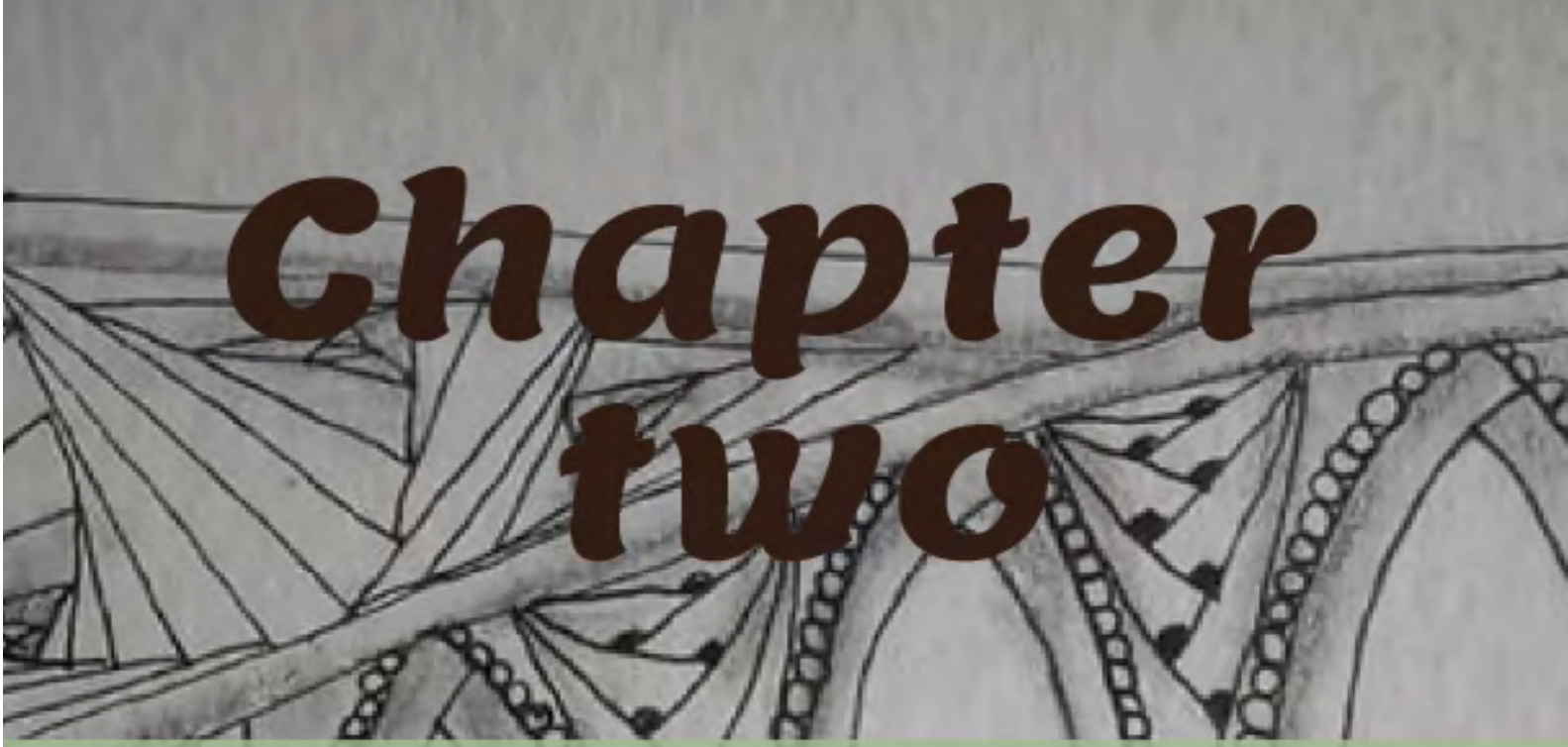
UN. (2015). *Objetivos de Desarrollo del Milenio: Informe de 2015*. New York: UN, 70 pp.

UN. (2016). *Situaciones y perspectivas de la economía mundial, 2016*. New York: UN, 8 pp.

WB. (2022). *Sovereign Environmental, Social, amd Governance Data*. World Bank. Link: https://datatopics.worldbank.org/esg/framework.html

WTO. (2009). *El comercio y el cambio climático*. Geneva: WTO, 190 pp.

Yoon, B., Lee, J. H., & Byun, R. (2018). Does ESG performance enhance firm value? Evidence from Korea. *Sustainability*, *10*(10), 3635.



Chapter two

Home Office and Productivity: Social Approach During the Pandemic

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Home Office and Productivity: Social Approach During the Pandemic

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Introduction

The "Home Office," also known in Mexico as telecommuting, is a working modality where workers can carry out their professional activities remotely, without physically appearing at the company's facilities. Although Garcia (2020) mentions, "this form of work has been in operation for years, thanks to the expansion of the use of the internet, the development of different digital tools and the possibility that some professions can be carried out from home".

The importance of this issue lies precisely in the fact that the COVID-19 pandemic led more companies and institutions to implement it to continue their activities during the health emergency. In this way, the confinement, decreed by the Federal Secretary of Health in March 2020, was a forced result of the appearance of the COVID-19 pandemic in the world, reason that after a few weeks and to safeguard many of the existing jobs, most of the administrative workers had to work remotely from their homes (home office or telecommuting).

Despite this, Mendoza (2021) mentions that COVID-19 had its initial repercussions on the labor market. The results of his research indicate that, based

on the initial economic shock, in the short term, the Mexican economy experienced a period of stagnation in the employment levels of the economically active population, with the possibility of recovery in the following years.

Likewise, Salas et al. (2020) describe in their article the "probable" magnitude of the changes in income distribution, poverty, and extreme poverty in the country in the metropolitan areas of the Valley of Mexico, Guadalajara, and Monterrey, as well as in the City of Mexico, according to different hypotheses of the behavior of labor income based on information available until the start of the pandemic and that consider the closures of so-called non-essential activities and their impact on specific occupations.

The pandemic appeared during the context of an incipient process of an increase in real wages and employment that began in 2019. The slowdown in the activities derived from the health emergency in Mexico and the world caused an increase in poverty and extreme poverty, the growth of inequality measured by the Gini index (Lakner et al., 2022).

On the other hand, Aguilar and Lira (2020), in their article on the COVID-19 pandemic, talk about the Mexican automotive industry, which is one of the most important industries.

The Mexican automotive industry represents a significant segment of the economy, on which a significant mass of workers depends directly and indirectly, and which, given this unusual scenario, was one of the first industries that were forced to suspend work immediately.

It is crucial to know what companies and the federal government have done to face this emergency scenario and if these measures have been sufficient to maintain the usual dynamism of this industry, as well as to preserve the health and labor safety of workers in different entities of the country during the pandemic.

Therefore, the authors Martinez and Veloz (2020) question to what extent the Mexican state is responsible for the economic damage with the measures adopted to counter the pandemic. On the other hand, Landa et al. (2020) carried out an analysis that reveals that technological dependence, the weak productive linkages of the industrial manufacturing sector, and the high concentration of Mexican exports in the world market: conditioned the vulnerability of the economy before the outbreak of the pandemic.

For this reason, it is important to know how the Home Office will influence the productivity, competitiveness, formal employment, and economy of companies in the context of COVID-19 in Mexico.

The answers to these questions will be useful for those who make decisions. Since as described in a study carried out by Rodríguez (2020), "It is necessary that people who telecommute are duly trained and have the developed

skills necessary to fulfill said task and thus ensure success in meeting the objectives of companies and the continuity of businesses and institutions."

It highlights the need to close the technological gap between Mexico and developed countries (Blomström, Kokko & Zejan, 2000; Esquivel & Rodrıguez-López, 2003); otherwise, competitiveness will be lost. Based on what was previously described, this research seeks to know, among other aspects, a new way to increase productivity and labor competitiveness in organizations, as well as knowing the changes in the labor market for the effective hiring of "Home Office" in commercial and industrial activity and its possible repercussions on employment (Fadinger & Schymik, 2020; Kaushik & Guleria, 2020; Hill, Ferris & Märtinson, 2003).

According to the objective of this research, the following was structured: firstly, a review of the literature on the relevance of the adaptation of the "home office" by organizations in the face of the current crisis generated by COVID-19, as an alternative to being able to continue working from home; secondly, as part of the methodology, an own instrument was developed, which was applied to a sample of 59 subjects, and thirdly, an analysis of the results obtained is made and finally, the main conclusions are presented.

CONTEXTUAL FRAMEWORK

Telecommuting in times of COVID-19. Telecommuting or Work from Home

Teleworking is one of the flexible work modalities (Felstead & Henseke cited in Ramos et al., 2020). One of the main elements is information and communication technologies to maintain contact with supervisors and colleagues.

Studies have shown that telecommute people take more effort to fulfill their objectives and do not mind lengthening the working day for this purpose, verifying a more significant commitment to their organization. Among the benefits of this modality, the increase in personal performance was determined due to the flexibility of schedules and the autonomy of activities. Among the disadvantages are problems that affect mental health, such as: due to working long hours, a feeling of insecurity at work, lack of time control, and frustration due to problems in coordinating activities.

Likewise, the difficulty of separating work and family spaces (Hill, Ferris & Märtinson, 2003; Ng, 2010; Patton, 2020; Hill et al., 1998) was identified when both coincide and the lack of mental disconnection from work problems (Table 1).

Three critical productivity elements affect people: 1) individual factors such as gender and social status, 2) social factors such as relationships with

clients, supervisors, colleagues, and family, and 3) situational factors. Such as resources and distractions.

Table 1. Advantages and Disadvantages of the Home Office

Advantages	Disadvantages
* Greater commitment of the worker with the organization * Increased personal performance * Flexibility of schedules *Autonomy of activities	* Long working hours * Feeling of insecurity at work * Lack of time control * Frustration due to problems coordinating activities * Difficulty separating work and family spaces * Lack of mental disconnection from work problems

Source: own elaboration taken from Ramos et al. (2020).

Due to health, crisis charges other additional aspects to those mentioned above. Among the consequences of the impact of the COVID-19 pandemic, work-related insecurity problems have become more acute, with an estimated reduction in employment of 6.7% (ILO, 2020), affecting above all sectors where it is not possible to adopt an alternative work modality as is the case of small businesses.

At the same time, other elements are added that affect the world population, such as uncertainty and fear —competitiveness and sustainability in the strategic management of global companies in times of COVID-19.

The COVID-19 pandemic is one of the most transcendental events in the life of humanity (Ballesteros et al., 2020). Among them are the social and economic consequences that directly affect the development of business organizations.

Companies see the need and responsibility to lead a more assertive and agile direction in terms of decision making in a changing and unpredictable environment; it is necessary to find new forms, programs, and action plans to improve the management of companies.

Figure 1. Business Management in the Health Emergency

Source: Own elaboration (ECLAC, 2020; Ballesteros et al., 2020).

As shown in Figure 1, the companies face health emergencies by applying occupational health and safety protocols, the deployment of teleworking, new digital tools, labor flexibility, and the reorganization of working hours. In an environment of rapid change and market uncertainty, many companies have been forced to innovate, re-evaluate how they operate and change their business models.

This chapter mentions that most companies have registered significant drops in their income and have difficulties maintaining their activities. For example, they have serious problems meeting their salary and financial obligations and difficulties accessing financing for working capital.

Although the crisis affects all companies, the impact is much more significant in the case of micro-enterprises and SMEs due to their weight in the business structure, which translates into extensive business closures and job losses.

The impact has been very different depending on the sector and the type of company. Several of the heavily affected sectors, such as commerce, hotels, and restaurants, have many micro and small businesses, which have been more affected.

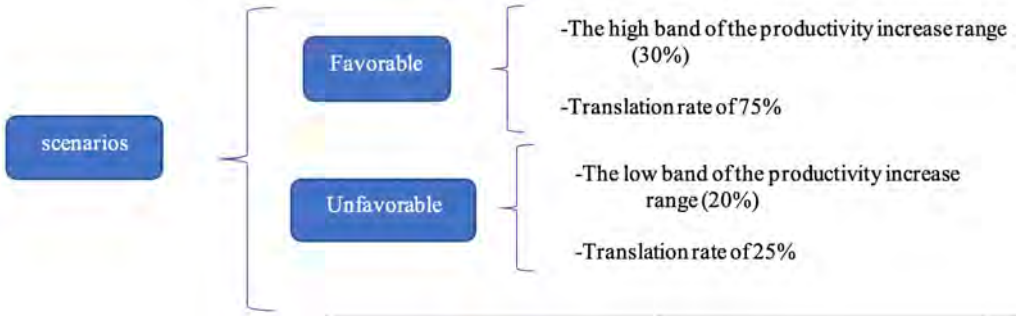
So news like the following is expected: Teleworking could increase productivity in Spain between 1.4% and 6.2%. A few years ago, Stanford University economics professor Nicholas Bloom carried out an empirical study on the benefits of teleworking in terms of labor productivity (Rodríguez & Pérez, 2021).

This analysis was based on the results of an experiment lasting almost a year in one of the largest tourism services companies in the world and concluded that remote work improved the performance of workers by no less than 13%.

However, the same study indicates that this improvement occurs when there is an adaptation to the employees' preferences, or, in other words, the increase in the workers' performance goes from 13% to 22% when teleworking is voluntary and not mandatory.

It is necessary to consider that telecommuting is not exempt from a certain "stigma", as the time spent in an office is associated with the worker's commitment to the company. The Stanford University study, for example, finds a negative relationship between telecommuting and career advancement. If we consider two equally productive employees, the probability of obtaining a promotion will be greater for those who work physically in the office: about who works remotely.

Figure 2. Scenarios in Spain Regarding the Impact of Teleworking on Productivity



Source: Own elaboration (Canals, 2021).

Canals (2021), to make a first approximation of the impact of teleworking on productivity in Spain. Starting from the estimates of said study on the impact of teleworking on worker productivity, they take the percentage of employees in Spain who could potentially carry out their work remotely (estimates that speak of 33%). Moreover, they apply the "transfer rate".

It is that: to get the most out of teleworking, it is not enough that the type of job can be carried out remotely. It is also necessary that the person wishes to do so and have the appropriate conditions in place, with a room of own or with a broadband internet connection.

Thus, both analysts point to two possible scenarios (Figure 2). In the one considered "most favorable," they consider the high band of the range of productivity increase reported by Nicholas Bloom (30%).

They also consider a high “transfer rate” of 75%, which means that a large part of the workers likely to work remotely want and meet the conditions to do so. In a second scenario, much less favorable, they consider the low band of the productivity increase range (20%) and a low “transfer rate” of 25%. Thus, the

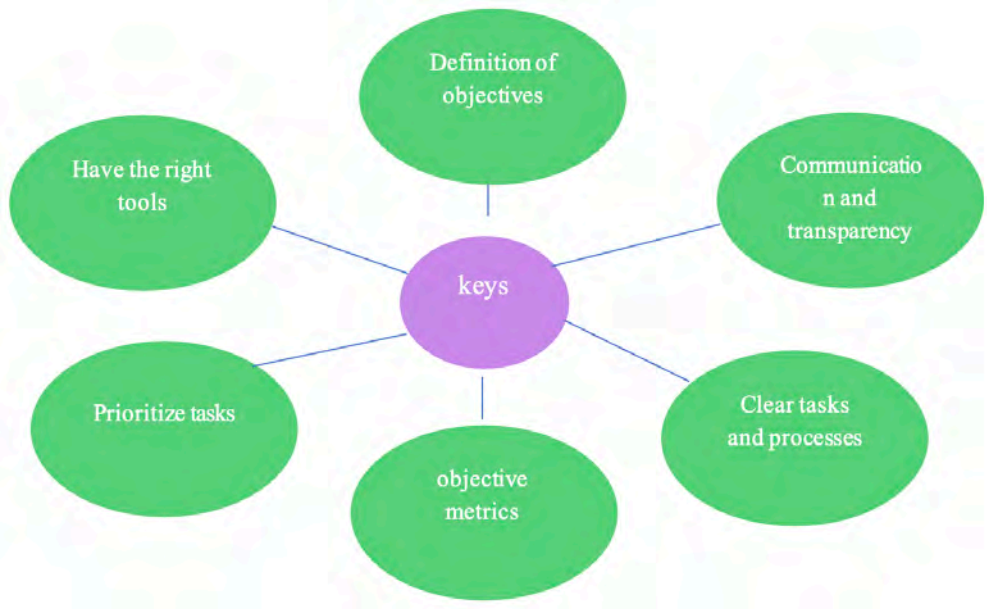
widespread adoption of teleworking can increase Spanish productivity between 1.4% and 6.2%.

Can productivity be measured in telecommuting? Accurately measuring the level of activity of employees in teleworking, it is essential to have a strategy and an organizational culture (Capell, 2020). The Covid-19 pandemic and the state of alarm forced Spanish companies to implement teleworking in all those positions where it was possible.

Due to the circumstances, many companies were not prepared either at a technological level or at a corporate culture level, which is why one of the main concerns of companies is that the productivity of teleworking is lower than in person. If they want to accurately evaluate their employees' performance, companies must focus on a framework of objectives, with its corresponding key performance indicators (Key Performance Indicators. KPI).

A correct corporate and digital culture will be critical for this model to work without affecting productivity, quite the contrary. The National Institute of Statistics (INE) in Spain itself indicates in 2006 that teleworking was 5.2%; in 2019, it rose to 8.3%. However, in 2020 there was a difference due to the pandemic of 22.3%. Likewise, it mentions that teleworking is between 5 and 22% more productive than face-to-face employees, while some international reports report different figures, but in any case, positive (Epdata, 2021).

Figure 3. Keys to Evaluate the Productivity of Teleworkers



Source: own elaboration taken from Capell (2020).

As shown in Figure 3, companies must consider the following considerations:

1) The definition of objectives. In addition to being transparent and realistic, these must be specific, measurable, affordable, results-oriented, and time-bound.

2) Communication and transparency. Keeping communication channels open between the company and remote workers is vital to boosting productivity. A good communication flow will allow us to help employees understand what their task is, offer them support to adapt to their new work reality, answer their questions and take care of the cohesion of the entire team.

3) Clear and understandable tasks and processes. Not only will they help the worker understand what to do, but they will also make it easier to objectively evaluate their performance.

4) Objective metrics to evaluate productivity. Aligned with work by objectives and results orientation, it is recommended that the company opt for objective indicators to avoid possible biases when evaluating employee productivity.

5) First, monitor the tasks that add the most value. To evaluate workers' performance, rather than tracking all their actions, it is essential to define which objectives and tasks are priorities and focus on their monitoring.

6) Have the right tools. Technology is of great help to monitor the work performance of remote workers. Technology can almost double the number of highly productive employees in the organization.

There are many solutions available on the market. From performance evaluation software, which offers us benchmark data with which to compare the productivity of employees, to tools that calculate how much time an employee spends working on the computer or that allow us to follow the progress of each project, identify those responsible, delivery dates (Capell, 2020).

Telecommuting: strengthening work in times of the COVID-19 pandemic. In Costa Rica**, w**ith the declaration of a pandemic, directive No. 073-S-MTSS establishes a series of inter-institutional coordination measures to guarantee compliance with the protocols of the health authorities and implement teleworking guidelines in state offices on the health alert (Montero et al., 2020).

As can be seen in Figure 5, it is essential to mention that this measure is temporary for the public sector, even though several state agencies have implemented this practice in their institutional work for years, focused on professional positions and that, in addition, impacts operating costs in the use of space or infrastructure.

Meanwhile, teleworking is a common practice that has a lesser impact on the transition from face-to-face work to a remote modality. The preceding is a response to the new demands of the market and interaction with clients. It breaks with the paradigm that works is subject to a specific place.

It is verified that for the performance of teleworking positions, these can be carried out in any place with facilities through connectivity, modern technologies, communication, security measures in labor matters and work risks, and the parties' commitment.

The regulations approved on teleworking for Costa Rica post-COVID-19 encourage organizations to adopt the guidelines to internal protocols and policies. So, it clarifies the responsibilities, duties, and rights of employers and collaborators (Figure 4), which must be guided by internal or external experts that guarantee the implementation of safety measures for occupational and occupational health, and that indirectly affects social and family health, since the home becomes an extension of the office.

The new global reality means that the labor market must rethink and evolve towards new concepts of doing things. Teleworking anticipates the national emergency in the case of Costa Rica for some sectors of the industry, strengthening certain companies that have this alternative to face the demands and needs of their strategic partners, based on compliance with quality standards and security in the provision of goods and services, with only access to virtual, remote or distance work (Montero et al., 2020).

Figure 4. Telecommuting in the Public and Private Sector

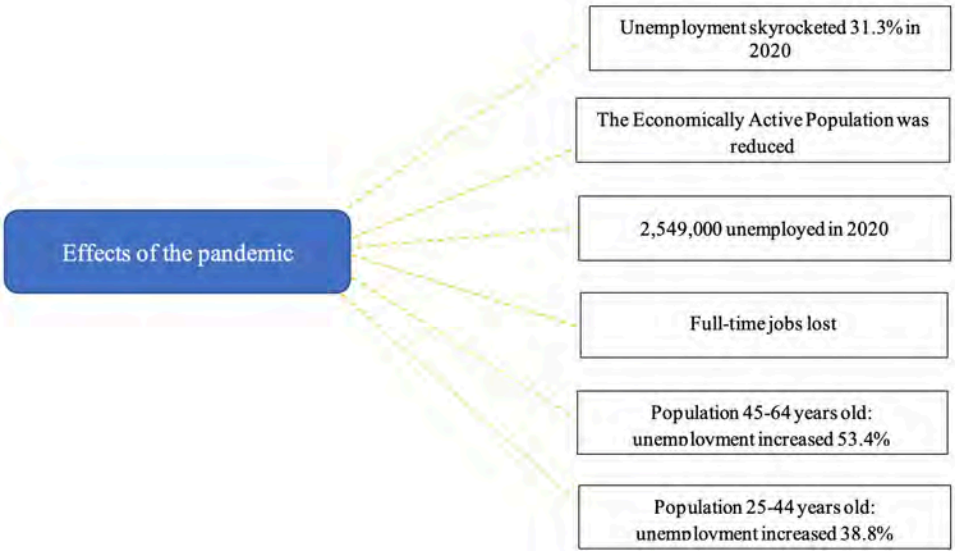
Source: Own elaboration taken from Montero et al. (2020).

The pandemic triggered 31.3% unemployment. The Mexican unemployed shot up 31.3% throughout 2020, compared to 2019, in one of the expressions of the crisis derived from the pandemic (Villanueva, 2021). Additionally, the Economically Active Population (PEA) was reduced, full-time jobs were lost, in micro-businesses and the informal sector (Villanueva, 2021); doubling underemployment and the volume of people who are not in the labor market because they do not see opportunities.

Between the last quarter of 2019 and the same period last year, the unemployed: population actively looking for a job without finding it went from 1,942,000 to 2,549,000. Despite the high degrees of informality that help reduce the open unemployment rate in the country.

The number of people who have been looking for a job between six months and a year grew by 332%. Among the most affected groups, the population aged 45 to 64 saw a 53.4% increase in unemployment, followed by those aged 25 to 44, which increased 38.8%.

Figure 5. Effects of the Pandemic on Employment in Mexico



Source: Own elaboration (Villanueva, 2021).

By educational level, it advanced 51.3% among those who have completed elementary school and 39.1 percent for high school graduates, even college. Except, the government sector and international organizations, where the number of workers increased by 145 thousand; social services that did it in 50 thousand; and construction in 46 thousand, there is no economic activity that has not seen its total workforce reduced.

In December, the employed population totaled 53 million 331 thousand workers, 2 million 352 thousand less than in December 2019. In addition, as a result of the pandemic, the underemployed population increased by 3 million 840 thousand, to reach 8 million 103 thousand workers, of whom one in 10 seeks additional employment.

It is accompanied by the loss of one million 383 thousand full-time jobs, 9 percent less than at the end of 2019, and an increase of 76.6 percent in temporarily absent; but maintaining the employment relationship (Villanueva, 2021).

RESEARCH PROBLEM

The research problem can be defined based on the lack of knowledge of how the COVID-19 pandemic, the digitalization of technology, and the current communications of the "home office" restrict the productivity and competitiveness of companies.

Principal objective

Determine how the home office influenced the productivity and competitiveness of companies

Specific objectives

Know how the economic effects of the COVID-19 pandemic in Mexico will influence the occupation of the economically active population

Hypothesis

H_T: There is the "Home office" as a work technique that influences the productivity and competitiveness of companies

Research Method

The research is explanatory; since it is essential to indicate that this work was explicity developed to correlate in the best waworkersy 1) how the home office influenced the productivity and competitiveness of companies in the Laguna Region in Mexico and 2) the effects on the occupation of the economically active population as a result of the COVID-19 pandemic in Mexico.

METHODOLOGY

Scope and limitations

As characteristics of the method used in this project, it would be said that it is an investigation that is mainly at an explanatory level and not experimental, since there was no deliberate manipulation of the variables, that is, there are no conditions or stimuli to which the subjects were exposed.

Research, nor was any situation constructed to see its effects. It is transversal because the research revealed how the home office influences the productivity and competitiveness of companies, and a study was not carried out

over time. It is from the field because the surveys were carried out in the interviewees' habitat or workplace and were not removed from their environment to carry out the research.

Sample size and description

An Own elaboration instrument was applied to a sample of 59 subjects; the said instrument comprises 50 interval questions with a Likert scale from 0 to 6 and 4 nominal variables that characterize the sample. This instrument was validated by obtaining Cronbach's alpha, where a value of 96.0% was obtained, which has high reliability and content validity, also presenting an estimation error of 3.08%.

Of the total of the 59 subjects surveyed, 69% are women and 31% men, with an average age of 34 years, 93% being trusted employees and 7% unionized, of which the level of studies is 61% bachelor's degree, 36% master's degree and 3% doctorate.

RESULTS

Univariate data analysis

In Table 2, Frequency Distribution by Gender, the vast majority of those interviewed are female (69.49%), and the rest (30.51%) are male. In Table 3, Frequency Distribution by Position, the vast majority of those interviewed are trusted employees (93.22%), and the rest (6.78%) are unionized.

Table 2. Distribution of Frequency by Gender

<table>
<tr><th>Gender</th><th>Frequency</th><th>Cumulative Frequency</th><th>Percentage</th><th>Accumulated percentage</th><th>Histogram</th></tr>
<tr><td>Female</td><td>41</td><td>41</td><td>69.49</td><td>69.49</td><td>| | | | | | | | | | | | | | | | | | | | | | | |
| | |</td></tr>
<tr><td>Male</td><td>18</td><td>59</td><td>30.51</td><td>100</td><td>| | | | | | | | | | | |</td></tr>
</table>

Source: Own elaboration made with NCSS.

Table 3. Frequency Distribution by Position

<table>
<tr><th>Position</th><th>Frequency</th><th>Cumulative Frequency</th><th>Percentage</th><th>Accumulated percentage</th><th>Histogram</th></tr>
<tr><td>Trusted employee</td><td>55</td><td>55</td><td>93.22</td><td>93.22</td><td>| | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | |</td></tr>
<tr><td>Unionized</td><td>4</td><td>59</td><td>6.78</td><td>100</td><td>| |</td></tr>
</table>

Source: Own elaboration made with NCSS.

In Table 4, Distribution of Frequency by Studies, it is observed that of the interviewees, the vast majority have a bachelor's degree (61.02%), 35.59% have a master's degree, and only 3.39% have a doctorate.

Table 4. Frequency Distribution by Studies

Studies	Frequency	Cumulative Frequency	Percentage	Accumulated percentage	Histogram
Doctorate	2	2	3.39	3.39	|
bachelor's degree	36	38	61.02	64.41	| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
Master's degree	21	59	35.59	100	| | | | | | | | | | | | | |

Source: Own elaboration made with NCSS

In Table 5, Frequency Distribution by Age, it can be seen that the vast majority of those interviewed are between 27 and 41 years old (28.81%), 27.12% are between 20 and 27, 8.47% are between 41 and 48, and the rest (6.78%) are between 48 and 55 years old.

Table 5. Frequency Distribution by Age

Age	Frequency	Cumulative Frequency	Percentage	Accumulated percentage	Histogram
20 to 27	16	16	27.12	27.12	| | | | | | | | | |
27 to 34	17	33	28.81	55.93	| | | | | | | | | | |
34 to 41	17	fifty	28.81	84.75	| | | | | | | | | | |
41 to 48	5	55	8.47	93.22	| | |
48 to 55	4	59	6.78	100	| |

Source: Own elaboration made with NCSS.

Multivariate factorial analysis

To determine if the study contained valid variables, three initial tests were performed: Determinant of the correlation matrix, KMO, and Bartlett's sphericity. The test shows that the validity of the study (Table 6) is based on the coefficient of the determinant of the correlation matrix with an almost zero value (1.245E-028), where a correlation is observed at a regular level of sample adequacy of the variables in 63.7% initial in KMO.

Table 6. KMO Tests, Bartlett Test, and Determinant

Kaiser-Meyer-Olkin measure of sample adequacy.	.637	
Bartlett's sphericity test	Approximate chi-square	2602.3
	G. L.	1225
	Sig.	.000
Correlation matrix	Determinant	1,245E-25

Source: Own elaboration made with SPSS

In addition, the Chi-square (2602.3) is at an acceptable level, which is why when correlating the variables, significant data were obtained through which the

initial hypothesis was approved, the minimum validity factor in the Bartlett sphericity test is 1225, whose significance is close to 0.000, which indicates that it is significant at 95% confidence ($\alpha < 0.05$).

Table 7 shows the total explained variance of 70.2%, where the variables are reduced to communalities and the maximum level of explanation of the survey for the investigation is determined; a minimum acceptable level is 50%.

Table 7. Total Variance Explained

Factor	Initial eigenvalues			Sums of the squared loadings of the extraction			Sum of the squared saturations of the rotation		
	Total	% variance	% accumulated	Total	% variance	% accumulated	Total	% variance	% accumulated
1	17.8	35.6	35.6	17.4	34.9	34.9	6.8	13.6	13.6
2	5.2	10.4	46.0	4.9	9.8	44.6	6.0	11.9	25.5
3	2.7	5.4	51.5	2.2	4.5	49.1	4.9	9.7	35.2
4	2.1	4.3	55.7	1.9	3.9	53.0	3.0	6.0	41.2
5	2.0	4.0	59.7	1.5	3.1	56.0	3.0	6.0	47.2
6	1.9	3.8	63.4	1.4	2.9	58.9	2.6	5.2	52.4
7	1.6	3.1	66.6	1.3	2.6	61.6	23	4.5	56.9
8	1.5	2.9	69.5	1.2	2.4	64.0	2.0	3.9	60.8
9	1.3	2.6	72.1	1.0	2.0	66.0	1.8	3.5	64.3
10	1.2	23	74.4	1.1	23	68.3	1.7	3.4	67.8
11	1.1	2.1	76.6	1.0	2.0	70.2	1.2	2.5	70.2

Source: Own elaboration made with SPSS.

The rest is explained with the theory contained in the literature. With this, the model for the application of the home office in companies is complemented to see the impact that this has had on their productivity and competitiveness.

Table 8. Exploratory Re-Test of Reliability of Unit Factors

Number of factor	Name Factor	Variables		Cronbach's Alpha
F1	Productivity and competitiveness	CarCom11 CarOrg10 CarProd12 CarProd13	ProdLabor04 HabMent09 MercLab08	924
F2	Employees	acreautoe35 MejProdE34 WithPodAd40	ExtSecEc36 ConPodAd38 ComEmpl37	893
F3	Commercial and industrial activity	MejPres27 BestActMer26 MejActIn25	AddComp21 AlcaMet23	890
F4	Increase in demand	IncDemaBi44	IncProdBi43	881
F5	Telecommuting	Implem03	IncrEqui19	703
F6	Economy and unemployment	Economy02	Performance1	882

Source: Own elaboration with the results achieved in the project "Impact of the Home Office on the productivity and competitiveness of companies".

As can be seen in Table 8, for the significance of the factors to be studied, a Re-Test was carried out, considering a minimum value of 0.6 to explore the significance of the individual factors. Based on tradition, the reliability value in exploratory research must be equal to or greater than 0.6; among these authors, Nunnally (2009): even establishes that in the first phases of the investigation, may be a reliability value of 0.6 or 0.5 be sufficient.

Based on the above, the six (6) significant factors in terms of reliability and individual validity are described in the subsequent parts, as shown in Table 8, which refers to the Re-Test of Cronbach's alpha, the factors: 1 Productivity and competitiveness (0.924), 2 Employees (0.893), 3 Commercial and industrial activity (0.890), 4 Increase in demand (0.881), 5 Telework (0.703), 6 Economy and unemployment (0.882), all with Cronbach's alpha more significant than 0.6 exploratories with Eigenvaluesgreater than one.

Table 9. Productivity and Competitiveness

FACTOR 1	LOAD F	N	min	max	Me	Md	Mo	Des Est	Sk	K
CarCom11	.860	59	1	6	4,271	4	4.0	1.3239	-.430	-.315
CarOrg10	.785	59	1	6	4,237	4	4.0	1.3044	-.314	-.641
CarProd12	.757	59	1	6	4,305	4	4.0	1.3803	-.453	-.490
CarProd13	.744	59	0	6	4,153	4	6.0	1.5292	-.565	-.325
ProdLabor04	.688	59	1	6	4,034	4	3	1.3641	-.147	-.698
HabMent09	.650	59	1	6	4,186	4	4.0	1.3706	-.182	-.887
MercLab08	.618	59	1	6	4,441	4	6.0	1.3553	-.300	-.819

Source: Own elaboration.

Table 10, Productivity and Competitiveness, shows that the interviewees agree that many times (Me => 4) due to the pandemic and the home office, this in influenced the productive (CarProd12), competitive (CarCom11), and organizational characteristics of the companies (CarOrg10), just as it influenced the productive characteristics of the workers (CarProd13), as well as influenced labor productivity (ProdLabor04) allowing the development of mental skills of workers (HabMent09) and the labor market in the national territory (MercLab08).

Table 10. Employees

FACTOR 2	LOAD F	N	min	max	Me	Md	Mo	Des Est	Sk	K
acreautoe35	.856	59	0	6	3,237	3	2	1.5574	-.071	-.540
MejProdE34	.755	59	0	6	3,441	3	3.0	1.3680	-.060	-.048
WithPodAd40	.722	59	1	6	3,678	4	3.0	1.3447	-.306	-.475
ExtSecEc36	.717	59	1	6	3,780	4	4.0	1.4863	-.226	-.730
ConPodAd38	.612	59	1	6	3,492	3	3.0	1.4065	.056	-.749
ComEmpl37	.604	59	1	6	4,220	4	4	1.3780	-.248	-.909

Source: Own elaboration.

It can be seen in Table 10, Employees, that the interviewees regularly agree that the home office increases the self-esteem of the employees (AcreAutoe35), improves the productivity of the company (MejProdE34), allows conserving the purchasing power of the consumer (ConPodAd40), in addition to having the possibility of being extended to all economic sectors (ExtSecEc36), it also makes it possible to preserve the purchasing power of real wages (ConPodAd38) and highlights that it is more comfortable for employees (ComEmpl37).

Table 11. Commercial and Industrial Activity

FACTOR 3	LOAD F	N	min	max	Me	Md	Mo	Des Est	Sk	K
MejPres27	.836	59	0	6	4,102	4	5.0	1.5613	-.737	-.056
BestActMer26	.722	59	0	6	4,034	4	4.0	1.3641	-.654	.416
MejActIn25	.721	59	0	6	3,881	4	5.0	1.5434	-.552	-.489
AddComp21	.681	59	1	6	4,254	4	4.0	1.3721	-.354	-.493
AlcaMet23	.662	59	1	6	4,780	5	6.0	1.3008	-1,277	1,604

Source: Own elaboration.

Table 12, Commercial and Industrial Activity, shows that the interviewees agree that many times (Mo => 4) the home office improved the provision of services (MejPres27) as well as commercial activity (MejActMer26), and industry (MejActIn25). As well was able to increase the company's competitiveness (AumComp21) and enabled the organization's goals to be achieved (AlcaMet23).

Table 12. Demand Increase

FACTOR 4	LOAD F	N	min	max	Me	Md	Mo	Des Est	Sk	K
IncDemaBi44	.803	59	1	6	3,661	3	3.0	1.3723	.106	-.958
IncProdBi43	.771	59	0	6	3,492	3	3.0	1.4783	.117	-.486

Source: Own elaboration.

It can be read in Table 12, Increase in Demand, that the interviewees regularly agree that the home office increased the demand for goods and services (IncDemaBi44), so the production of goods and services also increased (IncProdBi43).

Table 13. Telecommuting

FACTOR 5	LOAD F	N	min	max	Me	Md	Mo	Des Est	Sk	K
Implem03	.680	59	1	6	4,949	5	6.0	1.1806	-1,200	1,417
IncrEqui19	.632	59	0	6	4,610	5	6.0	1.4022	-.933	.859

Source: Own elaboration.

Table 13, Telework, shows that the interviewees agree that many times (Me => 4), the current pandemic influenced the implementation of the home office of the companies (Implem03) and increased the equipment for the necessary telework at home (IncrEqui19).

Table 14. Economy and Unemployment

FACTOR 6	LOAD F	N	min	max	Me	Md	Mo	Des Est	Sk	K
Economy02	.854	59	1	6	4,508	4	4.0	1.2370	-.331	-.435
Performance1	.709	59	1	6	4,644	5	4	1.2143	-.528	-.105

Source: Own elaboration.

Table 14, Economy and Unemployment, shows that the interviewees agree that many times (Mo = 4), the current pandemic had a considerable influence on the decline of the Mexican economy. (Economy02) and in unemployment in Mexico (Performance1).

Multivariate Structural Equation Model Analysis

On the other hand, to determine and corroborate the set of latent variables (factors with validity), four additional tests were carried out using the Structural Equations Model as described in Table 15, as well as the relationships between the factors: Productivity and competitiveness, Employees, Commercial and industrial activity, Increased demand, Telecommuting, Economy and unemployment, when eliminating non-significant variables, a good fit of the model and the acceptance parameters of the Chi-square relationship (390.6) and degrees of freedom (240) were achieved, with a level of significance (p) of 0.000, a root mean square residual (RMSEA) of 0.104, a Tucker-Lewis index (TLI) of 0.828, an NFI of 0.695, IFI of 0.9191 and a minimum value of the discrepancy function (CMIN/DF) is equal to 1.303 of the model and a (CFI) comparative fit index of 0.850. (Cea D'Ancona, 2004).

Table 15. Tests of the Structural Equations Model

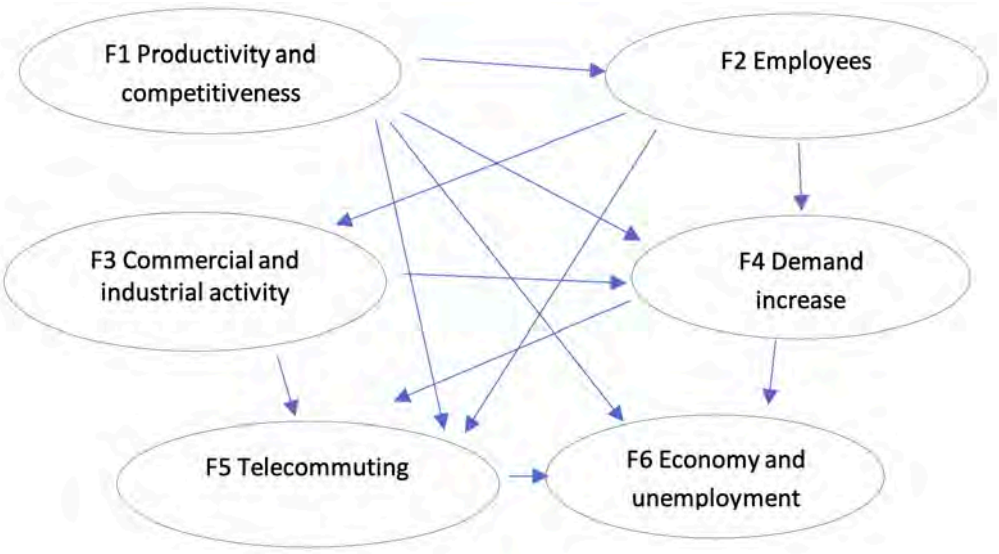
Omission Model Test	Chi-squared	390,624	
	G. l	240	
	Sig.	0	
Defect Model Test: CMIN	Chi-squared	390,624	
	G. l.	240	
	Next (CMIN/DF)	1,628	
Omission Model Test: Baseline Comparisons	NFI Delta 1	695	
	IFI Delta 2	649	
	TLI	828	
	CFI	850	
Defect Model Test: RMSEA Comparison	Next (RMSEA)	104	
	LO	85	
	HI	122	

Source: Own elaboration.

These values indicate that the model is consistent and good goodness of fit, which corroborates and confirms the initial hypothesis. In Figure 6, it is observed that the latent variables F1 Productivity and Competitiveness is the

source of the correlation with F2 Employees, F4 Increase in demand, F5 Telecommuting and F6 Economy and unemployment allow, according to the model, to affirm that the home office that people are carrying out has had an impact on the productivity and competitiveness of companies, so Figure 7 and Table 14 corroborate what is established in the Work Hypothesis.

Figure 6. Structural Model



Source: Own elaboration.

CONCLUSIONS

The interviewees established that in the face of the COVID-19 pandemic, a new way was developed to increase the productivity and labor competitiveness of both organizations and their employees since it changed the format of the labor market from face-to-face to telecommuting, forcing them also to change skills. The new productivity of workers supports companies in all economic sectors to maintain the possibility of implementing the "home office" effectively.

As a result of the COVID-19 pandemic, the Home Office had a better provision of services in commercial activity and industrial activity, despite the difficulties; the demand for goods and services increased so it was necessary to increase the production of companies. Without forgetting that the companies had to provide their collaborators with all the necessary equipment for teleworking..

Additionally, among the results specifically obtained, the following advantages of implementing the home office are distinguished:

- Employees develop new job skills
- Labor productivity is motivated

- The labor market in Mexico is restructured
- The self-esteem of the employees is increased
- Savings in transport costs
- Reduces transportation time and the need for transfers
- Improves time management to achieve established goals
- Improvement in the provision of services of the company and its competition
- In many companies, increased demand for goods and services by users
- In many companies increased the production of goods and services
- The pandemic accelerated the implementation of the home office

Despite this, the Mexican economy was negatively affected by COVID-19, reflecting a small proportion of unemployment in the population, which encouraged the development of a new way to increase productivity and competitiveness of labor and organizations.

Due to the above, a model was structurally confirmed that shows the relationships between the factors: Productivity and Competitiveness, Employees, Increase in demand, Teleworking and Economy and unemployment, which proved to be very significant in their correlations, so these values indicate that the model it is consistent and with acceptable goodness of fit, which allows, according to the model, to affirm that the home office that people are carrying out has had an impact on the productivity and competitiveness of companies.

In this way, the working hypothesis that establishes that the "Home office" as a work technique influences the productivity and competitiveness of companies in the face of Covid-19: was corroborated and verified.

REFERENCES

Aguilar, F. J. & Lira, A. (2020). The COVID-19 pandemic and its impact on the Mexican automotive industry, 2020. *I+D Space, Innovation plus Development, 9*(25). https://doi.org/10.31644/IMASD.25.2020.a04

Ballesteros, E.Y., Parra, D.A., & Aguayo, V.R. (2020). Competitiveness and sustainability in the strategic management of global companies in times of COVID-19. *Journal of Alternative Perspectives in the Social Sciences, 10*(4), 899–916.

Blomström, M., Kokko, A., & Zejan, M. (2000). Multinational corporations and productivity convergence in Mexico. In *Foreign Direct Investment* (pp. 134-159). Palgrave Macmillan, London.

Canals, C. (2021). *Teleworking and productivity: a complex binomial*. Spain: Caixa Bank. Link: https://www.caixabankresearch.com/en/economics-markets/activity-growth/teleworking-and-productivity-complex-binomial

Capell, J. (2020). *Can productivity be measured in telecommuting? Human capital.* Link: https://capitalhumano.wolterskluwer.es/ch/2020/11/01/se-puede-medir-la-productividad-en-el-teletrabajo

Cea D'Ancona, M. A. (2004). *Análisis multivariable. Teoría y práctica en la investigación social.* Madrid: Síntesis.

Epdata. (2021). *The evolution of 'telework' in Spain, in graphics*. Epdata. Link: https://www.epdata.es/datos/teletrabajo-datos-graficos/517#:~:text=Un%20total%20de%204.405.320,different%20occupations%2C%20seg%C3%BAn%20un%20an%C3%A1lisis

Esquivel, G., & Rodrıguez-López, J. A. (2003). Technology, trade, and wage inequality in Mexico before and after NAFTA. *Journal of development Economics, 72*(2), 543-565.

Fadinger, H., & Schymik, J. (2020). The costs and benefits of home office during the covid-19 pandemic: Evidence from infections and an input-output model for germany. *COVID Economics: Vetted and Real-Time Papers, 9*, 107-134.

García, J., L. (2020). *Home office, a job option before and after the coronavirus.* Ciencia UNAM. Link: http://ciencia.unam.mx/leer/1015/home-office-una-opcion-laboral-antes-y-despues-del-coronavirus#:~:text=El%20home%20office%2C%20tambi%C3%A9n%20conocido,las%20instalaciones%20de%20la%20empresa.

Hill, E. J., Ferris, M., & Märtinson, V. (2003). Does it matter where you work? A comparison of how three work venues (traditional office, virtual office, and home office) influence aspects of work and personal/family life. *Journal of Vocational Behavior, 63*(2), 220-241.

Hill, E. J., Miller, B. C., Weiner, S. P., & Colihan, J. (1998). Influences of the virtual office on aspects of work and work/life balance. *Personnel psychology, 51*(3), 667-683.

Ibarra-Muñoz, A. M., Varela-Castro, W. H., Yañez-Betancourt, G. (20021). Impacto del "Home office" en la productividad y competitividad de las empresas a raíz de la pandemia COVID-19. En Sánchez-Gutiérrez, J., Mayorga-Salamanca, P. I. (Coords.). *Reinventándose para la Competitividad Post-Covid-19 (984-1003)*. Mexico: RIICO.

ILO. (2020). *ILO Observatory: COVID-19 and the world of work.* Second edition. Geneva: ILO

Kaushik, M., & Guleria, N. (2020). The impact of pandemic COVID-19 in workplace. *European Journal of Business and Management, 12*(15), 1-10.

Lakner, C., Mahler, D. G., Negre, M., & Prydz, E. B. (2022). How much does reducing inequality matter for global poverty?. *The Journal of Economic Inequality*, 1-27. https://doi.org/10.1007/s10888-021-09510-w

Landa, H., Cerezo, V., & Perrotini, I. (2020). The structural vulnerability of the Mexican economy in the face of the crisis derived from the COVID-19 pandemic. *Contaduría y Administración, 65*(4).

Martínez, S., & Veloz, M. (2020). Consequences of the measures adopted in Mexico as a result of the coronavirus. Analysis of a possible responsibility. *Ius Comitialis, [Sl], 3*(6), 239-260.

Mendoza, J. E. (2021). COVID-19 and employment in Mexico: Initial impact and short-term forecast. *Contaduria y Administracion, 65*(4), 1-18.

Montero, B., Vasconcelos, K.L. & Arias, G. (2020). Telecommuting: strengthening work in times of the COVID-19 pandemic. *Revista de Comunicación y Salud*, 10(2), 109-125. DOI: https://doi.org/10.35669/rcys.2020.10(2).109-125.

Ng, C. F. (2010). Teleworker's home office: an extension of corporate office?. *Facilities, 28*(3-4), 137-155.

Nunnally, J. C. (2009). *Teoría Psicométrica*. Mexico: Trillas.

Patton, E. A. (2020). *Easy living: the rise of the home office*. Rutgers University Press.

Ramos, V., Ramos-Galarza, C., & Tejera, E. (2020). Telecommuting in times of COVID-19. *Interamerican Journal of Psychology, 54*(3), 1–29. https://doi.org/10.30849/ripijp.v54i3.1450

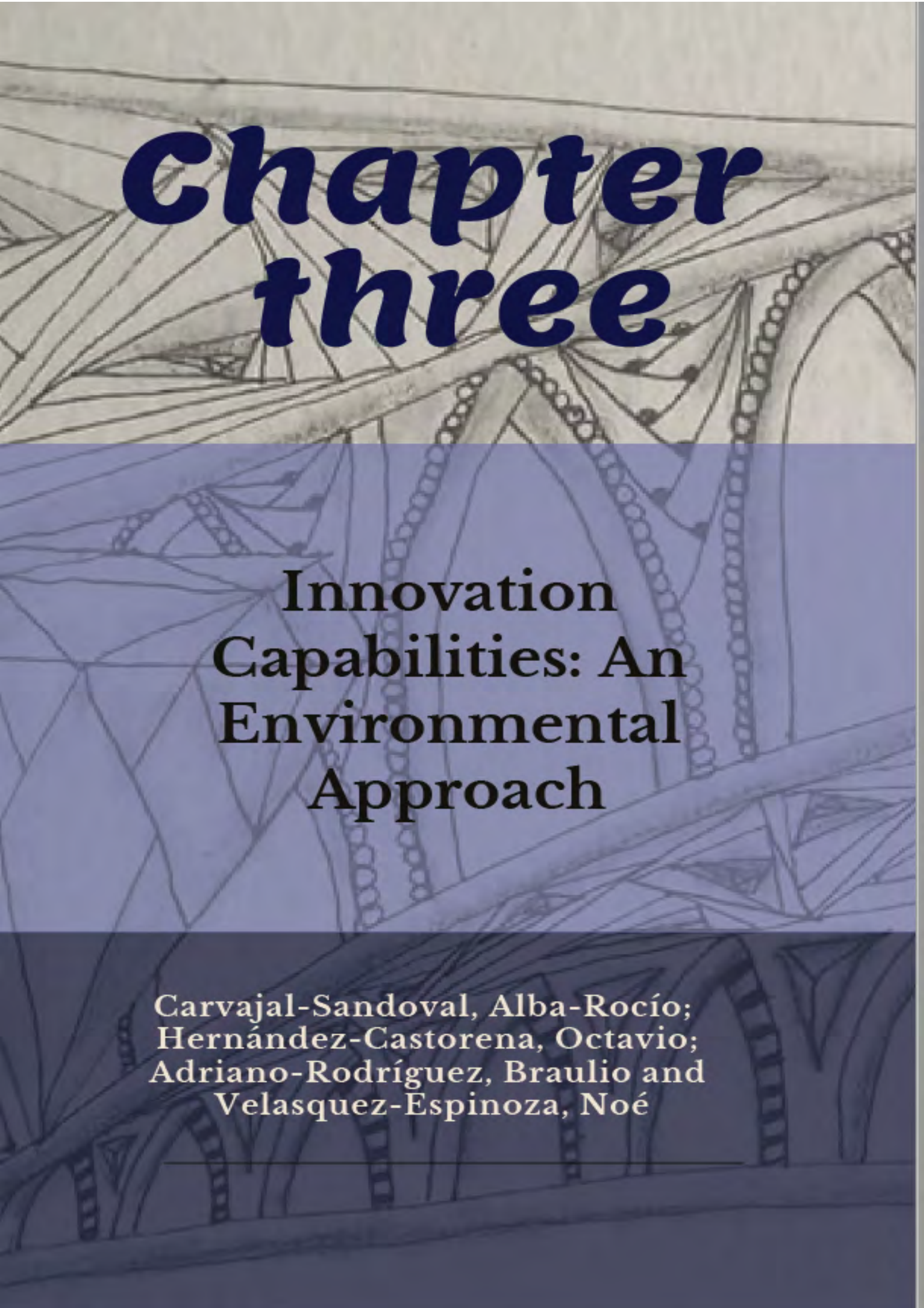
Rodríguez, O. (2020). Home Office in the new normality: Challenges and future of the Home Office. *Latin American Journal of Social Research, 3*(3), 94-99.

Rodríguez, J., & Perez, C. (2021). Teleworking could increase productivity in Spain between 1.4% and 6.2%. *Special Directors, 1794*, 56–60. link: https://www.cesce.es/es/-/asesores-de-pymes/el-teletrabajo-poder-incrementar-la-productividad-entre-un-14-y-un-62

Ruiz, P. (2021). Covid-19: Teleworking in times of pandemic. *History and Social Communication, 26*(SE), 11. https://doi.org/10.5209/hics.74237

Salas, C., Quintana, L., Mendoza, M. Á., & Valdivia, M. (2020). Distribution of the labor income and poverty in Mexico during COVID-19 pandemic. Scenarios and potential impacts. *El trimestre económico, 87*(348), 929-962. https://doi.org/10.20430/ete.v87i348.1148.

Villanueva, D. (2021, February). Disparó la pandemia 31.3% el desempleo. *La Jornada*. Link: https://www.jornada.com.mx/notas/2021/02/16/economia/disparo-la-pandemia-31-3-el-desempleo/



chapter three

Innovation Capabilities: An Environmental Approach

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Innovation Capabilities: An Environmental Approach

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Introduction

Nowadays, innovation has been recognized as a factor of analysis in creating future scenarios based on in-depth diagnoses carried out in organizations outside their sector and business activity (Carvajal, 2019). In this regard, Schumpeter (1935; 1950) states that companies must be innovative because of customers' dynamics and natural demands for constant improvement.

As a result, it is crucial to be at the cutting edge and take advantage of the areas of opportunity in the products (and even of the services) to be in the clients' preference. The relationship between innovation and company performance is abundant in the literature (Duréndez & García, 2008; Moradi et al., 2021; Li et al., 2021; Latifi, Nikou & Bouwman, 2021; Hutahayan, 2021)), and, in general, the importance of innovation is known by big enterprises that participate in the market.

If the organization is innovative, its flexibility will give it more extraordinary performance and make it more competitive. Since it will have a greater capacity to adapt to changes in the environment, to respond promptly to market demands as well as to meet customer needs considering the changing needs of the environment as a whole to obtain better results (Drucker, 1985; Miles & Snow, 1978). Faced with the urgent need to give importance to the issue of innovation, entrepreneurs need to determine how necessary it is to innovate

processes, systems, or work methods even if their organizations are small and medium-sized companies. That is why the purpose of this research paper attempts to identify the innovation capabilities that influence the factors of change for better performance in manufacturing SMEs in Aguascalientes.

THEORETICAL FRAMEWORK

Innovation capabilities

Innovation capabilities are natural talents that organizations have to make the best use of their resources. Their purpose is to improve their relations strategies among organizations and with the environment where they develop, speaking productively, by considering as a basis their technological capabilities (Quintero et al., 2021; Hafeez et al., 2002).

Morales and Díaz (2019), who quote Kim (1997), also establish that the technological capabilities at the level of individual companies can be subdivided into four essential elements that show specific subsets of production of required skills in order to carry out processes of technological change.

The first one (*production capabilities*) refers to all the necessary skills to achieve an efficient operation of the enterprise comprised of the standard technical parameters necessary to adapt and improve within the current technologies as a reaction to the market's changing conditions.

A second subset is the *investment capabilities*, the skills needed to expand production capacity and create new products. It involves not only the identification, preparation, and attainment of technology, but also the design, construction, and operation of the acquired equipment, as well as the ability to carry out internal analysis of profitability, feasibility of new projects, and the engineering capacity to execute, coordinate and supervise them to have increased competitive organizations (Boyaci & Yildiz, 2017; Conner, 1991; Penrose, 1959).

Finally, another subset is *linkage capabilities*, which refers to the skills necessary to receive and transmit knowledge from other companies and institutions such as supplying companies, specialized services, subcontractors, consultancy, and technological institutes, among others (Carvajal, 2019).

The essential functions of innovation capabilities are critical in order for organizations to operate in a systematic and coordinated manner, so the internal processes are efficient and meaningful with other structures, either internal or external to the company (Carlsson, 2002).

In this regard, innovation capabilities need to be comprehensive and trigger competitiveness, high performance, use of technology and strengthen knowledge as well as the development of organizations (Guan & Ma, 2003; Yam et al., 2004; Gilsing & Nooteboom, 2006; Quintero et al., 2021).

In addition, however, it can also denote those improvements that, despite not being on the international frontier, contribute to a substantial increase in productivity at the level of a particular company (Carvajal, 2019; Tidd, 2001).

The directors of innovative companies recognize the importance of competitiveness to avoid falling by the wayside (Morales & Díaz, 2019).

Additionally, the organization needs to strengthen its internal development. In order to have more excellent knowledge, optimize their experience and develop their skills in an environment of permanent improvement to have more significant competitive advantages (Richardson, 1972; Nadler and Tushman, 1980; Baden-Fuller, 1995).

From this perspective, it is essential to highlight that the most effective organizations contain a solid structure in their internal processes. The solidity is from their ability to innovate necessary elements of change and a comprehensive view beyond the structuring of their operational mechanisms that allow and guarantee the efficiency in their natural internal systems of operability (Nadler & Tushman, 1997; Quintero et al., 2021).

Research and Development activities in organizations are one of the primary sources of growth in business productivity. However, several empirical studies reflect a sustantial disparity between companies when benefiting from their innovative activities. However, this difference is explained by productivity and knowledge and efficiency differences (Manjón & Añón, 2009).

That is why it is essential to understand the importance of the capacities produced by innovation and that the use of knowledge leads public authorities to make permanent efforts for research in technology transfer of innovation systems (Arnold & Thuriaux, 1997).

Nevertheless, the only common trait in all the definitions regarding technological innovation is that innovation implies the concept of novelty, and the market acts as a regulatory agent and promoter of innovation, but this demands knowledge and skills, so it becomes a sustainable competitive advantage (Tidd, 2001).

CHANGE FACTORS

It is pretty evident that organizations are constantly in the process of learning about the changes that are required in the business environment, and this depends on the typical demands of clients, the market, the social and governmental adjustments as well as the permanent internal improvements that are perceived by all company personnel considering that they have a constant interest in improvement (Lusthaus et al., 2002; Prieto et al., 2015).

Therefore, allows considering that companies, faced with the urgencies of change, need strategies that allow them to adapt to the new conditions of

survival as well as improvement focused, obviously, on better performance, management quality, and responsible integration in the social-productive sphere (Prieto et al., 2018).

In this regard, it is essential to highlight that the change factors are intended to be significant support. These guarantees that the adjustments made in the organizations have a better work culture, better use of technologies, readjustments of processes of the activity they have, and of course, a greater focus with competitive advantages that allow organizations to have a better performance regardless of their commercial activity (Schermerhorn, 2005).

On the other hand, it is a reality that nowadays, no organization is considered operationally stable due to how it perceives the market and the clients' needs (Newstron, 2011). Therefore, those responsible for this type of company need to be attentive to internal technological, strategic, and organizational improvements (Prieto et al., 2018).

In this regard, the present research paper has the purpose of analyzing each one of the dimensions that integrate the innovation capabilities and how they affect the factors of change in SMEs manufacturing companies in Aguascalientes, as well as exploring their level of competitiveness in the market (Carvajal, 2019; Tidd, 2001). In this regard, the following hypothesis is established:

H1: Are innovation capabilities key elements that influence change factors in the improvement of manufacturing SMEs in Aguascalientes?

METHODOLOGY

The following section contains the methodological design implemented in this research paper describing how the empirical work was developed:

a) Due to its approach, the analysis of the study is quantitative under the scheme of the use of statistical techniques and measurement instruments (Pita & Pértegas, 2002; Ferrán, 1996).

b) The method used in this research paper is deductive, as explained by Sánchez (2012), where the analysis of each of the elements that make up the study model will be carried out in-depth, which was analytical according to the book of "The Analytical Method as a Natural Method" by Echavarría (2010). Likewise, the method requires a hermeneutical analysis since it is crucial to describe and interpret particular meanings that derive the depth of the study of the present investigation (Cárcamo, 2005).

c) The type of research was a descriptive and correlational analysis (Pita & Pértegas, 2002).

d) Regarding the data collection techniques, the analysis requires an inferential analysis once the statistical analyses are available, which are constituted by a Cronbach's alpha reliability analysis (George & Mallery, 2003; Nunnally, 1967), descriptive analysis, and a Person correlation analysis (Joe, 1997), with the support of the version 25 SPSS software.

e) A survey of two blocks identified as Innovation Capabilities and Change Factors was implemented.

f) The sample is stratified random with a sample of 156 units (manufacturing SMEs of Aguascalientes State, Mexico).

MEASUREMENTS DEVELOPMENT

Regarding the instrument implemented in the present research to the manufacturing SMEs of Aguascalientes State, it was designed with two blocks identified as Innovation Capabilities and Factors of Change measured with a Likert scale from one to five where one corresponds to "totally disagree", and five corresponds to "totally agree". Figure 1 shows the theoretical model used in this research paper.

Figure 1: Theoretical model of the research paper

Source: Compiled by the authors based on Carvajal (2019)

The theoretical model is an adaptation of Carvajal (2019) to analyze how the managers or owners of the manufacturing SMEs in Aguascalientes perceive the innovation capabilities of companies regarding the factors of change.

RESULTS

In this section, the reliability results of the instrument applied to the managers or owners of the companies located in Aguascalientes State, Mexico, are shown. It is essential to mention that the value of Cronbach's Alpha was used for the reliability of the instrument, which indicates that it needs to meet some acceptance conditions.

If the result is 0.7 or higher, the construct is considered acceptable and reliable for validation (Frías, 2014). However, for investigations in the experimental phase, it is permitted to continue with the study regardless of the references made by George and Mallery (2003) and Nunnally (1967) about having values of 0.6 (questionable analysis). Below are the results obtained from the instrument used in this research by block or factor.

Regarding the general data obtained from the empirical work, the SMEs located in Aguascalientes State, Mexico, was used as the object of study. A measurement instrument was applied to the managers or owners of these companies in a sample of 156 units.

The results obtained show that the oldest company has had commercial operations since 1926, and the most recent one was created in 2019. Furthermore, the results of the reliability analysis, shown in Table 1, confirm the validity of the instrument by exceeding the value of 0.7 established by Frías (2014).

Table 1. Reliability Analysis of the CHANGE FACTORS block

Factor	Cronbach's Alpha
Change Factors	966

Source: Compiled by the authors

The reliability analysis for the change factors block complies with the minimum allowed in the Cronbach's Alpha analysis (minimum 0.7), so it block is considered reliable for its application in the fieldwork. Similarly, Table 2 shows the reliability results of the innovation capabilities block.

Table 2. Reliability analysis of the INNOVATION CAPABILITIES block.

Factor	Cronbach's Alpha
Importance of the Environment	906
Innovation of the Enterprise	940
Innovation Impacts	947
Collaboration and Marketing	944
Organization	947
Environment	930
Knowledge	952
Technology	970
Organizational Culture and Executives:	956

Source: Own elaboration.

The results of Table 2 indicate that each factor integrated into the Innovation Capabilities block meets the minimum value of 0.7 required by the reliability analysis for an evaluation instrument. Regarding the general data, Table 3 shows general data of the companies surveyed regarding their type of company and type of productive processes.

Table 3. Form of ownership and Type of Production

	Type of Production Process			
Property Form	Automated	Semi-Automated	Labor intensive	Total
National Private	12	23	31	66
State	5	15	32	52
Mixed	2	1	0	3
Total	19	39	63	121

Source: Own elaboration.

Table 3 shows that 31 companies carry out manual activities and are national private companies, while 32 of the manual processes organizations are state-owned companies. Few enterprises have automated processes in which the national private sector has the most companies with these working conditions (12). It is essential to describe that 35 companies do not have a record of their relationship with ownership and type of production process. On the other hand, Table 4 shows the type of company and the production processes.

Table 4. Type of Company and Type of Production Processes

	Type of Production Process			
Number of employees	Automated	Semi-Automated	Labor-intensive	Total
From 1 to 11	15	27	51	93
From 12 to 50	1	10	8	19
over 51	0	1	1	2
Total	16	38	60	114

Source: Compiled by the authors.

Table 4 reflects that micro-companies have the most manual processes internally (51). The companies with the most automated processes are micro with 15 and one small enterprises. It is worth noting that the companies surveyed have not been interested in automating internal processes that allow them to expand their productive capacity. 42 companies did not present the number of employees and the type of production processes.

Similarly, in the present research, a Pearson Correlation analysis was carried out in order to analyze which dimension of the Innovation Capabilities block has the most significantt impact in the Change Factors block and with this infer in which companies there are elements that can be key for higher competitiveness in the market. Table 5 shows the results of the Pearson Correlation.

Table 5. Results of the Pearson Correlation for the Change Factors and Innovation Capabilities blocks

Factors		Change Factors
Importance of the Environment	Pearson correlation	**.758****
	Next (2-sided)	.000
Innovation of the Enterprise	Pearson correlation	**.646****
	Next (2-sided)	.000
Innovation Impacts	Pearson correlation	**.569****
	Next (2-sided)	.000
Collaboration and Marketing	Pearson correlation	**.626****
	Next (2-sided)	.000
Organization	Pearson correlation	**.749****
	Next (2-sided)	.000
Environment	Pearson correlation	**.671****
	Next (2-sided)	.000
Knowledge	Pearson correlation	**.759****
	Next (2-sided)	.000
Technology	Pearson correlation	**.769****
	Next (2-sided)	.000
Organizational and Management Culture	Pearson correlation	**.618****
	Next (2-sided)	.000

Source: Own elaboration.

For the Pearson correlation analysis with the aspects of the Change Factors and Innovation Capabilities blocks, the results are 100% positively significant, which indicates that, for managers and owners, any relation among these factors is important for the performance and growth of their organizations.

Furthemore, the analyses show that, for entrepreneurs, any integrated element as a factor of change is significant and relevant to improve any activity that is related to innovation regardless of its form of expression and approach, either by product or service, so the theoretical model is highly recommended for any research approach in the uses that can be considered applicable.

Discussion

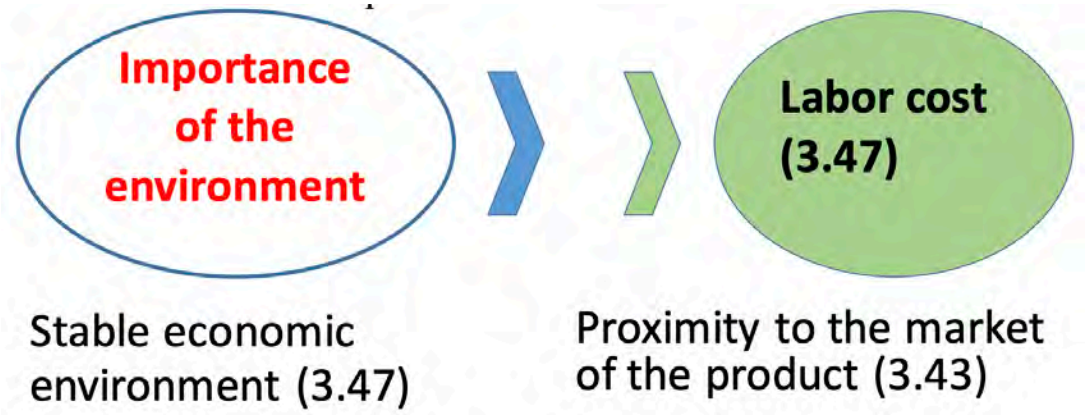
Considering that small companies still tend to carry out manual or semi-automated operations, with the results obtained, it can be seen that the innovation capabilities considered in the evaluation instrument for this research significantly benefit the operational and organizational performance of these companies, thus guaranteeing a more reliable future, mainly in the environment, knowledge, and technologies (Escorsa & Pasola, 2004).

In this regard, the dynamic process that generates a skill, resource, or technology in an organization develops a competitive advantage that keeps organizations competitive, and therefore, with a vision of the future, which becomes much more reliable. When the enterprises are innovative, or do not last, suggesting to entrepreneurs or managers of these companies to have a more future vision of improvement and innovation in all the internal aspects of the company (Schumpeter, 1935).

The innovation capabilities in organizations, in general, can keep not only their current sustainable competitive advantages but also their competitive survival in response to the changing environment (Gálvez & García 2012). That is why the analysis in this research shows that the group of experts recognizes the importance of innovation capabilities to remain competitive.

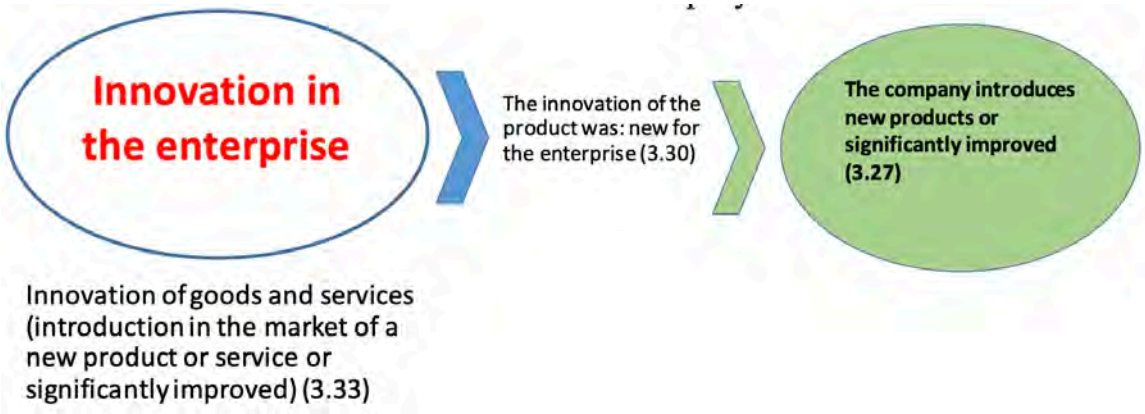
Moreover, thus building the desired future in the process of strategic foresight. It is mainly due to the significant impact that this block has on each of the elements of the change factors, which in turn affect the performance. The following figures 2, 3, and 4) show the factors with the highest scores which experts choose to create competitive advantages in the company's future.

Figure 2. Analysis of competitive advantages with the implementation of Innovation capabilities – Importance of the Environment



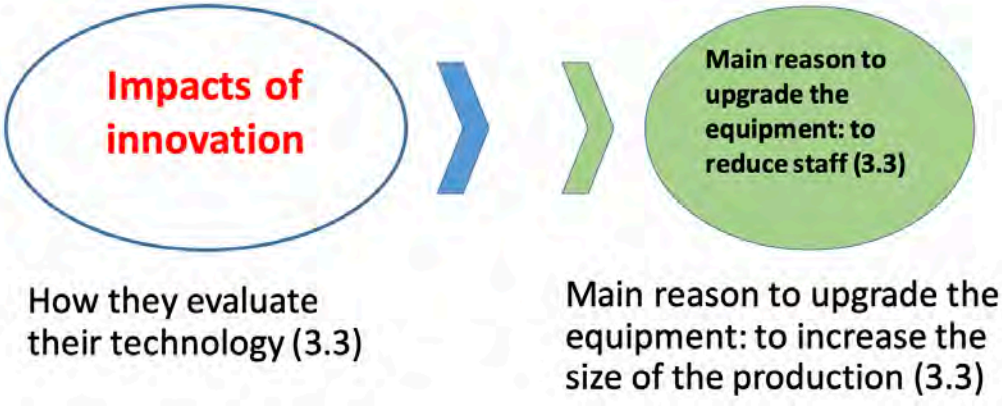
Source: Compiled by the authors.

Figure 3. Analysis of competitive advantages with the implementation of Innovation capabilities – Innovation in the company



Source: Compiled by the authors.

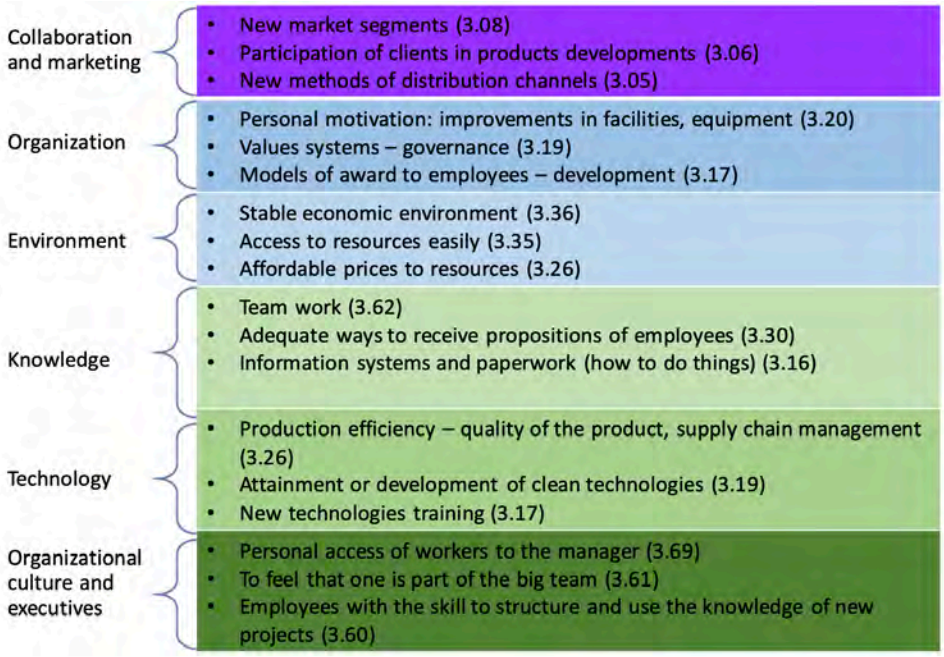
Figure 4 Analysis of competitive advantages with the implementation of Innovation capabilities – Impacts of Innovation



Source: Compiled by the authors.

Figure 5 shows the critical elements in their relationship with change factors in each dimension of the Innovation Capabilities block, so these organizations have greater competitiveness and development in their business activities.

Figure 5 Analysis of competitive advantages with the implementation of Innovation capabilities – Innovation Activities



Source: Author's elaboration.

Finally, it is essential to highlight that the organizations considered in this research tend to take advantage of the opportunities in the market considered and develop their innovation capabilities as well as to structure each of the elements of the change factors at the same time to have better development and higher performance.

Further research projects can implement the model in other regions, in another type of business sector, and other countries considering the characteristics of the companies analyzed in Aguascalientes in terms of size and business sector. On the one hand, the advantages of comparative analysis would be observable. On the other hand, the validation of the model would strengthen the academy in training future professionals who will potentially be the owners or managers of these organizations.

REFERENCES

Arnold, E. & Thuriaux, B. (1997). *Developing Firms, Technological Capabilities, Informe para la OCDE*, Brighton. Link: www.technopolis-group.com.

Cárcamo, H. (2005). Hermenéutica y análisis cualitativo. *Cinta de Moebio. Revista de Epistemología de Ciencias Sociales*, (23).

Carvajal, S.A.R. (2019). *Medición de las capacidades de innovación en un modelo de Prospectiva estratégica*, Doctoral Dissertation, Bogota: Universidad del Externado.

Drucker, P. (1985). *La Innovación y el empresario innovador*. México: Edhasa.

Duréndez, A. & Garcia, D. (2008). *Innovative culture, management control systems and performance in young SMEs.* Doctoral Dissertation, University of Caen, France. Link: http://www.unicaen.fr/colloques/Entrepreneurship_Conference_2008/Innovative_culture_management_control_systems_and_ performance_in_young_smes.pdf .

Echavarría, J. D. L. (2010). El Método Analítico como Método natural, *Nómadas*, *25*(1), 327-353.

Escorsa, C. P. & Pasola, J. V. (2004). *Tecnología e innovación en la empresa* (Vol. 148). Universidad Politècnica de Catalunya.

Frías, N. D. (2014). *Apuntes de SPSS: Análisis de fiabilidad de las puntuaciones de un instrumento de medida. Alfa de Cronbach: Un coeficiente de fiabilidad*. Valencia: Universidad de Valencia.

Ferrán, M. (1996), *SPSS para Windows. Programación y análisis estadístico.* Madrid: McGraw-Hill.

Gálvez, A. E. J. & García Pérez de Lema, D. (2012). Impacto de la innovación sobre el rendimiento de la MIPYME: un estudio empírico en Colombia. *Estudios gerenciales*, *28*(122), 11-28.

George, D. & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference*. 11.0 update (4thed.). Boston: Allyn & Bacon.

Hutahayan, B. (2021). The relationships between market orientation, learning orientation, financial literacy, on the knowledge competence, innovation, and performance of small and medium textile industries in Java and Bali. *Asia Pacific Management Review, 26*(1), 39-46.

Joe, H. (1997). *Multivariate models and dependence concepts*. New York: Chapman and Hall/CRC, Boca Ralton.

Kim, L. (1997). The dynamics of Samsung's technological learning in semiconductors. *California Management Review*, 39(3), pp. 86-100.

Latifi, M. A., Nikou, S., & Bouwman, H. (2021). Business model innovation and firm performance: Exploring causal mechanisms in SMEs. *Technovation*, 107, 102274.

Li, F., Xu, X., Li, Z., Du, P., & Ye, J. (2021). Can low-carbon technological innovation truly improve enterprise performance? The case of Chinese manufacturing companies. *Journal of Cleaner Production, 293*, 125949.

Manjón, M.C., & Añón, D. (2009). Aportación de la inversión de I+D a las mejoras en la productividad, *Economía Industrial*, 373, 13-22.

Miles, R. & Snow, C. (1978). *Organizational strategy, structure and process*. New York: McGraw-Hill.

Moradi, E., Jafari, S. M., Doorbash, Z. M., & Mirzaei, A. (2021). Impact of organizational inertia on business model innovation, open innovation and corporate performance. *Asia Pacific Management Review, 26*(4).

Morales, S. M. A., & Díaz, R. H. E. (2019). Determinantes de las capacidades de innovación en el sector biotecnológico en México. *Investigación económica*, *78* (307), 90-118.

Nunnally, J. C. (1967). *Psychometric theory*. New York: McGraw Hill, USA.

Pita, F. S. & Pértegas, D. S. (2002). Investigación cuantitativa y cualitativa. *Cad Aten Primaria*, *9*, 76-8.

Sánchez, J. C. (2012). *Los métodos de investigación*. Ediciones Díaz de Santos.

Schumpeter, J. (1935). *Análisis del cambio económico*. EUMED. Link: http://eumed.net/cursecon/ textos/schump-cambio.pdf

Schumpeter, J.A. (1950). *Capitalism, socialism, and democracy.* Third Ed. New York, NY: Harper.

Tidd, J. (2001). Innovation management in context: environment, organization and performance, *International Journal of Management Review*, 3 (3), 169-183.

chapter four

Knowledge Management and Organizational Performance: A Governance Approach

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Knowledge Management and Organizational Performance: a Governance Approach

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Introduction

Knowledge management is a buzzword in business. With the introduction of technology and the internet in all industry sectors, companies are changing their business model. As a result, Critical success factors previously accepted as plant, equipment, inventory, and financial capital (tangible assets), have already gone down in history, giving rise to the value of knowledge and information as the power base and competitive advantage of any company.

E-business has evolved the economic world into a new operational era, where the fundamentals and rules of the market change, presenting virtually unlimited opportunities and increasing the ability of organizations to do business and share information at a higher speed than ever before.

This channel has the power to connect people and organizations around the world, making it possible to create global relationships with partners, suppliers, and customers. It also clearly changes how these relationships are started, strengthened, and maintained. It is here where optimal knowledge management becomes essential for the company and value and competitive advantage.

Two of the most critical opportunities and risks in the new economy are taking advantage of knowledge as a corporate asset and building and maintaining solid relationships with clients, employees, shareholders, and other company personnel (Du Plessis and Boon, 2004).

This article aims to identify the knowledge management practices carried out in the Mexican banking sector and their impact on organizational

performance to establish the basis for future empirical works of greater scope and depth that relate this line of research and the banking industry.

Contextual Framework

The banking sector in Mexico

The Mexican banking system comprises 51 authorized and operating banks that comply with international regulatory standards and are supervised by the National Banking and Securities Commission (CNBV) under a risk-based prudential scheme. Its important work within the financial system is to contact suppliers and applicants of financial resources so that, through this financial intermediation function, the efficient functioning of the economy is supported (CNBV, 2020).

The banking sector in Mexico has had significant growth in recent years. According to the CNBV (2020) in the Multiple Banking Statistical Bulletin, during the period from December 2010 to December 2020, the following data is available:

- Assets have grown by 54.89%.
- Total deposits grew by 45.57%.
- The net result is positive, with a growth of 45.82%.
- Regarding the loan portfolio, growth has been 39.35%, and a delinquency rate fell from 2.33 to 2.20% in the same period.
- The coverage index closed in 2019 with 146.01.

However, despite the promising figures mentioned above, the banking sector faces a series of challenges that, like any company, to stay in the market, it must consider and face.

According to the CNBV (2019), one of the main challenges facing this sector is bank deconcentration. Most of the assets (78.34%) of the banking sector, as well as the majority of the portfolio (81.93%) and deposits (79.63%), are concentrated in only seven institutions (BBVA Bancomer, Santander, Banamex, Banorte, HSBC, Scotiabank, Inbursa).

Although the number of access points per 10,000 adults has increased continuously (1.9 more access points per 10,000 adults in 2018, municipal coverage of 51%, and demographic coverage of 92%; CNBV, 2019), Mexico is still lagged compared to other Latin American countries. Regarding credit, the level of credit penetration in the country is low (12% of adults with credit in 2017 below Chile, Brazil, and Colombia; CNBV, 2019, p. 45). Another challenge is to increase penetration through formal financial infrastructure and credit since the commercial banking sector still does not provide products and services to significant segments of the population.

Another challenge is to maintain the stability and development of the industry. This refers to the fact that international regulation standards must be implemented but paying attention and care to the sensitivity of the characteristics of the Mexican sector so that regulation guarantees stability and the sea conducive to its development.

WHY STUDY KNOWLEDGE MANAGEMENT IN THE BANKING SECTOR?

The reasons for studying knowledge management in the banking sector are many; however, they can be summarized in the following three:

- Mandatory automation as part of financial sector reforms around the world and the use of technology gives rise to various information systems and, therefore, massive generation of information from the different products and services it offers and the points of interaction (ATMs, internet, mobile, among others).

- Banking has been considered the riskiest business that affects the economy (Goyal, 2007), so risk management is another area that requires banks to document, turn information into knowledge, and take advantage of it to make it more competitive.

- Banks are improving the speed of processes and supply. They are working with knowledge to create service innovations, new products, and customer focus. In this complex and challenging operating environment, their orientation to knowledge and their ability to harness it can only differentiate them to help them continue to grow (Goyal, 2007). Reasons for which it has been decided to carry out this work.

> "To compete and be successful in their market, banking sectors must now learn to manage their intangible asset: knowledge" (Satish, 2012). To the extent that they collect, organize, share and analyze their knowledge in terms of resources, they will respond more efficiently and satisfy customer expectations at any time and place by positioning themselves above the competition (Manivannan and Kathiravan, 2016).

LITERATURE REVIEW

KNOWLEDGE MANAGEMENT

Knowledge management has become an undoubtedly important component within the intangible assets of an organization. "Continuous change in market expectations and demand for new products has gradually replaced capital and labor with knowledge and the routine work of the knowledge worker" (Satish, 2012).

Therefore, companies must focus on knowledge management activities along with introducing new technologies. However, the banking sector has not been the exception in the financial panorama; it becomes somewhat more

difficult due to the nature of the activity and the type of resources it is direct to (Davenport, 1998).

Knowledge has been defined from different contexts to relate it to management, for example: knowing why, knowing what, knowing how to do, knowing who, knowing where, and knowing when (Satish, 2012).

Knowledge management is the conscious collection, organization, exchange, and analysis of knowledge regarding resources, documents, and people's skills.

While Bounfour (2003) defines it as the arrangement of a specific and administrative philosophy, systems, and gadgets designed to create, grant, use information and data within and around an association.

Knowledge management practices can be grouped into four large areas; knowledge acquisition, conversion, application, and protection process (Gold & Arvind Malhotra, 2001).

These knowledge management activities can be defined as:

1. Acquisition refers to obtaining information, achieving, searching, producing, developing, capturing, and coordinating are shared terms used to represent the knowledge acquisition process.

2. It refers to the procedures that make existing learning useful and are related to the capacity of an organization to assimilate knowledge (Grant, 1996), solidify it (Sánchez & Mahoney, 1996), and transmit it (Zander & Kogut, 1995).

3. It is the actual use of learning.

4. Learning or knowledge within the company can be printed or electronic. However, its protection must be guaranteed by licenses, copyrights, trademarks, among others. Moreover, as Barney (1991) mentioned, the organization must know that the basis of an advantage will be the premise that it is exceptional and cannot be duplicated.

KNOWLEDGE MANAGEMENT: PROCESS OR SYSTEM

Dutt (2013) establishes that knowledge management can be seen as a process and a system. As a process that involves any systematic activity related to the organization's capture and exchange of knowledge (Nonaka & Takeuchi, 1996; Singh, 2008). It is a strategy, a cultural practice, a technology-driven process, and a leadership agent to harness and extract value from intellectual assets.

Table 1 shows the characteristics of the CG, its source, where to look for it, objective, focus, fundamental principle, evaluation scale, benefits, the role of the client, the role of the organization.

Table 1. Knowledge management characteristics

	Knowledge management
Source of knowledge	Internal knowledge, incorporated within the organization.
Where to look for knowledge?	Employees, team, company, business, colleagues.
Objective	Discover, use and share internal knowledge.
Whom is it focused on?	Employees who do not use and /or share their knowledge.
Basic principle	If we knew what we know.
Explanation	Integrating employee knowledge about customers, sales processes and R&D.
Business purpose	Increase return on capital, decrease economic cost, omit repeated processes, share lessons learned.
Evaluation scale	Efficiency versus budget.
Profits	Customer satisfaction.
Customer role	Passive, recipient of the product or service.
Role of the organization	Empower the employee to share her knowledge with their co-workers.

Source: Adapted from Gibbert, Leibold & Probst (2002).

Knowledge management in the banking sector

In recent years, banks have made an effort to automate their processes by creating information systems to carry out their operations and improve services. However, while these systems have helped improve their processes, they have also generated extensive data and information. Therefore, applying technologies and knowledge management has become vital to obtaining a competitive advantage in this environment.

In addition, apart from the large volumes of knowledge, the use of information technology in knowledge management has given it another dimension. According to DeSanctis and Poole (1994), technology and the social process must be in harmony. Unfortunately, not all banks know this, as very few banks apply knowledge management principles (Blesio & Molignani, 2000). According to Satish (2012):

The first step for banks to start with the knowledge management process is to create the necessary mentality among employees regarding this issue, subsequently identifying the areas in which knowledge is required, acquiring knowledge, developing the knowledge bank within the organization, and constantly updating it.

Then make the appropriate updated knowledge available to employees (users) anytime, anywhere, and reuse it. Moreover, finally, define places of concentration of knowledge where new knowledge can be added.

Satish (2012) mentions that knowledge management in the banking sector involves the external environment (Regulations, financial system, competitors, clients, media, among others) as an essential element to be considered by any organization that wishes to maintain a competitive advantage.

In its turn, through the proper management of knowledge. Moreover, all the company personnel is involved in the internal or organizational environment, from the General Manager to the lowest level subordinate.

It is here where through the combination of people with technology (internet, intranet, email, mobile, computers, and other equipment), information is transformed (through the process of creation, retention, and dissemination in meetings, emails, discussions, among others) in knowledge (explicit: documents, reports, letters, emails, among others. And implicit: ideas, opinions, thoughts, plans, experience, among others) that produce services and products.

Performance within the organization is a common theme in most management-related areas. Performance can be characterized as: "a measure of the achievement of the organizations' objectives" (Daft, 2012). Organizational performance can be defined as efficiency related to money, operational efficiency, and productivity of an organization (Venkatraman & Ramanujam, 1986).

If organizational performance is associated with knowledge management, the benefits are many and can be individual and business (Cong & Pandya, 2003).

> "At the organizational level, knowledge management provides two main benefits for an organization: improving the performance of the organization through greater efficiency, productivity, quality, and innovation and increasing the financial value of the organization by treating people's knowledge as active" (Satish, 2012).

Knowledge is the only input to help it cope with radical changes and take corrective action before it is too late. Knowledge alone can accelerate product innovation and increase revenue (Kalling, 2003; Darr, Argote & Epple, 1995).

Knowledge provides adequate decision support. Effective knowledge sharing of past successes, failures, projects and initiatives enables better decisions and creates more excellent economic value for the organization (Youndt, Subramaniam & Snell, 2004).

Directing the direct benefits to organizational performance, it can be mentioned that there is a reduction in costs, an increase in the flexibility to accept and change, a reduction in time to market for new products/services, an increase in sales, a reduction in the cycle times of the process and better decision-making, more excellent responsiveness to customers, improved innovation, greater customer satisfaction, and improved employee competence (Ofek & Sarvary, 2001; Tsai, 2001; Wiig & Jooste, 2003; Carmeli, 2004).

The literature shows that efficiency is influenced by knowledge management. Knowledge management is seen as the origin of performance (Darroch, 2005). The achievement of learning and dispersion does not have a specific direct or identifiable result on the efficiency of an organization; however,

a large part of organizations affirm that adequacy and productivity in knowledge management procedures are helpful for the performance of an organization.

When there is an improvement in technology and knowledge management capabilities, the organization is in a superior position to satisfy customer needs by offering better services (Hunt & Morgan, 1995; Satish, 2012). The literature shows that the security of learning and information exchange within a company led to improved profitability (Darr et al., 1995). Learning is the best variable for a company (Hendriks & Vriens, 1999; Schiuma, 2012).

One way to measure the effectiveness of knowledge management applications is to measure their influence on business performance (Yaşar & Kızıldağ, 2013).

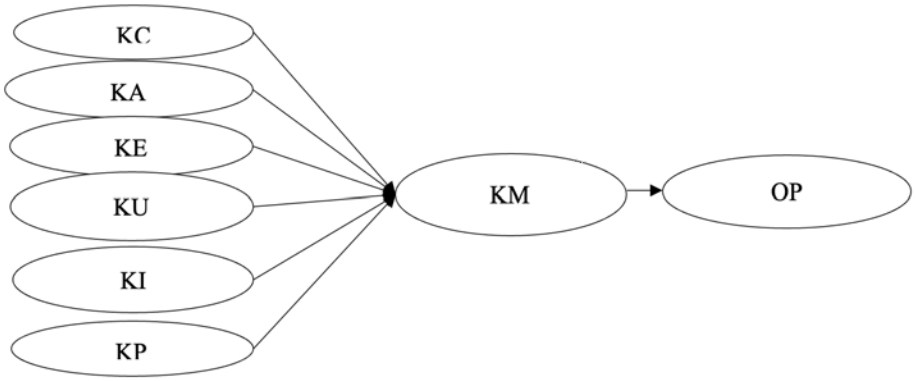
Some studies focus on financial indicators, and those that consider that these studies are insufficient to evaluate this variable to measure organizational performance. Studies such as that of Chakravarthy (1986), Kaplan and Norton (1996), and Robinson, Anumba, Carrillo, and Al-Ghassani, (2005), point out that considering only the classical financial measures is not enough to make a reasonable calculation of organizational performance (Tseng, 2015). Fliaster (2004) mentions non-financial measures such as client and employees relationships, satisfaction, and loyalty. They can be variables that positively or negatively influence organizational performance.

On the other hand, Pfeffer and Sutton (1999), Mentzer et al. (2001), Ribiere and Sitar (2003), and Tseng and Fang (2015) establish that the management of knowledge, as another non-financial measure, has a positive impact on corporate performance. Alavi and Leidner (1999) mention that in the financial aspect, the company can have an increase in sales and decrease in costs, which means higher economic returns.

However, they also establish that these benefits are given by good knowledge management with positive impacts on non-financial but visible issues, such as internal communication between staff is more excellent, better, and faster, reducing problem-solving, better customer service, improves project management, in short, there is greater overall efficiency in the company.

Given the above, the following model shown in figure 1 was proposed.

Figure 1. Proposed model



Note: KC - Creation of knowledge, KA - Accumulation of knowledge, KE - Knowledge exchange, KU Knowledge utilization, KI – Knowledge internalization, KP – Knowledge protection, KM- Knowledge management, OP - Organizational performance.
Source: Adapted from Tseng and Fang (2015), and Yaşar and Kızıldağ, (2013).

METHODOLOGY

An exploratory analysis divided into two stages was carried out to conduct this study. The first stage consisted of holding a focus group meeting with bank executives to apply a structured questionnaire in which they were asked their perception of how much the knowledge above management practices was carried out within the company.

The instrument was structured in such a way that they evaluated, according to their experience, a Likert scale using five options, ranging from "never / not done / not have / not applied" to "always / applied/have/are done" The activities mentioned concerning knowledge management. Table 2 presents the variables with their definitions. Table 3 presents the indicators by variable.

For the data analysis of this first stage, the SPSS program was used. It started with the coding of all the answers. Subsequently, mean scores were established for each question, and in the same way, it was continued until obtaining a result per dimension and then in a general way. The results were located within one of the five levels of the following scale: 1 = very low, 2 = low, 3 = medium, 4 = high, 5 = very high. In this way, it was possible to describe the results obtained by the instrument.

In a second moment, with the coding of the responses, the statistical validation of the instrument was carried out, and finally, a multiple linear regression that allowed to find which dimensions of those analyzed exert the

most significant influence on knowledge management and how this variable impacts on organizational performance.

To carry out stage 1, 48 bank executives (28 men and 20 women) supported, whose age ranged between 22 and 49 years, the positions they held are executive of products other than traditional ones (n = 28), manager (n = 9), traditional bank executive (n = 5) and control desk analyst (n = 6). Years of experience working in the sector ranged from one to 29 years.

Table 2. Conceptualization to measure the variables of knowledge management (KM)

Variable	Definition	Source
Knowledge creation (KC)	It is the production of knowledge by creating or finding new internal or external knowledge through the analysis of existing information.	Holsapple & Singh, 2001 Tseng & Fang, 2015
Accumulation of knowledge (KA)	It is the systematized management of stored knowledge by linking information and communication systems in a company.	Davenport & Prusak, 1998 Teece, 1998
Knowledge exchange (KE)	It is the exchange of knowledge and experiences between the company members testing the processes, tools, and platforms that promote learning its exchange and thereby improve productivity.	Nissen & Espino, 2000 Hung, Lien, Yang, Wu & Kuo, 2011 Lin, Su & Chien, 2006
Knowledge utilization (KU)	Knowledge application.	Tseng & Fang, 2015 Lehtimäki, Simula & Salo, 2009
Knowledge internalization (KI)	The relevant knowledge is selected, acquired, and then applied.	Holsapple & Singh, 2011 Du Plessis & Boon, 2004
Knowledge protection (KP)	Forms that protect information theft and illicit use within a company are part of the information security framework..	Liebeskind, 1996
Organizational Performance (OP)	Efficiency is related to money, operational efficiency, and productivity of an organization.	Venkatraman & Ramanujam, 1986

Source: Own elaboration with information obtained from the authors cited in the table.

Table 3. Description of the indicators by variable

Variable	Indicator	Source
KM	KM1. The company has developed methods to achieve financial results through knowledge. KM2. The company has developed a series of specific indicators for knowledge management. KM3. The company has balanced hard and soft indicators and monetary and non-monetary. KM4. The company allocates resources for actions that improve the knowledge base measurably. KM5. The knowledge gaps found in our bank are systematically determined, and well-defined processes are used to compensate for them. KM6. The company has developed an advanced intelligence compilation mechanism by progressive and ethical values. KM7. Each member of our bank gathers opinions from traditional and non-traditional sources. KM8. The company has defined a specific pattern for the best practices transfer process, including documentation and lessons learned. KM9. The company values the knowledge of its employees that they know but do not express and transfer them.	Yaşar & Kızıldağ, 2013
KC	KC1. The company has processes to acquire knowledge about customers, suppliers, and employees. KC2. The company has a process to generate new knowledge from existing knowledge. KC3. The company has knowledge distribution processes throughout the organization. KC4. The company has collaboration processes with other organizations.	Ahmed, Fiaz & Shoaib, 2015
	KC5. The company has established a well-designed platform to provide the latest information.	Tseng & Fang, 2015
	KC6. The institution has processes to filter information.	Ahmed *et al*., 2015
KA	KA1. The company has the information I need for my work stored in a database. KA2. When doing my work, I search, analyze, and use the company's databases.	Tseng & Fang, 2015
	KA3. The company has processes for integrating the different sources and types of knowledge.	Ahmed *et al*., 2015
KE	KE1. The company promotes the exchange of information and knowledge between the different departments. KE2. The company offers a comprehensive network platform for accessing necessary information and knowledge sharing among staff.	Tseng & Fang, 2015
	KE3. The company has processes to convert knowledge into the design of new products and services.	Ahmed *et al*., 2015
KU	KU1. The company provides a social knowledge system to improve the same application. KU2. The company has promoted a culture of knowledge sharing. KU3. The company has a reward system to encourage staff to generate new ideas and suggestions to use existing knowledge. KU4. The company offers an excellent educational training opportunity to enhance staff knowledge and skills.	Tseng & Fang, 2015
	KU5. The company has processes for absorbing the knowledge of individuals.	Ahmed *et al*., 2015

KI	KI1. The company has processes to apply the knowledge learned from mistakes and experiences. KI2. The company has processes for using knowledge in the development of new services. KI3. The company has processes for the use of knowledge to solve new problems. KI4. The company has processes to make knowledge accessible to those who need it.	Ahmed *et al*., 2015
KP	KP1. The company has processes to protect knowledge leakage inside and outside the organization. KP2. The company has Incentives that promote the protection of knowledge. KP3. The company has technology that restricts access to some sources of knowledge. KP4. The company has processes to protect knowledge from theft inside and outside the organization.	Ahmed *et al*., 2015
OP	OP1. The organization is growing faster. OP2. The organization is highly profitable. OP3. The organization is achieving higher customer satisfaction OP4. The organization provides higher quality services. OP5. The organization is efficient in the use of resources. OP6. The organization is using internal quality-oriented processes. OP7. The organization responds faster to requests.	Ahmed *et al*., 2015

Source: Own elaboration adapting the information of several authors.

The second stage consisted of holding a meeting with high-level banking executives that allowed them to carry out a structured and straightforward interview that would yield valuable data on their perception of knowledge management practices in the banking sector due to the availability of their time. For this, they were asked to weigh from 1 to 100 the variables presented in table 4 in such a way that the sum gave 100—considering that more value would be given to the activities they considered most important due to their impact on organizational development.

Table 4. Weighting of variables

	Variable	**Weighing**
Knowledge Management Practices	Knowledge creation	
	Accumulation of knowledge	
	Knowledge exchange	
	Use of knowledge	
	Knowledge internalization	
	Knowledge protection	
Total	100 points	

Source: Own elaboration.

RESULTS

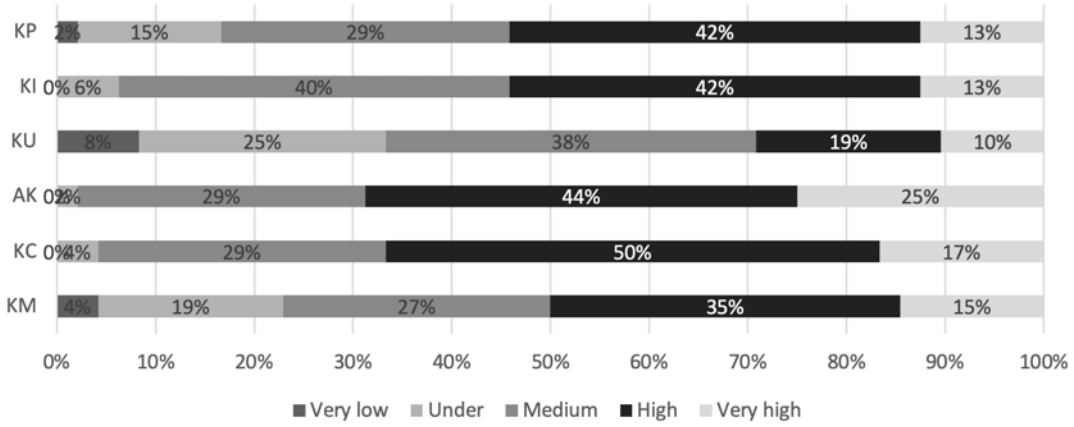
Results of the first stage

Figure 2 presents the weighted results of the responses of the 48 executives regarding the knowledge management practices that they considered were

carried out within their company. It is observed that about knowledge protection practices, they considered that they are carried out almost entirely since the High category obtained 42% and the internalization of knowledge. Unlike the knowledge use practices, they are considered to be carried out at a medium level, which accounted for 38% of the total. Similarly, Alto is the highest for accumulation and creation of knowledge, with 44% and 50%, respectively.

Regarding the knowledge management variable in general, 35% answered that it was high, a sign that they are indeed being carried out, not entirely by the questions considered for its measurement, but mainly.

Figure 2. The weighting of knowledge management practices by executives



Source: Own elaboration.

When making the sum by level, it was obtained that the inclination is indeed positive, since for "Very low" it was 15%, for "Low" it was 71%, for "medium" it was 192%, for level 4 (High) 231% and level 5 (Very high) obtained 92%, which means that knowledge management practices are effectively being carried out within banking companies.

According to the variable value, the executives gave greater weight to the accumulation of knowledge with 69% between levels 4 and 5, followed by creating knowledge with 67%, which differs a bit from what was obtained in the following tests.

Linear regression was carried out, for which the exploratory factor analysis of the items considered to measure each variable was previously carried out together with the validity and reliability tests. The results are presented in Table 5.

Table 5. Validity and reliability tests

Variable	Indicator	Cronbach's Alpha	KMO & Barlett Test	Total variance explained	Factorial load
KM	KM1.	0,943	KMO 0,895 Chi-squared 370,758 gl 36 Sig. ,000	69.624 %	0,916
	KM2.				0,856
	KM3.				0,708
	KM4.				0,861
	KM5.				0,869
	KM6.				0,913
	KM7.				0,728
	KM8.				0,846
	KM9.				0,785
KC	KC1.	0,902	KMO 0,829 Chi-squared 178,962 gl 15 Sig. ,000	67.809 %	0,837
	KC2.				0,877
	KC3.				0,866
	KC4.				0,759
	KC5.				0,798
	KC6.				0,799
KA	KA1.	0,848	KMO 0,688 Chi-squared 64,336 gl 3 Sig. ,000	76.643 %	0,913
	KA2.				0,901
	KA3.				0,809
KE	KE1.	0,873	KMO 0,688 Chi-squared 83,912 gl 3 Sig. ,000	80.184 %	0,822
	KE2.				0,929
	KE3.				0,930
KU	KU1.	0,915	KMO 0,832 Chi-squared 183,884 gl 10 Sig. ,000	75.257 %	0,736
	KU2.				0,886
	KU3.				0,870
	KU4.				0,914
	KU5.				0,919
KI	KI1.	0,937	KMO 0,804 Chi-squared 174,072 gl 6 Sig. ,000	84.349 %	0,887
	KI2.				0,955
	KI3.				0,936
	KI4.				0,894
KP	KP1.	0,811	KMO 0,690 Chi-squared 76,244 gl 6 Sig. ,000	64.346 %	0,892
	KP2.				0,702
	KP3.				0,760
	KP4.				0,842
OP	OP1.	0,958	KMO 0,880 Chi-squared 379,237 gl 21 Sig. ,000	80.726 %	0,867
	OP2.				0,878
	OP3.				0,940
	OP4.				0,943
	OP5.				0,893
	OP6.				0,928
	OP7.				0,835

Source: Own elaboration.

Subsequently, the multiple linear regression was run, performing two models. Model one considered knowledge management a dependent variable and knowledge creation, accumulation, exchange, use, internalization, and protection as independent variables.

Model two considered organizational performance a dependent variable and knowledge management an independent variable. The results are observed in tables 6, 7, and 8.

For model 1, a corrected R squared of 0.768 was obtained, which means that the variables of creation explain knowledge management, use, accumulation, internalization, and protection of knowledge by 76.8%, being significant (<0.05) the result obtained in the ANOVA test, and in the coefficients the significant variables were the creation of knowledge and the internalization of knowledge, with a beta of 0.554 and 0.210, respectively.

Model two explains that organizational performance is explained by knowledge management in 45.1%, being significant in the result of the ANOVA and a beta of 0.681.

Table 6. Multiple linear regression

Model	R	R square	R squared corrected	Standard error of the estimate
1	0,890	0,792	0,768	0,48198646
2	0,681	0,463	0,451	0,74062192

Source: Own elaboration.

Table 7. **ANOVA**

	Model	Sum of squares	gl	Quadratic mean	F	Sig.
1	Regression	37,243	5	7,449	32,063	0,000
	Residual	9,757	42	0,232		
	Total	47,000	47			
2	Regression	21,768	1	21,768	39,685	0,000
	Residual	25,232	46	0,549		
	Total	47,000	47			

Source: Own elaboration.

Table 8. Coefficients

Model		Non-standardized coefficients		Typified coefficients	t	Sig.
	B	Standard error	Beta			
1	(Constant)	-1,000E-13	0,070		0,000	1,000
	Knowledge creation	0,554	0,136	0,554	4,077	0,000
	Accumulation of knowledge	-0,051	0,118	-0,051	-0,434	0,666
	Knowledge utilization	0,136	0,113	0,136	1,201	0,237
	Knowledge internalization	0,210	0,103	0,210	2,031	0,049
	Knowledge protection	0,158	0,093	0,158	1,702	0,096
2	(Constant)	-1,000E-13	0,107		0,000	1,000
	Knowledge management	0,681	0,108	0,681	6,300	0,000

Source: Own elaboration.

Stage two results

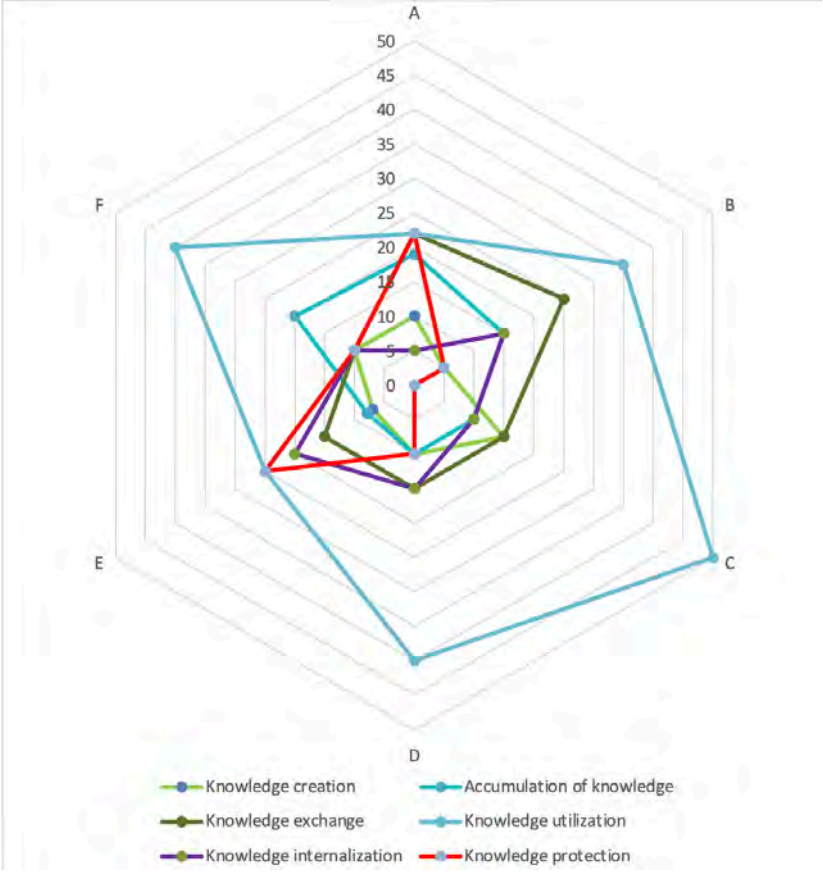
The stage 2 results are in table 9 and figure 3. For its elaboration, the sum of the points awarded per variable assigned by each interviewee. In this case, the CEOs gave greater weight to the use of knowledge, followed by the exchange of knowledge and, thirdly, its internalization.

Table 10. The weighting of knowledge management variables for bank CEOs

Variable	Points						Total
Knowledge creation	10	5	15	10	7	10	57
Accumulation of knowledge	19	15	10	10	8	20	82
Knowledge exchange	22	25	15	15	15	10	102
Knowledge utilization	22	35	50	40	25	40	212
Knowledge internalization	5	15	10	15	20	10	75
Knowledge protection	22	5	0	10	25	10	72
Total	100	100	100	100	100	100	

Source: Own elaboration.

Figure 3. The weighting of knowledge management variables for bank CEOs



Source: Own elaboration

The views between senior managers and executives are different; however, it is redeemable that even though they do not coincide, both recognize that knowledge management practices are carried out. To a greater or lesser extent, they are present.

CONCLUSIONS

Technology, new reforms, and innovations are generating essential changes in financial systems, promoting new strategies that favor expanding and digitizing products and services to increase financial inclusion. However, one of the challenges is maintaining the stability of these systems, where knowledge management has become an indispensable factor for data analysis and its transformation into valuable information that allows to understand customers better and offer solutions to companies. Organizations must now learn to manage their intangible asset, "knowledge," on which their competitive advantage in the market increasingly depends. Diverse individual needs and achieves lifetime customer loyalty.

The proposed model contributes to the literature on the subject without omitting that this study has limitations. The study is descriptive, which means that, although there is an excellent theoretical basis for the research propositions, more extensive and in-depth empirical tests must be performed shortly to validate the model.

In addition, future researchers can expand this study through a comparative analysis of the sectors that best perform knowledge management in the financial industry in Mexico or comparative within the same banking brands. In addition, empirical studies can be undertaken to validate or identify the distinguishing factors of knowledge management in Mexico in the banking sector, cooperatives, or any type of organization and compare it with other countries to develop them.

In addition, it should be mentioned that this study was carried out before the COVID 19 pandemic began, so it would be essential to evaluate what changes this sector experienced and how technologies in a certain way cushioned all the changes and restrictions established to monitor the safety of the employees and customers.

REFERENCES

Ahmed, S., Fiaz, M. & Shoaib, M. (2015). Impact of Knowledge Management Practices on Organizational Performance: an Empirical study of Banking Sector in Pakistan. *FWU Journal of Social Sciences*, 9 (2), 147-167.

Alavi, M., & Leidner, D. E. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *Mis Quarterly*, 107-136.

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17, 100–120.

Blesio, B., & Molignani, R. (2000). *Implementation Strategies for Knowledge Management in Banking, Part 1 (*September). Analysis of Demand: IDC.

Bounfour, A. (2003) *The Management of Intangibles: The Organization's Most Valuable Assets*. Routledge, London. http://dx.doi.org/10.4324/9780203465035

Carmeli, A., & Tishler, A. (2004). The relationships between intangible organizational elements and organizational performance. *Strategic Management Journal*, 25(13), 1257-1278.

Chakravarthy, B. S. (1986). Measuring strategic performance. *Strategic Management Journal*, 7(5), 437–458.

Comisión Nacional Bancaria y de Valores (CNBV) (2019). *Programa Anual de inclusión Financiera 2019*. Mexico: Comisión Nacional Bancaria y de Valores.

Comisión Nacional Bancaria y de Valores (CNBV). (2020). *Boletín Estadístico. Banca Múltiple – Diciembre 2019*. Mexico: Comisión Nacional Bancaria y de Valores.

Cong, X., & Pandya, K.V. (2003). *Issues of Knowledge Management in the Public Sector*. Link: http://www.ejkm.com

Daft, R. (2012). *Organization theory and design*. Cengage learning.

Darr, E. D., Argote, L., & Epple, D. (1995). The acquisition, transfer, and depreciation of knowledge in service organizations: Productivity in franchises. *Management Science*, 41(11), 1750-1762.

Darroch, J. (2005). Knowledge management, innovation and firm performance. *Journal of knowledge Management*, 9(3), 101-115.

Davenport T, & Prusak, L. (1998). *Working Knowledge: How Organizations Manage What They Know.* Boston: Harvard Business School Press.

Davenport, T. (1998). *Interview with Gerald Bernbom*, CAUSE97 Conference Chair. Retrieved June, 02, 2017 de http://www.educause.edu/ir/library/html/cem9813.html.

DeSanctis G., & Poole, M. S. (1994). Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory, *Organizational Science*, 5(2), 121-147.

Du Plessis, M., & Boon, J. A. (2004). Knowledge management in eBusiness and customer relationship management: South African case study findings. *International Journal of Information Management*, 24(1), 73–86.

Dutt, H. (2013). *Knowledge management initiatives in India: A study of Indian comercial banking sector. Doctoral Research Scholar*. New Delhi, India: Centre for Management Studies, Jamia Millia Islamia. Link: https://es.slideshare.net/himanshu_dutt/ph-d-viva-presentation-2003-version

Fliaster, A. (2004). Cross-hierarchical interconnectivity: forms, mechanisms and transformation of leadership culture. *Knowledge Management Research & Practice*, 2(1), 48–57.

Gibbert, M., Leibold, M., & Probst, G. (2002). *Five styles of Customer Knowledge Management, and how Smart companies put them into action*, working paper, Hautes Etudes Commerciales Geneva, Link: http://www.hec.unige.ch/recherches_publications/cahiers/2002/2002.09.pdf (retrieved in July 2008)

Gold, A. H., & Arvind Malhotra, A. H. S. (2001). Knowledge management: An organizational capabilities perspective. *Journal of management information systems*, 18(1), 185-214.

Goyal, O.P. (2007). *Knowledge management: analysis and desing for indian commercial banking system,* India: Kalpaz Publications.

Grant, R. M. (1996). Toward a knowledge−based theory of the firm. *Strategic Management Journal*, 17(S2), 109-122.

Hendriks, P. H., & Vriens, D. J. (1999). Knowledge-based systems and knowledge management: friends or foes? *Information & Management*, 35(2), 113-125.

Holsapple, C.W., & Singh, M. (2001). The knowledge chain model: activities for competitiveness. *Expert Systems with Applications*, 20(1), 77–98.

Hung, R.Y.Y, Lien, B.Y., Yang, B., Wu, C.M., & Kuo, Y.M. (2011). Impact of TQM and organizational learning on innovation performance in the high-tech industry. *International Business Review,* 20(2), 213–225.

Hunt, S. D., & Morgan, R. M. (1995). The comparative advantage theory of competition. *The Journal of Marketing*, 1-15.

Kalling, T. (2003). Knowledge management and the occasional links with performance. *Journal of knowledge Management*, 7(3), 67-81.

Kaplan, R.S., & Norton, D.P. (1996). *The Balanced Scorecard*. Harvard Business School Press: Boston.

Lehtimäki T, Simula H, & Salo J. (2009). Applying knowledge management to project marketing in a demanding technology transfer project: convincing the industrial customer over the knowledge gap. *Industrial Marketing Management*, 38(2), 228–236.

Liebeskind, J. P. (1996). Knowledge, strategy, and the theory of the firm. *Strategic Management Journal*, 17(S2), 93-107.

Lin Y, Su HY, & Chien S. (2006). A knowledge-enabled procedure for customer relationship management. *Industrial Marketing Management*, 35(4), 446–456.

Manivannan, M. & Kathiravan, C. (2016). A study on knowledge management of banking sector in Chennai. *Indian Journal of Applied Research, 6*(9), 306-309.

Mentzer, J.T., Flint, D.J., & Hult, G.T.M. (2001). Logistics service quality as a segment-customized process. *Journal of Marketing*, 65(4), 82–104.

Nissen, M.E., & Espino, J. (2000). Knowledge process and system design for the coast guard. *Knowledge and Process Management*, 7(3), 165–176.

Nonaka, I., & Takeuchi, H. (1995). T*he Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. New York: Oxford University Press.

Ofek, E., & Sarvary, M. (2001). Leveraging the customer base: Creating competitive advantage through knowledge management. *Management science*, 47(11), 1441-1456.

Pfeffer J, & Sutton RI. (1999). *The Knowing-Doing Gap: How Smart Companies Turn Knowledge into Action*. Harvard Business School Press: Boston.

Ribiere, V.M., & Sitar, A.S. (2003). Critical role of leadership in nurturing a knowledge-supporting culture. *Knowledge Management Research & Practice,* 1(1), 39–48.

Robinson, H.S., Anumba, C.J., Carrillo, P.M., & Al-Ghassani, A.M. (2005). Business performance measurement practices in construction engineering organizations. *Measuring Business Excellence*, 9(1), 13–22.

Sánchez, R., & Mahoney, J. T. (1996). Modularity, flexibility, and knowledge management in product and organization design. *Strategic Management Journal*, 17(S2), 63-76.

Satish, T. B. (2012). Benefits of knowledge management system for banking sector. *International Journal of Computer Science and Communication*, 3(1), 133-137.

Schiuma, G. (2012). Managing knowledge for business performance improvement. *Journal of knowledge management*, 16(4), 515-522.

Singh, S. K. (2008). Role of leadership in knowledge management: a study. *Journal of Knowledge Management*, 12(4), 3-15. Doi: 10.1108/13673270810884219

Teece, D. J. (1998). Capturing value from knowledge assets. *California Management Review*, 40(3), 55-79.

Tsai, W. (2001). Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance. *Academy of Management Journal*, 44(5), 996-1004.

Tseng, S.M., & Fang, Y. Y. (2015). Customer Knowledge Management Performance Index. *Knowledge and Process Management*, 22(2), 68-77. DOI: 10.1002/kpm.1463

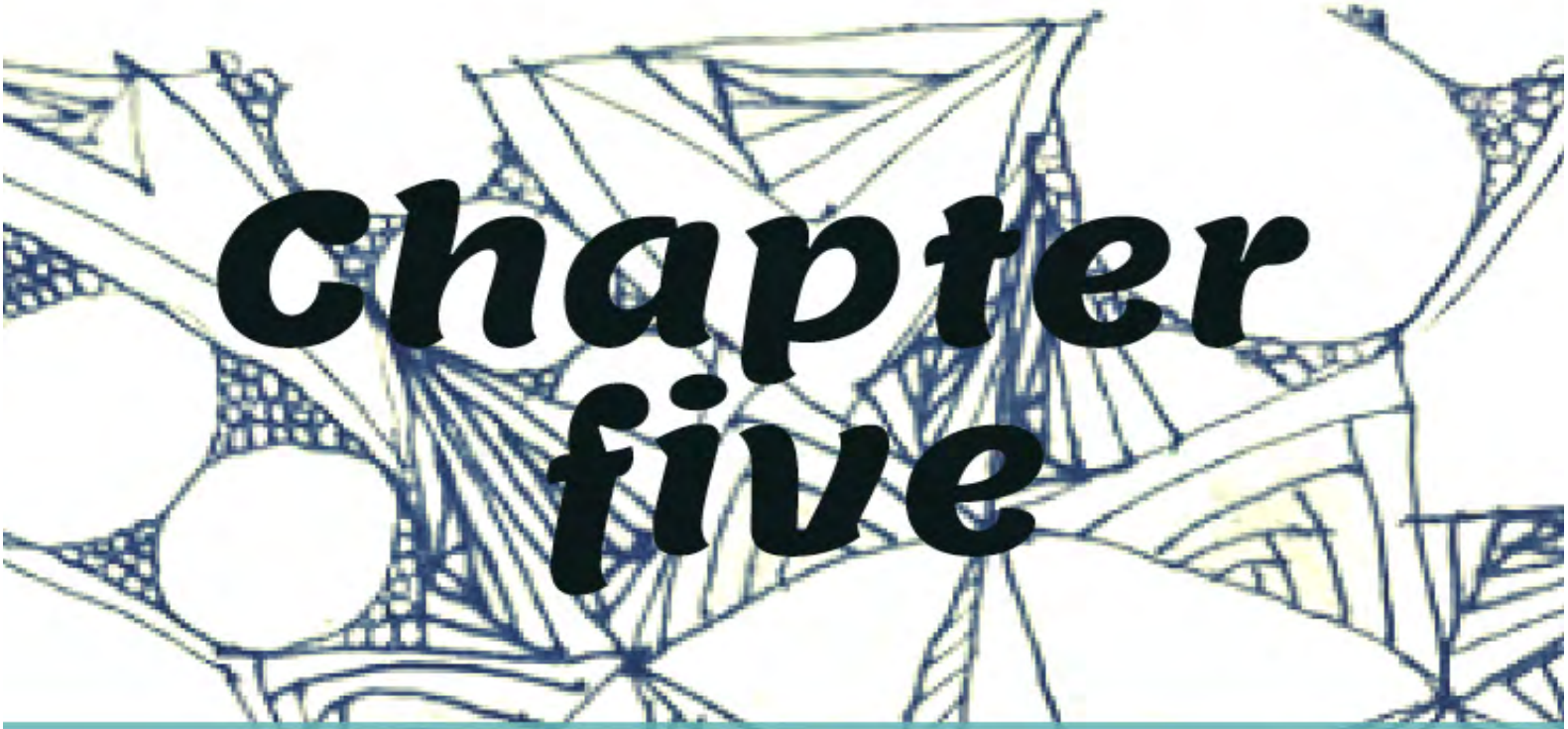
Venkatraman, N., & Ramanujam, V. (1986). Measurement of business performance in strategy research: A comparison of approaches. *Academy of management review*, 11(4), 801-814.

Wiig, K. M., & Jooste, A. (2003). *Exploiting knowledge for productivity gains*. Handbook on knowledge management, (pp. 289-308). Springer.

Yaşary Ö. U., & Kızıldağ, D. (2013). A Comparative Analysis of Knowledge Management in Banking Sector: An Empirical Research. *European Journal of Business and Management*, 5(16).

Youndt, M. A., Subramaniam, M., & Snell, S. A. (2004). Intellectual Capital Profiles: An Examination of Investments and Returns. *Journal of Management Studies*, 41(2), 335-361.

Zander, U., & Kogut, B. (1995). Knowledge and the speed of the transfer and imitation of organizational capabilities: An empirical test. *Organization science*, 6(1), 76-92.



chapter five

Robotics and Automation: Evolutionary Approach Based on their Life-Cycle

García-Martínez, Bogar; González-Acolt, Roberto and Díaz-Flores, Manuel

Robotics and Automation: Evolutionary Approach Based on Their Life-Cycle

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Introduction

The cluster has become the basis for the economic development of countries in the current globalized environment; Porter (1990) identifies it as a model of natural development that has been perfected.

In Aguascalientes, the term Clusters appear as a legally formalized group of companies. The state's economic development would rest, guided and directed by business people and the government, and be the instrument for financial support. Barnes (2000), Vom and Chen (2006) provide empirical evidence that the Cluster is not what the economic paradigms promised for developing countries.

Cedillo (2007), Unger and Chico (2004) identify two crucial aspects in their research on Clusters: the first: the problem of survival for local companies that are part of the Clusters, especially those in which there are companies with foreign capital; and the second, the need to study each Cluster individually.

Cortright (2006) provides two critical points for regional and local economic development based on Clusters. The first point establishes that the critical organizational unit to understand and improve the performance of local and regional economies is the Cluster.

It is because the basis of the economy is a group of Clusters and not a set of unrelated companies. The second point indicates that Cluster thinking is

essential because economic development policy and application are with companies rather than individual companies.

To establish the economic development guidelines and the relevant short, medium, and long-term public policies for each Cluster. First, its dynamics and evolution must be understood, distinguishing between the endogenous and exogenous dynamics, developing specific policies for each state of its life-cycle (Krugman, 1991; Hassink et al., 2012; Capó et al., 2011).

To contribute to the adequate development of the Clusters. It is necessary to identify their level of development, with a dynamic and evolutionary approach based on their life-cycle and their typology, providing the basis for developing indicators that measure the quantitative effects of the applied policies. (Hassink et al., 2012; Capó et al., 2011).

Binder and Clegg (2006), Spinak (2007) provide in their empirical research the theoretical bases of the concept of the extended company (Enterprise), and the network company, the connectivity provided by information technology is the basis for generating these linkages that expand the spectrum and the traditional management view of what a company is.

Fedele & García (2006) researched the level of electronic business, understood as companies managed with information technology. It establishes that connectivity is not only possible due to information and communication technologies, but the operating systems must also be compatible. The development of electronic business generates network and virtual companies with systems that can operationally be integrated with Clusters.

This new dimension of the network company is fully compatible and complementary with the points expressed by Cortright (2006) in supporting Clusters (groups of companies and organizations) and not individual companies. The state's economic development focuses on business and sectors related to Clusters, whether or not they are formalized; Since the global economic system is based on Clusters, it is necessary to clearly understand their contribution to the present and future development of the state.

The Robotics and Automation Cluster in Aguascalientes supports and promotes the development of other Clusters; identifying its life-cycle and typology will be relevant to implement policies in the state and the Cluster itself, supporting; as a result, other Clusters.

Objectives

1) Develop an operational framework (Taxonomy) to determine the level of Cluster development, based on the Cluster and life-cycle theories and its typology.

1.1Build an operational framework (Taxonomy) that allows locating the Cluster at its level of development.

1.2 Build an operational framework (Taxonomy) that allows locating the Cluster in its typology.

2) Apply the taxonomy in the robotics Cluster in Aguascalientes.

2.1 Apply the taxonomies (operational frameworks) to the Aguascalientes robotics and automation Cluster to determine its level of development and typology.

Object of study

Dynamic and evolutionary development of Clusters, delimited and characterized by their life-cycle and typology.

In addition to Cortright (2006), Binder and Clegg (2006), and Spinak (2007) explained enterprise, network company, and the conception of the Cluster as a group of companies and not individual companies. Finally, De Langen (2004) presents three arguments that focus on the Cluster as a unit of analysis in this type of study:

First, Krugman (1991) argues that the Cluster is not explained simply as the result of company's individual decisions to create a group, the development of the Cluster is a path with contingencies, so the Cluster approach as a unit of analysis allows the study the Cluster aspects, which could not be studied under the approach of individual companies.

Second, the performance of companies cannot be understood without considering their roots in the Cluster, and the interdependencies developed within the Cluster, such as subcontracting and specialization, which implies defining the Cluster as a unit of analysis (Carlsson et al., 2002).

Third, Cluster research provides elements for policy development and Cluster management. Regional specialization increases competition between regions and the need to be relevant in policy development, which focuses the Cluster as the unit of analysis.

Theoretical framework

The Cluster life-cycle

Menzel and Fornahl (2010) conclude that there is an excellent contribution in research regarding the way Cluster's work, in contrast to a great opportunity in research on the evolutionary development of Clusters, that they consider necessary since there is empirical evidence showing that the economic advantages that give rise to Clusters are not permanent. In addition to the fact that the factors causing the decline in the Clusters were advantages initially.

Forrnahl and Menzel (2009) argue that theories about the functioning and dynamism of Clusters are not enough to explain their evolution. The theory that explains the evolution of Clusters is their life-cycle. Different investigations have

shown that this differs from the life-cycle of the industry (Menzel & Fornahl, 2010; Kontostanos, 2009; Bergman, 2006).

Based on the analysis carried out by Bergman (2007), Table 1 was constructed, in which the different stages of the Cluster life-cycle considered by each author are identified.

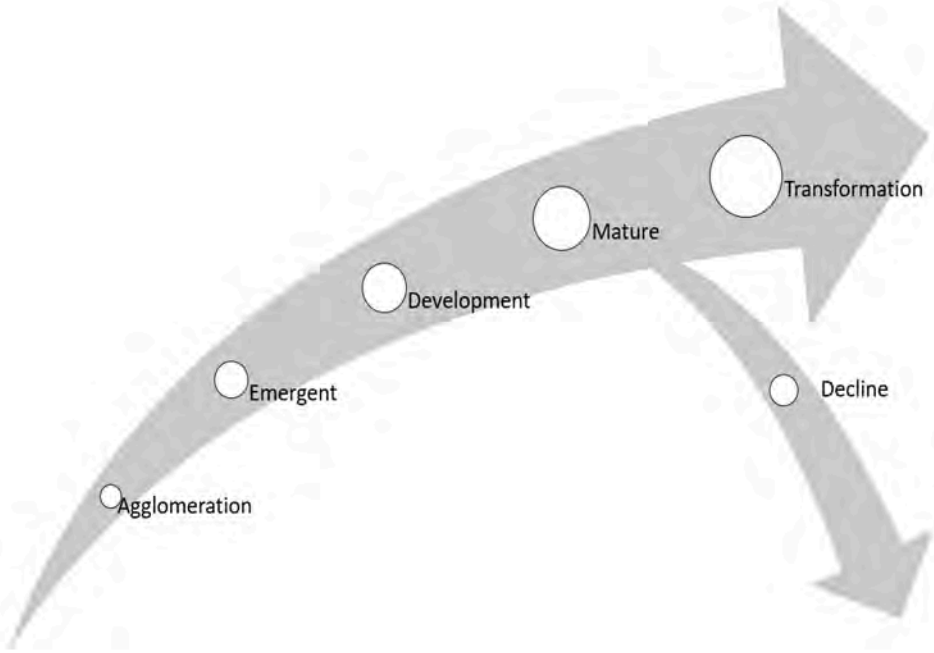
Table 1. Authors and their contribution to the Cluster life-cycle

Authors	Cluster Life-cycle Stages Identified	Evidence Presented	Main contribution
Tichy (1998)	Creation, Growth, Maturity, Petrifaction	Literature review, illustrative cases, and policy examples	Policies to apply for each lifecycle state
Swann (2002)	Critical mass, liftoff, maximum entry point, saturation	Simulation models of companies entering the Cluster	A reference model for evaluating Clusters in England
Formahl and Menzel (2003)	Emerging, Growth, Maintenance, Stagnation	Literature review, concepts, exploration.	It examines the role of companies in the different stages of the life-cycle.
Wolter (2003)	Establishment, Growth, Change, Adaptation	Literature review, dynamic modeling, illustrative cases	Develops life-cycle theory in the agglomeration phase
Brenner (2004)	Entry, Exit, Growth	Population ecology, Cluster modeling	Proposes a complete theory of the Cluster life-cycle
Maskell and Kebir (2005)	Existence, Expansion, and Depletion	Marshall, "Milleu" and Porter´s concepts	Identifies gaps in Cluster theory
Maggioni (2005)	Birth, Takeoff, Golden Age, Maturity	Population ecology Cluster modeling	Relate the dynamics of the Cluster with innovation
Waelbroeck (2004)	Agglomeration, Pop-up. Development, Maturity, Decline- Transformation	Literature review, concepts, exploration.	It characterizes each phase with the members, the internal links, and other Clusters, in addition to the benefits obtained.
Bergmann (2006)	Existence, Expansion, Exhaustion, Rebirth	Literature review, Cluster study evidence, simple correlations	Proven sustainability factors
Vandick and De Langen (2001)	Development, Expansion, Maturity, Transition	Case study, literature review	Identifies the characteristics of each proposed variable within the Cluster life-cycle
Knop and Olko (2008)	Identification, Initiative, Development of innovation, Maturity, and Transformation	Literature review, regional Cluster surveys in Silesia, Poland	CEC model (knowledge, structure, and trust); Crisis in the Cluster life-cycle
Hassink and Dong-Ho (2005)	Positive negative	closures	Development of operation framework.

Source: Adapted from Bergman (2007)

Waelbroeck (2004) creates a Cluster development model under a life-cycle approach, consisting of five major phases, including the transformation phase.

Figure I. Cluster Life-cycle.



Source: Adapted from Waelbroeck (2004).

Agglomeration

A region has some companies from a specific sector and others from complementary service sectors.

Emerging Cluster

From the agglomeration, the Cluster actors begin to cooperate around a specific business area, generating and taking advantage of opportunities, starting business leagues, developing connectivity, preparing for the next phase.

Development Cluster

New actors join the region in similar activities, developing new business links, an image, a label, and a connotation of the developed business activity.

Mature Cluster

Many actors in the same business area have been integrated, and relationships have been established, links outside the primary region of influence with other Clusters, new companies, and associations are generated internally.

Transformation Cluster

Time passes, markets, technologies, and processes change. As a result, the Cluster is transformed, too, creating new ones focusing on other activities, or simply adapt to new market forms.

Declining Cluster.

Markets, technologies, and processes change, the Cluster does not survive, disinvestment strategy, company, exits and bankruptcy, and depending on the level of dependence of the local economy on the Cluster, there may be high unemployment and even emigration.

Kontastanos (2009) states that Clusters evolve, so the factors that drive their success change, and those that caused their growth can differ from those that maintain it. For this reason, it is necessary to generate a model based on the Cluster's life-cycle to analyze it from the point of view of its evolutionary development.

CLUSTER TYPES

Markusen (1996) groups industrial Clusters into four general types, identifying their essential characteristics:

Marshallian Industrial Cluster

Business structure dominated by local and small companies. Relatively low economies of scale. A substantial intra-Cluster exchange between providers and consumers. Major investment decisions made locally. Long-term contracts and commitments between local buyers and suppliers. Low cooperation or connection with companies outside the district. Highly flexible internal labor market for the Cluster. Workers committed to the Cluster instead of the company.

High rates of labor immigration, low levels of emigration. Evolution of unique links, of local cultural identity. External specialized services to companies in financial and technical areas are available in the Cluster. The existence of "long-term capital" in the district. Turbulence,

Cluster Hub-and-spoke

Business structure dominated by one or more large vertically integrated companies surrounded by suppliers. Non-locally integrated leading companies have stronger links with suppliers and competitors outside the Cluster. Relatively high economies of scale. Low turnover rates in local companies, except in the third level. Substantial trade within the district between key companies and suppliers.

Critical investment decisions made locally spreading globally. Long-term commitments and contracts between dominant companies and suppliers. The high degree of cooperation links with both local and external companies. Moderate incidence of personnel exchanges between clients and suppliers.

Low degree of cooperation between large competing companies to share risk, stabilize the market and share innovation. Less flexible labor market within the Cluster. Disproportionate participation of workers. Workers committed first to large companies, then to the Cluster, and later to small companies.

Labor immigration rates are higher than labor emigration. Evolution of local cultural identity links. Specialized sources of finance, technical expertise, business services, dominated by large companies. Low availability of "long-term capital" within the district, excluding large companies. Absence of business associations providing a shared infrastructure, administration, training, marketing, technical and financial assistance, risk-sharing, and stabilization mechanisms.

Decisive local government role in promoting and regulating primary industries at local, state, and national levels. High level of government involvement in providing infrastructure. The industry's long-term growth is dependent on its prospects and the strategies of the dominant companies.

Satellite industrial platforms

The business structure is dominated by large foreign capital companies and corporations with foreign headquarters. Moderate to high economies of scale. Low to moderate staff turnover rates, except in the third supply level. Minimal trade within the Cluster between buyers and suppliers.

Critical investment decisions made externally. Absence of long-term commitments with local suppliers. A high degree of cooperation links with external companies, especially the parent company. High incidence in staff exchanges between clients and suppliers externally, but not locally. Low degree of cooperation among competing companies to share risk, stabilize the market and share innovation.

Labor market external to the Cluster and vertically integrated to the companies within the Cluster. Workforce committed to the company and later to the Cluster. High rates of labor immigration and emigration at the managerial, professional, and technical levels and lower at the blue-collar and support levels. Little evolution in the generation of ties with the local culture.

Primary sources of finances, technical skills, and services provided externally through corporate or external purchases. There is no availability of "long-term capital" in the Cluster. No business association provides shared infrastructure, administration, training, marketing, technical or financial assistance, risk-sharing mechanisms, and stabilization.

The government has an essential role in providing infrastructure, fiscal incentives, and other business support incentives. Growth is jeopardized by the portability of plants in the medium term to other places with similar platforms.

Cluster anchored to the government sector.

Business structure dominated by one or several government institutions such as military bases, federal, state, and public universities surrounded by suppliers and consumers (including those that are regulated). Relatively high economies of scale in public sectors.

Low degree of turnover for local businesses. Substantial trade between the dominant institutions and the suppliers, but not between the other Cluster members. Critical investment decisions are made at various levels of government, some internal, some external. Short-term commitments between providers and dominant institutions.

The high degree of cooperation links with external companies for supplier organizations with external headquarters. Moderate incidence of staff turnover between consumers and providers. Low degree of cooperation between local private sector companies to share risks, stabilize the market and share innovation.

The workforce is internal in the case of local government and national in the case of a university, military installations, or federal offices, for other professionals, technicians, and administrators —The disproportion between technical workers and professional workers. Workers are committed first to large institutions, Clusters, and small businesses— a High degree of labor immigration and a low degree of emigration. There is an evolution in the identity of the local culture. There are no specialized sources of financial support, technical expertise, business services.

Barkley and Henry (2003) classify Markusen's contributions based on three main variables, the first characteristic of the member companies, the second interdependencies within the Cluster, and the third employment growth perspective, as shown in Table 2.

Table 2. Cluster types

Cluster Types	Characteristics of member companies	Intra-Cluster Interdependencies	Outlook for job growth
Marshallian (Marshallian)	Medium and small locally owned businesses	Business exchange and substantial collaboration between companies	Dependent on the synergy and economy provided by the Cluster
Hub companies and their suppliers (Hub-and-spoke)	One or several large companies with numerous smaller suppliers and service companies	Cooperation between large companies and small suppliers on the terms of large companies	Dependent on the growth of large companies (hub)
Satellite platforms	Large and medium-sized plants of the same global business group.	The minimal exchange between companies and networks	Dependent on the region's ability to recruit and retain business group plants
State Anchored	Large public or non-profit entity and related service and provider companies	Restricted to purchase-sale relationships between the public entity and its suppliers	It depends on the region's ability to expand political support for public works

Source: Barkley and Henry (2003).

There are other models of Cluster typology. For example, Arikan and Schilling (2011) propose a model based on the structure and governance of the

Cluster, basing the model basically on the centralization of control and the need for coordination.

Boja (2011), based on Markusen (1996), complements his typology by adding other factors, such as the life-cycle of the Cluster and the determinants of its development.

Cluster Definition

Martin and Sunley (2003) carry out an analysis of Cluster definitions. They find contradictions and confusions in two significant areas: geographic scale and socioeconomic dynamics.

They comment that Clusters include everything, so the definitions are imprecise, we know they are called (Clusters), but we do not know what they are — definitions in Table 3.

Table 3. Cluster definitions

Clusters: The confusion of definitions.
Porter (1998a, p199) "A Cluster is a geographically close group of interconnected companies and associated institutions in a particular field, linked by similarities and complementarities.
Crouch and Farrell (2001, p. 163) The more general concept of "Cluster" suggests a tendency for firms and similar types of businesses to be located close together, although without any particular or essential presence in the area.
Rosenfeld (1997, p, 4) A Cluster is used to represent concentrations of firms capable of producing synergy thanks to their geographical proximity and interdependence, even though their capacity to generate jobs is not prominent.
Feser (1988, p26, 4) Economic Clusters are not only related and supporting industries and institutions, but they also generate institutions that are more competitive by their relationships.
Swann and Prevezer (1998, p, 1) Clusters here are defined as groups of firms within the same industry located in the same geographic area.
Swann and Prevezer (1998, p, 51) A Cluster means a large group of firms in related industries in a particular location.
Simmie and Sennett (1999a, p. 51) define an innovation Cluster as a large number of industrial and/or service companies with a high level of collaboration, typically through the supply chain, and operate within the same conditions of the market.
Roelandt and den Hertag (1999, p.9) Clusters can be characterized as networks of strongly interdependent producers (including specialized suppliers) linked together in a value-added production chain.
Van den Berg et al. (2001, p 187) The popular term Cluster is closely related to a local or regional dimension of networks...most definitions share the notion that Clusters are localized networks of specialized organizations, whose production processes are intimately linked through the exchange of goods, services and/or knowledge.
Enright (1996, p.191) A regional Cluster is an industrial Cluster in which member firms are nearby.

Source: Martin and Sunley (2002).

There is no consensus or unification in the definition of a Cluster. It is essential to build one helpful in developing this research work and fulfilling the objectives, as Giuliani (2005) suggested.

The definition of the Cluster for this research is: Cluster is a productive agglomeration in a defined geographical area with the following elements: companies, public and private support institutions, research and education

institutions, which interact in different ways and levels, carrying out activities related to a specific productive sector, generating an evolutionary organizational unit, characterized for having a level of structure, governance, and performance, which place it at an evolutionary level of development, according to its life-cycle and typology. The definition is made up of five elements:

First element

Cluster is a productive agglomeration in a defined geographical area of companies, public and private support institutions, research, and education institutions.

The definition contains the term agglomeration because one of the axes of this work is the theory of agglomeration developed by Marshall in 1890, the theory of growth and formation of Clusters, by sectoral agglomeration, which is updated by the theory of the new geographical economics (Krugman, 1998).

Garnica and Ganga (2006) explain the first elements of the definition. At the theoretical level, there are strong indications, in the sense that once a certain critical mass of human capital has been accumulated, it presents solid advantages for the agglomeration of companies and therefore for the formation of Clusters in a given geographical area.

The second element of the definition

They interact in different ways and levels, carrying out activities related to a specific product sector.

It is based on what Porter (1998) expressed, referring to the interconnection of companies and the association of institutions as a characteristic of a Cluster, in two probable areas, social interaction and the integration of chains to obtain benefits— generating what Marshall called externalities, including of course the generation of local knowledge reinforced by geographical proximity and the mentioned interaction (Garnica & Ganga, 2006).

the third element

Generating an evolutionary organizational unit.

The Cluster, and not the companies part of the Cluster, is defined as the unit of analysis (De Langen 2004), so the term organizational unit is included in the definition. It follows a life-cycle characterized by phases that place the Cluster in perspective in time and its development (Bergman, 2007; Martin & Sunley, 2003).

Studies carried out by Unger and Chico (2004) confirm that in its beginnings, the formation of Clusters emphasized on the existence of labor, although other factors intervene simultaneously in a context of dynamic evolutionary development.

The fourth element

It circumscribes the dimensions that characterize the evolutionary level of development of the Cluster according to its life-cycle.

Characterized by having a level of structure, governance, and performance.

Structure. The definition for this research is "The conformation and integration of a Cluster, characterized by the effects of agglomeration, internal competition, barriers, and the heterogeneity existing in the Cluster, and categorized in a Cluster development level based on its life-cycle and its typology."

Government

It is defined in this research as: The coordination of activities in the Cluster is characterized by the level of trust, the leading firms, the intermediaries, the solutions to collective action problems, and categorized by their levels of development based on their life-cycle and typology.

Performance is defined for this research as Growth in the number of jobs, companies, and participation proportion in the GDP. *(State and/or regional and/or national).*

LEVEL OF DEVELOPMENT BASED ON THE LIFE-CYCLE

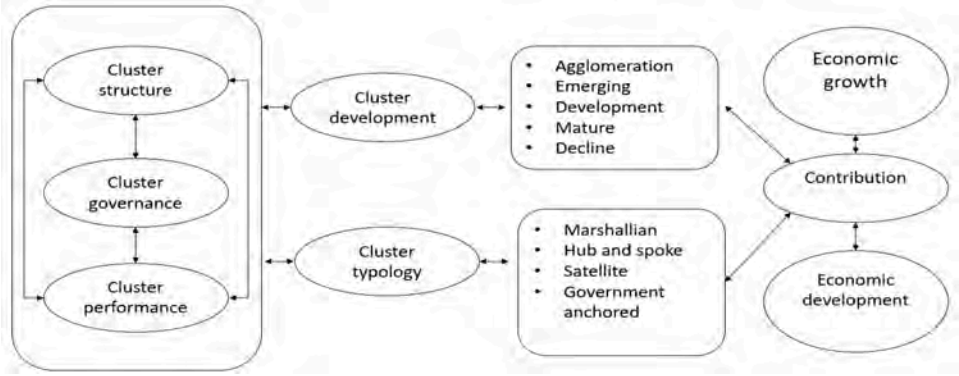
According to its life-cycle, that places it at an evolutionary level of development. The levels of the evolutionary cycle selected in this research are those of Waelbroeck et al. (2004): Agglomeration, Emerging, Development, Maturity, Decline.

METHODOLOGY

Qualitative Approach. As the unit of analysis is the Cluster, statistically, a descriptive level of analysis is reached. To reach an inferential level is necessary a meta-study in a global application. The instrument developed is a taxonomy that identifies operational references to establish the level of development of the Cluster. Information is obtained through an interview.

The information is obtained from the companies taken from the Aguascalientes robotics and automation Cluster directory, forty-seven companies. Research model based on the taxonomy.

Figure 2. Cluster taxonomy.



Source: Own elaboration.

The taxonomy is based on three broad dimensions, Cluster structure, Cluster governance, and Cluster performance. These dimensions are fifteen variables, twenty-nine constructs, and sixty-one items. Each dimension is identified with the level of development of the Cluster life-cycle: first, agglomeration, second, emerging, third, development, fourth, maturity, and fifth decline.

The interviews are carried out to determine the level of development of each construct, variable, and dimension, obtaining with the mode statistic the level of the Cluster and its integration.

In the same way, with the Cluster typology, the taxonomy is built, although only with three dimensions, and four types of Cluster, sixty-two probable characteristics, that place the Cluster in one of the four types. Again, the mode statistic is used to determine the typology.

RESULTS

The following results were obtained, the Cluster is a Marshallian type, with a developing level of development.

The following table shows the results obtained at the development level of the life-cycle, identifying the dimensions and their values, the variables and their values, the constructs and their values.

The structure dimension comprises the variables, agglomeration effects, internal competition, Cluster barriers, and heterogeneity. The government dimension comprises the variables, trust, leading firms, intermediaries, and quality of collective action processes. Finally, the performance dimension includes the growth variables in state GDP and the number of companies.

Finally, we identify the development level with the five levels and the indication that the Aguascalientes Robotics and Automation Cluster is at the development level with 3, See Table 4.

Table 4. Taxonomy Cluster Development Level

DIMENSIONS	VARIABLES	CONSTRUCTS	ITEMS	VALUES
CLUSTER STRUCTURE VALUE 3	A) AGGLOMERATION EFFECTS VALUE 3	WORKFORCE	1,2,3,4,5	3
		CUSTOMERS, SUPPLIERS	7,8,9,10,11,12,13	4
		INFORMATION, TECHNOLOGY DEVELOPMENT	6,14,15,16	4
		LAND PRICE	17,18,19	3
		OVERCROWDING	20.21	3
	B) INTERNAL COMPETITION VALUE 3	EXCHANGE COSTS	23.24	3
		SPECIALIZATION	25.26	4
		INTERNAL CLIMATE	22,27,28,29,30	3
	C) CLUSTER BARRIERS VALUE 3	ENTRY BARRIERS	31.32	4
		EXIT BARRIERS	33	3
		BARRIERS TO THE CREATION OF COMPANIES	34, 35	3
	D) HETEROGENEITY CLUSTER 3	ECONOMIC ACTIVITY	36,37,38,39	two
		SIZE		two
		INTERNATIONAL REACH	40.41	3
CLUSTER GOVERNMENT VALUE 3	E) TRUST 3	COORDINATION COSTS	43, 44	3
		SCOPE OF COORDINATION	42,45,46	3
	F) LEADING FIRMS 3	INNOVATION PROMOTION	48	3
		PROMOTION OF INTERNATIONALIZATION	49.51	3
		INVESTMENT IN EDUCATION AND TRAINING, KNOWLEDGE AND INFORMATION INFRASTRUCTURE	fifty	3
	G) INTERMEDIARIES 3	SHARE IN COORDINATION COSTS	52	3
		PARTICIPATION IN THE SCOPE OF COORDINATION	52	3
	H) QUALITY OF THE FORMAL PROCESSES OF COLLECTIVE ACTION 3	INFRASTRUCTURE	54,55,56,57	3
		ROLE OF PUBLIC ORGANIZATIONS	58,59,60,61	3
		VOICE	53	3
		ROLE OF LEADING FIRMS	47	3
		PARTICIPATION OF COMPANIES IN THE COMMUNITY (THE CLUSTER)	53	3
CLUSTER PERFORMANCE VALUE 3	I) VALUE ADDED	GROWTH IN THE NUMBER OF COMPANIES	DOCUMENTARY RESEARCH	3
		EMPLOYMENT GROWTH	DOCUMENTARY RESEARCH	3
	J) GDP PARTICIPATION	GROWTH IN THE PARTICIPATION OF THE STATE GDP	DOCUMENTARY RESEARCH	2
CLUSTER DEVELOPMENT VALUE 3	K) AGGLOMERATION	1		
	L) EMERGING LEV	2		
	M) DEVELOP	3		3
	N) MATURE	4		
	O) DECLINING LEV	5		

Source: Author

The typology of the Robotics and Automation Cluster was identified as Marshallian.

CONCLUSIONS

This robotics and automation Cluster in Aguascalientes is Marshallian typology, level of development. Besides contributes to the competitiveness of other Clusters.

The Cluster has all the characteristics to be the axis of local development of the state of Aguascalientes. It means to be the base for the development and creation of local companies. With entrepreneurs, preferably undergraduate and postgraduate students, for their integration into business models, previously designed to be the e-business of the robotics and automation digital business ecosystem, in the state of Aguascalientes, this is the second part of this research. There is an agreement signed with the Cluster. The e.businesses will be designed with a multidisciplinary team.

REFERENCES

Arıkan, A.T., & Schilling, M.A. (2011). Structure and Governance in Industrial Districts: Implications for Competitive Advantage. *Journal of Management Studies, 4,* 35.

Barnes, J., & Kaplinsky, R. (2000). Globalization and the death of the local firm?. The automobile components sector in South Africa. *Regional Studies, 34*(9), 797-812.

Barkley, D.L., & Henry. M.S. (2003). *Are Industry Clusters a Good Bet for Rural Development?*. Regional Economic Development Research Laboratory, Clemson University, Community Economics Newsletter.

Binder, M., & Clegg, B.T. (2006). A conceptual framework for enterprise management. *International Journal of Production Research,* 4(18–19), 3813–3829.

Bergman, E.M. (2007). *Cluster life-cycles: an emerging synthesis*. Vienna: Institut für Regional- und Umweltwirtschaft, WU Vienna University of Economics and Business.

Boja, C. (2011). Clusters Models, Factors and Characteristics. International *Journal of Economic Practice and Theories, 1*(2).

Boja, C. (2011). IT Clusters as a Special Type of Industrial Clusters. *Informática Económica,15*(2),184-193.

Capó-Vicedo, J., Martínez-Fernández, M., Vallet-Bellmunt, T., & Expósito-Langa, M. (2011). Content analysis of publications on Clusters and industrial districts in Spanish Ecomonía journals. *European Research on Business Management and Economics,17* (2), 119 – 141.

Carlsson, B., Jacobsson, S., Holmén, M., & Rickne, A. (2002). Innovation systems: analytical and methodological issues. *Research policy, 31*(2), 233-245.

Cedillo-Campos, M., Piña-Monarrez, MR, & Noriega-Morales, S.A. (2007). Hybrid supply chains in emerging industrial countries: The case of Mexican auto industry. *Proceedings of the 12th Annual International Conference on Industrial Engineering Theory, Applications and Practice*, November 4.,

Cortright, J. (2006). *Making Sense of Clusters: Regional Competitiveness and Economic Development.* The Brooking Institution Metropolitan Policy Program.

De Langen, P.W. (2004). *The Performance of Seaport Clusters: A Framework to Analyze Cluster Performance and an Application to the Seaport Clusters of Durban*, Rotterdam, and the Lower Mississippi, Erasmus Research Institute of Management ERIM.

Fedele, J. J., & García, M. H. (2006). Roughness function for alluvial rivers with dunes. In *4th IAHR Symposium on River, Coastal and Estuarine Morphodynamics, RCEM 2005* (pp. 903-908).

Garnica, V., & Ganga, C., (2006). Industrial Clusters: conceptual precision and theoretical development. *Administration Notebooks, 20*(33), 303-322.

Giuliani, E. (2005). Cluster absorptive capacity: Why do some Clusters forge ahead and others lag? *European Urban and Regional Studies, 5,* 269-288.

Giuliani, E. (2005). *The Structure of Cluster Knowledge Networks: Uneven and Selective, not Pervasive and Collective*, DRUID Working Paper No.05-11

Hassink, R., Fornhal, D., Menzel, M.P., & Tödtling, F. (2012). Cluster life-cycles: towards a research agenda, Draft paper presented at the *7th International Seminar on Regional Innovation Policies, Special Session on Cluster Life-cycles, port.*

Kontostanos, S. (2009). *Clusters: examining the evolution of the notion and its key characteristics. What are the main lessons for Corallia?* Athens: Information Technology.

Krugman, P. (1991). Increasing Returns and Economic Geography. *Journal of Political Economy, 99* (31), 483-499.

Krugman, P. (1998). What´s new ago about the new economic geography?. *Oxford Review of Economic Policy, 14*(2).

Markusen, A. (1996). Sticky Places in Slippery Space: A Typology of Industrial Districts, *Economic Geographe, 71* (3), 293-313.

Marshall, A. (1890). *Principles of Economics*. London: Macmillan.

Martin, R., & Sunley, P. (2003). Deconstructing Clusters: Chaotic Concept or Policy Panacea? *Journal of Economic Geography, 3*(1), 5-35.

Menzel, M. P., & Fornahl, D. (2010). Cluster life cycles—dimensions and rationales of cluster evolution. *Industrial and corporate change, 19*(1), 205-238.

Porter, M. (1990). *The Competitive Advantage of Nations*. New York, the Free Press.

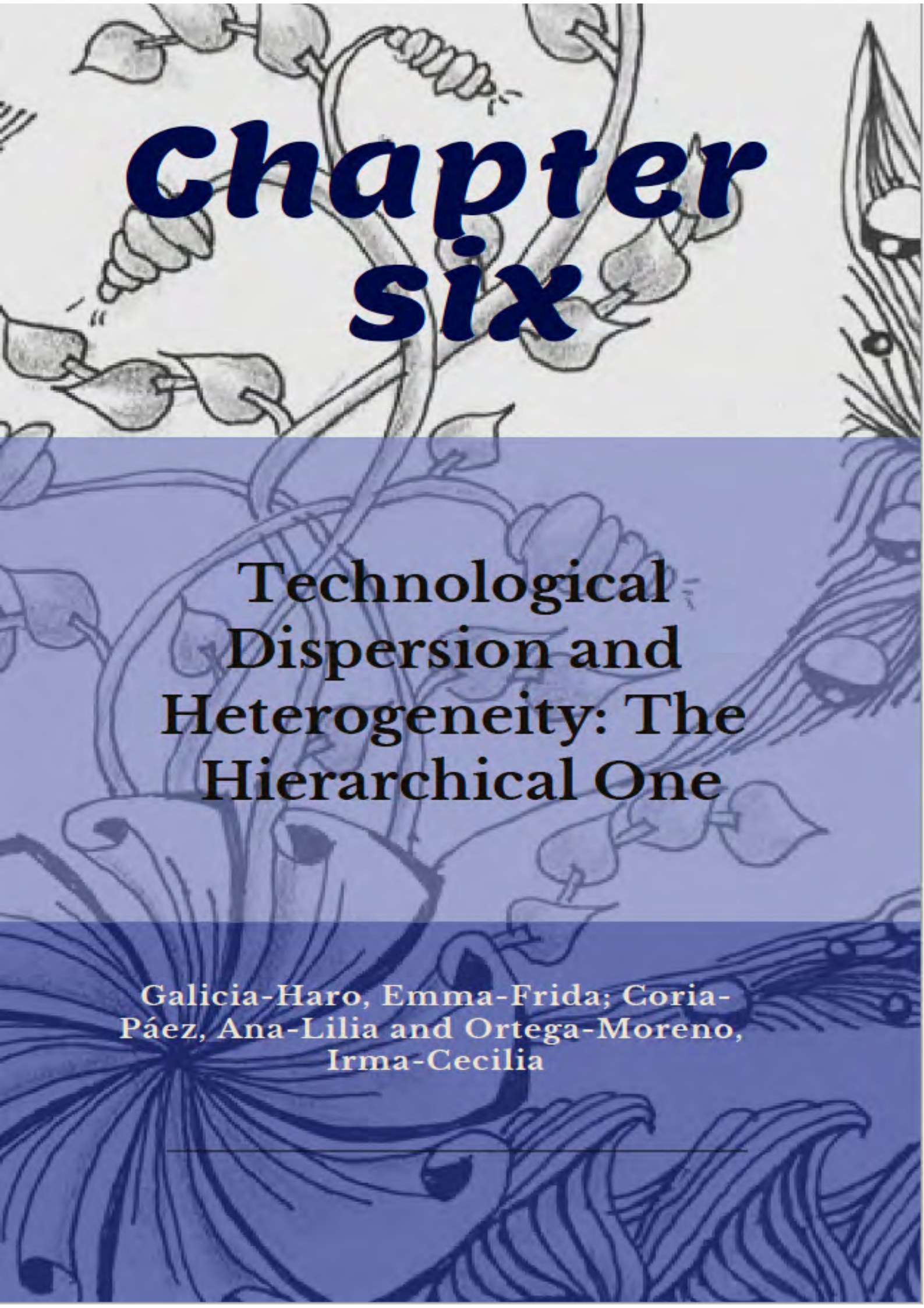
Porter, M. (1998). *On competition*. Boston: Harvard Business School Press.

Spinak, E. (2007). Una nueva definición de "empresa-red". *Profesional de la Información, 16*(1), 49-56.

Unger, K., & Chico, R. (2004). La industria automotriz en tres regiones de México. Un análisis de clusters. *El Trimestre Económico, 71*(284), 909-941.

Vom Hofe, R., & Chen, K. (2006). Weither or not industrial Cluster: Conclusions or co fusions? *The Industrial Geographer,*4(1), 2-28.

Waelbroeck-Rocha Elisabeth, Andersson, T., Schwaag, Server, S., Sörvik, Jens and Wise, Hansson, E. (2004). *The Cluster Policies Whitebook,* Iked.



Chapter six

Technological Dispersion and Heterogeneity: The Hierarchical One

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Technological Dispersion and Heterogeneity: The Hierarchical one

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Introduction

In Mexico, there were 4,800,157 economic units in 2018, of which 12.1% belong to the manufacturing sector with 579,828 units, composed of 21 subsectors, 86 branches, 178 sub-branches, and 290 classes of activity (INEGI, 2019a).

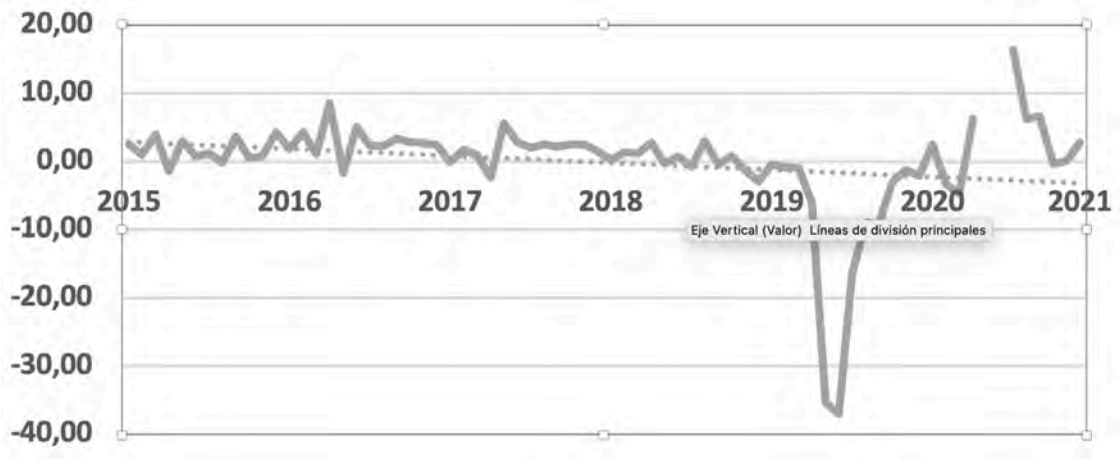
The industry occupies 3rd place by the number of employees with more than 6.4 million workers, generating 48% of the Gross National Production (INEGI, 2018a). However, the growth of the physical volume index in that same year only registered 2.07% (INEGI, 2022b).

However, this behavior is mainly due to the advance of services driven by the dynamism of digital technologies and the growth of commercial activities. The manufacturing sector remains essential in creating sources of employment and the sector's contribution to the large global supply chains; via its exports that presented a great dynamism to grow annually 9.3% (Peña, 2018).

During recent years the manufacturing sector has registered a downward evolution. The period 2015-2021 reached the pandemic stage of 2020, with an annual reduction in April and May 2020 of -35% and -37% (INEGI, 2022b). (See Figure 1).

In addition to the closure of economic activity imposed by the confinement, the climate associated with uncertainty regarding the current public policy is not perceived as favorable for private investment as it was in the previous six-year terms. They also added a weak sectoral structure of manufacturing due to the heterogeneity of the size and technological level of the companies.

Figure 1. Annual Variation of the Timely Indicator of Industrial Activity (Manufacturing Sector)



Note: The cut in the graph refers to extraordinary increases of 51% and 38%
Source: Own elaboration.

By size of the productive units, there are many micro and small manufacturing companies, 97.9%, compared to medium enterprises, 1.3%, and large companies, 0.8%. In comparison, their contribution to production is very different, 5.9%, 15.9%, and 78.2%, respectively, which focuses attention on the low productive capacity of the smaller ones compared to the largest ones (INEGI, 2019b).

Under this same division, the innovation capacity of companies is not observed in the micro since only the small ones (69.6%), the medium (18.4%), and 12% of the large companies have a formal department Research and Development (R&D). A more significant number (3,443) generated or developed their technology for the use of the company or group to which it belongs, 62.5% were derived from small businesses, 25.8% from medium-sized companies, and 11.7% from large companies.

It will be necessary to consider that only 16.3% perform these activities (INEGI, 2017). This diversity in Mexico implies the existence of industries with very different technological levels and, in general, with very little interest in

developing their innovations (Lederman, Messina, Pienknagura & Rigolini, 2014).

Another relevant aspect since the sector establishes favorable conditions for workers with medium skills that allow them to access better economic and social well-being levels. At the same time, industries requiring high qualifications provide jobs in financial and legal areas and the incorporation of personnel in research, technological development, industrial design engineering, and laboratory activities (Padhi, 2022).

DEVELOPMENT

In the first half of the twentieth century, Schumpeter (1943) established the concept of an innovative entrepreneur as the agent that promotes technical and financial innovations driven by competition and declining profits. Its proposal bases the importance of innovation on identifying it as the engine that generates economic growth and positive spillovers towards other sectors in the long term.

Moreover, new technologies generate additional benefits through an initial monopolization while knowledge is not public. Hence the great interest developed to achieve changes based on the technological transformation that creates new products (Solow, 1957; Kline, 1986).

On the other hand, Pavitt (1984) created a taxonomy to identify patterns of innovation behavior at the sectoral level, based on the characteristics of the activities of innovative companies classified into three categories.

The first corresponds to the companies whose innovation is supplier-dominated, with weak in-house R&D and engineering capabilities, generally traditional manufacturing branches.

The second named production intensive integrated by large-scale production companies, attracted to technological changes by reducing costs derived from economies of scale.

And the last one is conceptualized as science-based whose sources of technology founded in R&D activities focused on basic science developed by universities or elsewhere (currently in departments of R&D of the companies themselves).

The prominent representatives are those derived from biochemistry in the generation of products for medical application and other biological and solid-state physics processes in the electronics and communications industry.

Recent studies have shown that investment in R&D and the economic growth of nations were positively related, particularly in the high-tech sectors of developed countries (Raychev, Dimitrova, Madzhurova & Stoyanova, 2020).

Furthermore, studies conducted in OECD countries confirm that increasing 1% in R&D spending generates a 2.83% increase in their real GDP

growth rate (Moustapha & Yu, 2020). At the same time, Zachariadis (2004) demonstrated that from the beginning of this century intensity of R&D has a positive impact on productivity growth, which generates production growth (mentioned in Galicia-Haro et al., 2021).

Currently, countries with higher technological advancement register better levels of growth by having highly competitive companies. Hence, the companies with high technology achieve more incredible innovations that allow them to dominate new markets or expand existing ones.

In the face of the 4th Industrial Revolution (4IR), technological innovations generate a transcendental change throughout the world, something inevitable. The difference comes from both the development and diffusion of innovation (creation), as are the cases of digitalization, information technologies, and the consumer, which allow almost non-existent marginal costs (Schwab, 2016).

In countries such as China with dynamic economic growth, there are studies on high-tech companies that provide sustainable competitive advantages based on technological capabilities (Feng, Sun, Chen & Gao, 2020). The promotion of the development of the regions (Zhao, 2020) and their attractive potential for effectiveness for investors from abroad (Hoholm et al., 2016; Zhu et al., 2019)

In the case of Latin America, the Central American region registered an important advance in the growth of exports of technology-intensive manufactures in the period 1995-2000 of 3.2 times more. Result of exports of high-tech manufactures in 2000 due to the case of Costa Rica, which has two plants of the Intel microprocessor company and the export-oriented foreign investment policy.

However, the rest of the Central American countries continue to export low-tech products (Gutiérrez et al., 2003). The concentration in a few high-tech industries is also found in Colombia's heart, were more than 50% of manufacturing sales abroad correspond to air, space, or maritime navigation; machinery and the branch of sound, image, and television recording or reproduction devices (Heredia, 2011)

According to the SME sector study carried out in Spain, small enterprises are unlikely to be inserted into the high-tech branches. Companies of this medium-high technological level present percentages of more than 3.4% up to 5.8% of investment in R & D on sales. At the same time, those located in the low level do not exceed 1.3% (Arbussà et al., 2004). While in the OECD countries, it is observing the sectoral composition by intensity is statistically significant in the case of high-tech sectors, and its structure is stable over time (Cáceres & Camúñez, 2008).

While in less developed countries, a structure that bases its success on the branches corresponding to technologies with medium technological intensity is more frequent, such as in the Santa Fe region in Argentina (Báscolo & Leguizamón, 2021) or Colombia (Heredia, 2011).

In Mexico's case, an analysis identifies the composition of foreign trade in both directions concerning dealing with the United States and China. They concluded that there is a general decrease in the levels of technological intensity of both exports and imports in the first case. In the relationship with China, Mexico's imports are in high-tech products while exports are mostly medium-low. In both cases, there is a close interdependence concerning high-tech products of origin and destination, which is not observed with the branches of lower intensity (Rodil & Martín, 2017).

In this document, the interest focused on knowing the dimension and characteristics of the existing high-tech industries in Mexico. Locating their composition in front of the enterprises of lower technological levels to see the status of the national technological intensity since it is looking into essential to identify the companies with the most remarkable technological development, that due to their disruptive condition its the basis of long-term economic growth and fundamental in the composition of manufacturing exports, central to the competitive insertion of Mexico in the world, to consolidate its position within the 15 largest economies in the world (The World Bank, 2021)

Research Method

This proposal is approached with a qualitative character to understand the composition of the manufacturing sector from a perspective of technological intensity. The methodological purpose is to address a practical problem, which describes the fundamental elements of this topic.

For the development of this investigation was taken into account the revision developed for the first definition of Technological Intensity in 1997 by the OECD that takes into account the direct intensity of R&D, represented by the proportion that R&D spending has overproduction (OECD Directorate for Science, Technology and Industry, 2011). As a result, the classification includes four levels of even intensity Manufacturing sector: High-tech industries, Medium-high technology industries, Medium-low technology industries, and low-tech industries. See Table 1.

Table 1. Technological Intensity Classification of Manufacturing Industries

High-tech industries	**Medium-high technology industries**
Aircraft and space vehicles 33641 Manufacture of aerospace equipment	Electrical machinery and appliances, n.c.o.s.
Pharmaceutical industry 32541 Manufacture of pharmaceutical products	Motor vehicles, trailers and semi-trailers
Office, accounting and IT machinery 33411 Manufacture of computers and peripheral equipment 33429 Manufacture of other communication equipment	Chemicals, except pharmaceuticals
Radio, television, and communications equipment 33422 Manufacture of equipment for the transmission and reception of radio and television signals and wireless communication equipment 333431 Manufacture of audio and video equipment 33441 Manufacture of electronic components 33632 Manufacture of electrical and electronic equipment and parts thereof for motor vehicles	Railway equipment and transport equipment, n.c.o.s.
Medical, precision, and optical instruments 33451 Manufacture of measuring, control, navigation, and electronic medical equipment instruments 33461 Manufacture and reproduction of magnetic and optical media	Machinery and equipment, n.c.o.s.
Medium-low technology industries	**Low-tech industries**
Construction and repair of ships and vessels	Manufactures, n.c.o.p.; Recycling
Rubber and plastic products	Wood, pulp, paper, paper products, printing and publishing
Coke, refined petroleum products and nuclear fuel	Foodstuffs, beverages and tobacco
Other non-metallic mineral products	Textiles, textiles, leather and footwear

Source: Own elaboration.

Took the data of the number of companies, personnel, and gross value of production registered by the INEGI of the economic censuses to integrate the information of the high-tech industries in Mexico (INEGI, 2004; INEGI, 2014; INEGI, 2015; INEGI, 2019b) as an initial basis and complemented by the interactive tabulations of the Automated Census Information System(INEGI, 2022c) for the same years, as well as the Annual Survey of the Manufacturing Industry, EAIM (INEGI, 2022a) in the years 2018 and 2013.

This combination of sources was necessary to obtain all the information derived from the first issuance of the original censuses, taking for this the final adjustments to the preliminary data obtained from the complementary databases and after the original census publication. This activity was attended by the scholarship students of the research training program (BEIFI-IPN), Alondra

Bautista Trejo, and León Felipe Terrazas Morales assigned to the IPN-SIP20211360 Project.

Data on R&D spending by the various industries came from the Survey on Research and Technological Development of 2016 (INEGI, 2017). The national calculation of the technological intensity herself refers to the database OECD. State (OECD Stat, 2022) and its methodology for classifying companies according to their technological intensity (Hatzichronoglou, 1996) corresponding to R&I expenditure. Among the methods of the OECD and the INEGI, there is a difference in the classification of companies; the first takes into account the United Nations International Standard Industrial Classification. However, CIIU (United Nations Statistics Division, 2022) and the INEGI have to follow the North American Industrial Classification System (INEGI, 2018b), so they made the necessary equivalences to make them compatible without data loss in industries where this was possible.

Results and Discussion

The overall intensity of the manufacturing sector in Mexico calculated with the available data provided by INEGI was almost non-existent 0.019, See Table 2. Because very few companies in the grand universe that make up the sector make up R&D expenses, derived from the fact that more than 90% of micro-companies that compose the industry do not present registration as observed in the ESIDET survey (INEGI, 2017). While analyzing the grouping of companies in the different OECD classification levels, heterogeneity and low-intensity levels were observed (OECD, 2022).

Table 2. Technological Intensity of the Manufacturing Sector

Manufacturing	Number of companies[1]	R&D spending thousands of pesos	Number of companies[2]	VBP thousands of pesos	Technological Intensity[3]
National Total	1 559	14,852,252	244,466	7,738,813,596	0.0019

Note: 1 Enterprises Manufacturing who spent on R&D

2 Total manufacturing companies that can be classified under the OECD methodology

3 R&D Expenditure on production

Source: Own elaboration.

The characteristics of the technological intensity of the sector determining by the type of industry concerned; in the first group of low-tech sectors, the intensity is less than the average or does not make expenses in R & D, except for textiles, clothing, and leather.

This result involves the industries that provide the most significant number of establishments nationwide. Furthermore, it highlights the low coefficient registered by the food, beverage, and tobacco industries that contribute more than 60% of these productive units (INEGI, 2022a).

Table 3. Low Technological Intensity of Manufacturing Industries

	Manufacturing	Number of companies[1]	R&D spending thousands of pesos	Number of companies[2]	VBP miles of pesos	Technological Intensity[3]
313	Textiles, clothing, leather, and leather	13	175 871	229	62,164,092	0.002829
337	Furniture and others	5	13 119	326	14,136,827	0.000928
312	Food, beverages, and tobacco	121	739 409	157,160	1,123,892,447	0.000658
339	Other manufactures not elsewhere specified	1	8 421	469	50,024,011	0.000168
314	Textile products other than clothing			161	18,180,778	0.000000
315	Clothing			672	73,412,801	0.000000
316	Tanning and finishing of leather and leather, and manufacture of leather, leather, and substitute materials			434	53,066,415	0.000000
321	Wood industry			271	16,858,780	0.000000
322	Paper industry			318	209,190,799	0.000000
323	Printing and related industries			221	36,406,143	0.000000

Note: 1 Enterprises Manufacturing who spent on R&D
2 Total manufacturing companies that can be classified under the OECD methodology
3 R&D expenditure on production
Source: Own elaboration.

Two industries located in the group of medium-low technological intensity register values above the average, and the other two of them are lower than the best performing industry of the low-intensity group. Although the four sectors that make up this level spend on R&D, only the branches of non-metallic minerals and those of metal products exceed the intensity registered in the low technology ones, See Table 4.

Table 4. Medium Low Technological Intensity of Manufacturing Industries

	Manufacturing	Number of companies[1]	R&D spending thousands of pesos	Number of companies[2]	VBP thousands of pesos	Technological Intensity[3]
327	Non-metallic mineral products	37	944 455	748	103,884,753	0.00909
332	Products made of metal (except machinery and equipment)	82	485 287	59,437	99,466,203	0.00488
331	Base metals	10	70 437	297	146,811,957	0.00048
324	Coal, petroleum products (and nuclear energy not in manufactures)	19	33 887	54	540,816,307	0.00006

Note: 1 Enterprises Manufacturing who spent on R&D
2 Total manufacturing companies that can be classified under the OECD methodology
3 R&D expenditure on production
Source: Own elaboration.

At this level, the noteworthy thing is that the machinery, equipment, instruments, and transport equipment industry, corresponding to the members of the automotive industry's supply chain (motor vehicle transport equipment), has the best coefficient of the intensity of manufacturers and ranks as the best performance of the four levels of the classification. In the case of the automotive industry, which is the engine of industrial growth in Mexico, its coefficient is far from that presented by its suppliers. See Table 5

Table 5. Medium High Technological Intensity of Industries in the Manufacturing Sector

	Manufacturing	Number of companies1	R&D spending thousands of pesos	Number of companies2	VBP thousands of pesos	Technological Intensity3
333	Machinery, equipment, instruments, and transport equipment	201	6 009 996	458	68,507,604	0.0877
336	Motor vehicle transport equipment	21	3 148 887	1,010	682262774	0.0046
325	Chemicals and chemicals	123	1 697 395	490	643,008,342	0.0026
326	Plastics and rubber industry			942	256,653,931	0.0000
335	Manufacture of accessories, electrical appliances, and electrical power generation equipment			355	82,956,779	0.0000

Note: 1 Enterprises Manufacturing who spent on R&D
2 Total manufacturing companies that can be classified under the OECD methodology
3 Proportion of R&D expenditure has on production
Source: Own elaboration.

The intensity recorded in high-tech industries except aerospace equipment is higher than the national average. The Industry of television, radio and communications equipment is the second with the best intensity record of the manufacturing sector.

The four remaining industries exceed the national average. So, it is possible to affirm that this sector is by nature the one that can drive with greater certainty the technological intensity of manufacturing. Highlight, in this case, the absence of R&D expenditure of the industry of aerospace equipment that contemplates airplanes and aerospace components, and that together with the automotive have promoted with strength development regional in Mexico, See Table 6.

Table 6. High Technological Intensity of Industries in the Manufacturing Sector

	Manufacturing	Number of companies[1]	R&D spending thousands of pesos	Number of companies[2]	VBP thousands of pesos	Technological Intensity[3]
334220	Television, radio, and communications equipment	1	235 859	21	5,352,932	0.0441
3342	Electronic equipment (radio, TV, and communications)	15	239 255	52	12,599,136	0.0190
3254	Pharmacists	65	1 070 233	137	140 368 148	0.0076
3345	Medical, precision, and optical instruments, clocks and chronometers	16	42 271	43	5,621,298	0.0075
334	Office, accounting, and computer machinery	12	412 585	388	85,234,000	0.0048
3364	Aerospace Equipment			49	9017740	0.0000

Note: 1 Enterprises Manufacturing who spent on R&D

2 Total manufacturing companies that can be classified under the OECD methodology

3 Proportion R&D expenditure has on production

Source: Own elaboration.

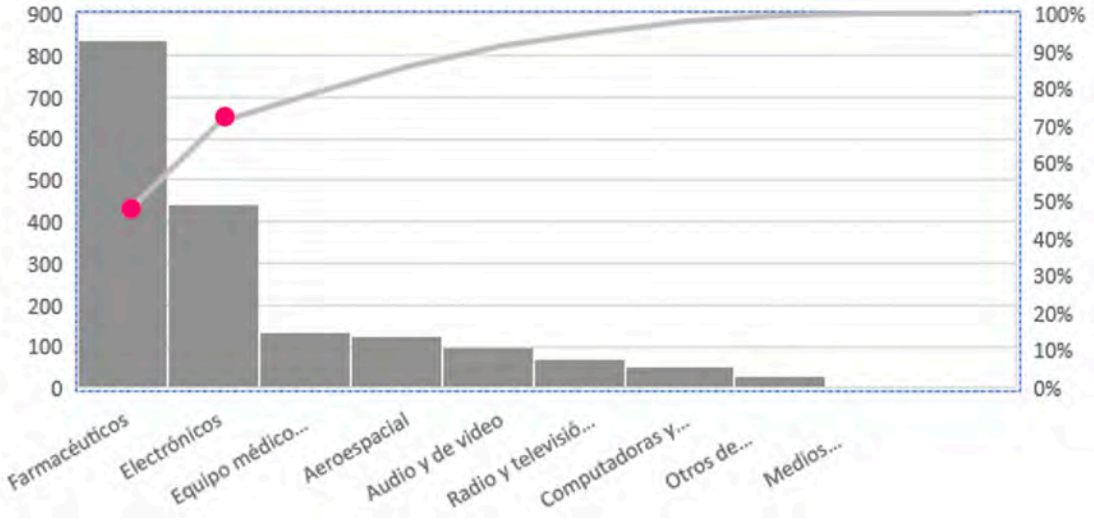
This information shows the extent to which companies located at higher levels of intensity register better coefficient values. It is crucial to expand the knowledge of both the scarcity in the lower intensity of investment in R & D and heterogeneity in greater intensity.

To provide more information to identify other characteristics of high-tech industries, indicators of the number of enterprises employed personnel and addressed the gross value of production by sub-branch. This classification was based chiefly on data from economic censuses, complemented by the Annual Survey of the Manufacturing Industry (INEGI, 2022a).

In general terms, the number of companies went from 1,548 to 2,127 with an average annual growth of 6.46%, employees from 553,525 to 934,352 (11.84%), and gross value of production the average increase was 21%. This advance is integrated in a heterogeneous way when analyzing each of the industries analyzed.

In the case of economic units, the pharmaceutical industry has the most significant number of establishments, 45% of the total, followed by electronic equipment (30%) and in 3rd place, medical equipment (5%) with which they add up to 80% of the total of high-tech companies, See Figure 2.

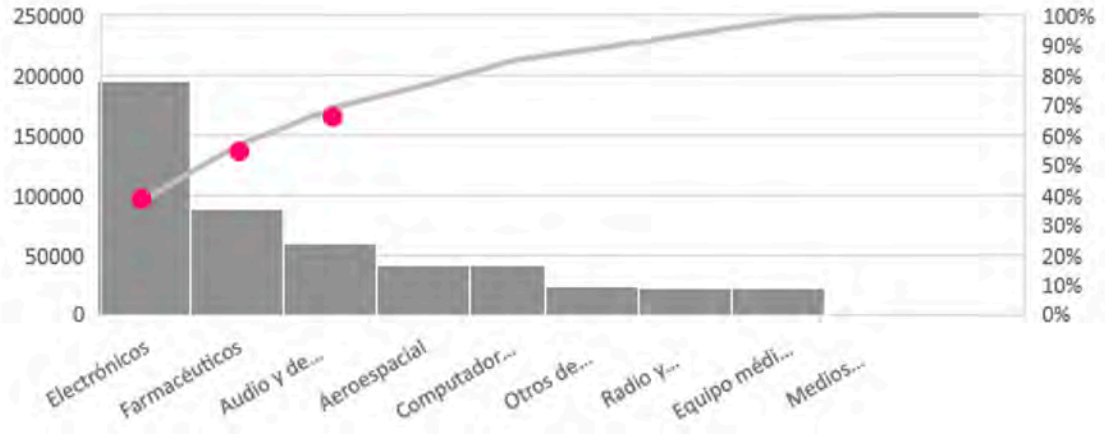
Figure 2. Number of Establishments of high-tech industries



Note: cumulative line portion of establishments
Source: Own elaboration.

The number of employees in these industries is concentrating in electronics (38%), pharmaceuticals (19%), and audio and video (13%), which together absorb 70% of the industries, See Figure 3.

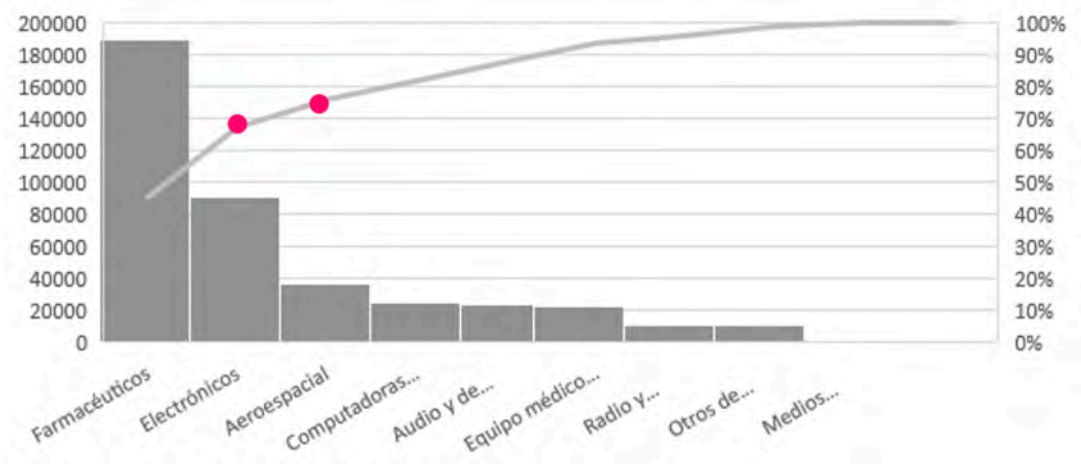
Figure 3. Personnel Employed in High-Tech Industries



Note: cumulative line portion of staff.
Source: Own elaboration.

In the case of the gross value of production, the most significant contributor is the pharmaceutical industry with 47%, in second place that of electronics (23% and in third place the aerospace with 4%, combining 74% of the total, See Figure 4.

Figure 4. Gross Value of Production of High-Tech Industries



Note: line accumulated portion of the gross value of production
Source: Own elaboration.

From the above, the industries that dominate the high-intensity group observe, in the first place, the pharmaceutical industry that has the most significant number of establishments, contributes the tremendous volume of gross production (VBP) and is second in employed personnel.

Secondly, the fabrication of electronic components first in employed personnel and second in establishments and VBP. These two industries represent on average between 70% and 75% of the three indicators, except they are not the ones that register the best coefficients of technological intensity, 0.00760 and .0048, respectively.

Compared to the manufacture of transport equipment (not including automotive), 0.08 of medium high intensity, or 0.04 of the fabrication of radio and television signal transmission and reception equipment, and wireless communication equipment.

Industry implies that while the expansion of these two industries has been significant, their R&D spending is not reflected, which may indicate a technological dependence that is not contributing advances to the knowledge generated in our country nor the expected boost economic and social development.

In terms of what was stated by Pavitt (1984) according to the patterns of innovation behavior, these results point to the best productive branches of manufacturing being in industries of medium-high technological intensity: machinery, equipment, instruments, and transport equipment and those of high technological intensity: television, radio, and communications equipment.

High-tech is provider-dominated despite its precise definition as they do not possess significant internal R&D capabilities. According to its expansion, the pharmaceutical industry is based on science developed in research centers or universities. It is verified that these developments are not found in the country given its reduced expenditure on R & D.

These results coincide with findings in Latin American countries on concentration in a few high-tech companies (Heredia, 2011; Gutierrez et al., 2003). The low probability that small companies can insert in high technology (Cáceres & Camúñez, 2008) and yet, in this case, can be identified even in low technology. While the significant dependence on trade with the U.S. USA seems to maintain the large volume of low-intensity companies with very low coefficients (Rodil & Martín, 2017).

The fact that the percentage of R&D spending in Mexico does not reach the goal of 1% proposed for several years now in part has been due to the low share of the private sector in R&D spending, as demonstrated in this paper, despite the possibility that in the last six years researchers were given for projects

with the private sector and the little developed purpose of achieving the university-business link in this field (Rodriguez, 2016).

Conclusions

It is considering the difficult task of accessing specific statistics on innovation, technology, and R&D in Mexico. Therefore, this study provides an initial overview of the types of technological intensity that the manufacturing sector presents.

In carrying out this research, a discrepancy was observed between the excellent availability of data on this topic in the OECD databases compared to dispersion and heterogeneity in Mexico.

The results presented here point to a significant weakness in the manufacturing sector due to the small coefficients of technological intensity in the four types studied; weakness associated with the reduced spending on R&D identified in all varieties. A good result within this reality founding in the ascending trajectory of the coefficients, to the extent that sectors of greater intensity appear.

A matter of great interest for public policies is to achieve a strategy to boost company spending on R&D, which is considered inappropriate based on the international status of the Mexican economy. In this same matter, a more detailed analysis of the causes that prevent highly technological content industries from investing in R&D in the national territory is required.

References

Arbussà, A., Bikfalvi, A., & Valls, J. (2004). La I+ D en las pymes: Intensidad y estrategia. *Universia Business Review,* (1), 40-49.

Báscolo, P., & Leguizamón, F. (2021). Inserción internacional de la industria Santafesina 2001-2018. Especialización según intensidad tecnológica. *Vigesimoquintas Jornadas "Investigaciones En La Facultad" de Ciencias Económicas y Estadística*, 1–23.

Cáceres, F., & Camúñez, J. (2008). La estrutura sectorial como factor determinante de la intensidad tecnológica de los países. *Economía Industrial,* 368, 27–34.

División de Estadística de las Naciones Unidas. (2022, January 8). *Estructura de la clasificación. Clasificación Industrial Internacional Uniforme de Todas Las Actividades Económicas* (CIIU). https://unstats.un.org/home/

Galicia-Haro, E., Coria-Páez, A., & Ortega-Moreno, I. (2021). Innovación sectorial y desigualdad tecnológica en el sector manufacturero. In RIICO (Ed.), *Reinventándose para la Competitividad Post-COVID-19.* Mexico: Universidad de Guadalajara.

Gutiérrez, R., Cortés, E., Penellol, D., & Zapata, R. (2003). *Intensidad tecnológica del intercambio comercial del Istmo Centroamericano y la República Dominicana con el resto del mundo.* Santiago de Chile: ECLAC

Hatzichronoglou, T. (1997). *Revision of the High-Technology Sector and Product Classification* (No. 1997/2). OECD Publishing. https://doi.org/10.1787/134337307632

Heredia, E. (2011). *Departamentos de Colombia que mayor intensidad tecnológica de las exportaciones emplean 1991-2008*. Cali, Colombia: Universidad autónoma de Occidente.

Hoholm, T., Araujo, L., Zhu, Z., Dhokia, V. G., Nassehi, A., Newman, S. T., La Rocca, A., Snehota, I., Purchase, S., Kum, C., Olaru, D., Ostendorf, J., Mouzas, S., Chakrabarti, R., Vokoun, M., Yang, M., Evans, S., Vladimirova, D., Rana, P., … Wunsch-Vincent, S. (2016). The Global Innovation Index 2016 Winning with Global Innovation. *Industrial Marketing Management*, 43(3). https://doi.org/10.1016/j.indmarman.2013.12.008

INEGI. (2004). *Censos Económicos 2004: Micro, pequeñas, medianas y grandes empresas: visión censal*. Mexico: INEGI

INEGI. (2014). *Censos Económicos 2014: Micro, pequeña, mediana y gran empresa. Estratificación de los establecimientos.* Mexico: INEGI.

INEGI. (2015). *Censo Económico 2014.* Mexico: INEGI.

INEGI. (2017). *Encuesta sobre investigación y desarrollo tecnológico y módulo sobre actividades de biotecnología y nanotecnología*. Mexico: INEGI.

INEGI. (2018a). *Industria manufacturera. Información de México para niños.* Mexico: INEGI. http://cuentame.inegi.org.mx/economia/secundario/manufacturera/default.aspx

INEGI. (2018b). *SCIAN2018 Categorías-productos*. Mexico: INEGI.

INEGI. (2019a). *Micro, pequeña, mediana y gran empresa: Estratificación de los establecimientos.* Censos Económicos 2019. Mexico: INEGI.

INEGI. (2019b). *Micro, pequeña, mediana y gran empresa*. Mexico: INEGI.

INEGI. (2019c). *Resultados Nacionales Censos Económicos 2019.* Mexico: INEGI.

INEGI. (2022a). *Encuesta Anual de la Industria Manufacturera (EAIM)*. Serie 2013. Subsistema de Información Económica. Mexico: INEGI.

INEGI. (2022b). *Industria manufacturera*. Banco de Información Económica. Mexico: INEGI

INEGI. (2022c). *Tabulados interactivo (SAIC).* Censos Económicos 2019. Mexico: INEGI

Kline, S. J. (1986). An Overview of Innovation. In Landau R., Rosenberg N., eds. *The Positive Sum Strategy*. Washington, DC: National Academy of Sciences.

Lederman, D., Messina, J., Pienknagura, S., & Rigolini, J. (2014). *El emprendimiento en América Latina: muchas empresas y poca innovación*. World Bank Publications..

OECD.Stat. (2022, January 7). *OECD Statistics*. OECD. https://stats.oecd.org/

OECD. (2022). *Analytical Business Enterprise Research and Development*. ANBERDdatabase. https://www.oecd.org/innovation/inno/anberdanalyticalbusinessenterpriseresearchanddevelopmentdatabase.htm

Padhi, A. (2022). *Want to drive inclusive economic growth? Start with manufacturing* (Davos Agenda 2022; Advance Manufacturing). https://www.weforum.org/agenda/2022/01/inclusive-economic-growth-manufacturing/?utm_source=sfmc&utm_medium=email&utm_campaign=27…

Pavitt, K. (1984). Sectoral patterns of technology change: toward a taxonomy and theory. *Research Policy, 13*(6), 343–373.

Peña, M. del C. (2018). *La manufactura y el comercio impulsarán la economía mexicana en 2018*. BBVA. https://www.bbva.com/es/manufactura-comercio-impulsaran-economia-mexicana-2018/

Rodil, O., y Martín, M. (2017). Las relaciones intersectoriales de México con Estados Unidos y China desde una perspectiva de intensidad tecnológica (2000-2014). *XVII Congreso Latino-Iberoamericano de Gestión Tecnológica - ALTEC*, 1–15. https://www.uam.mx/altec2017/pdfs/ALTEC_2017_paper_193.pdf

Rodríguez, A. (2016, Octubre 17). *Difícil destinar 1% del PIB a ciencia y tecnología antes de fin de sexenio: Conacyt*. Sdpnoticias, párrafo 4. https://www.sdpnoticias.com/nacional/destinar-dificil-pib-1.html

Solow, R. M. (1957). Technical change and the aggregate production function. *The Review of Economics and Statistics, 39*(3), 312–320. https://doi.org/10.2307/1926047

World Bank. (2021). *Mexico Overview: Development news, research, data*. Mexico: World Bank. https://www.worldbank.org/en/country/mexico/overview#1

Zhu, J., Wang, Y., & Wang, C. (2019). A comparative study of the effects of different factors on firm technological innovation performance in different high-tech industries. *Chinese Management Studies, 13*(1), 2–25. https://doi.org/10.1108/CMS-10-2017-0287

Chapter seven

Adaptation in the Artisan Sector: The Individualist Attitude

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Adaptation in the artisan sector: The Individualist Attitude

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Introduction

For a long time, hats have been woven by hand by artisans from various parts of Mexico: Puebla, Veracruz, Campeche, Guerrero, and Oaxaca. States that stand out for their most significant contribution in the weaving of artisan hats, derived from palm, plant that provides the raw material to weave the hat.

Tehuacán, Puebla is placed on the map of the hat due to its strategic location, which has contact with communities where they are dedicated to weaving hats, suppliers of raw materials (bell) are in the surroundings, such as the Mixteca poblana and Oaxaca.

In addition, this type of industry is one of the most important within the state of Puebla since it generates thousands of products distributed throughout the country, products that demand higher quality every day (Scrase, 2003; Brusco & Sabel, 1981; Juran, 999).

In the industrial sector of the hat in the Tehuacán region, the need arises for an improvement project due to problems related to the quality of its products since customers have identified defects that cause rejection of finished products. For this reason, the project is carried out that consists of the Design of an improvement system using the DMAIC methodology and lean manufacturing tools and thereby reducing the variability of the process and the waste found within it (Idole, 2013).

The implementation of DMAIC sought to focus the problem that affects the initial quality of the product through an identification based on facts and not

assumptions (De Mast & Lokkerbol, 2012; Krishnan & Prasath, 2013; Girmanová et al., 2017; Prashar, 2014). Therefore the methodology will quantitatively identify the most critical defect that afflicts the process and the Statistical analysis to identify the factors present that favor the opportunity for improvement and thus decide about which lean manufacturing tools will help solve the problem (Solís-Quinteros et al., 2021; Chouiraf & Chafi, 2018).

Six Sigma Methodology

According to Gutiérrez (2010), in 1987, Six Sigma was introduced at Motorola by a team of managers led by Bob Galvin, president of the company to reduce manufacturing defects. Electronic products. Currently, many organizations have this system as a business strategy to increase their profitability and improve the quality of their products and services (Navarro, Gisbert & Pérez, 2017).

If it is carried out correctly, the company will eliminate all operations that do not add value to the product, service, and processes. The increase in value of each activity carried out, eliminating what is not required, reducing waste, and improving operations, always based on respect for the worker, just as tangible, measurable and significant improvements in competitiveness will be obtained (Ibarra & Ballesteros, 2017).

It is a philosophy of improving manufacturing processes and/or services to eliminate waste and activities that do not add value. With immediately results in productivity, competitiveness, and profitability of the business, increasing the value of each activity carried out and eliminating those activities that are not required.

With the elimination or reduction, there is a decrease: up to 50% in production costs, inventories, and delivery times (Pérez et al., 2016), as well as improving quality and increasing the efficiency of the production team. Work and a strategy of continuous improvement of the business focused on the client, seeking to find and eliminate the causes of errors, defects, and delays in the processes.

The strategy is supported by a methodology based on tools and statistical thinking (Idole, 2013). Likewise, it has three priority areas of action: customer satisfaction, reduction of cycle time, and fewer defects. (Vara, 2009). The goal is to achieve processes with a quality that generates a maximum of 3.4 defects per million opportunities.

This goal is intended to be achieved through an improvement program, designed, and driven by an organization's top management, customer-oriented and focused on processes and directs statistical data (SIG consulting, 2018). As Niebel mentions, a good improvement program follows an orderly process:

selecting of the project and ending with its implementation (Niebel & Freivalds, 2010).

Mexico has experienced an unusual growth of companies that, under the scheme of the maquiladora industry, link the national economies of the country to the most powerful economy in the world, that of the United States. Another of the tools born in the automotive sector but continuously adapted to different sectors, to the hat maquiladora industry, is DMAIC. That helps increase profits, eliminate waste, improve efficiency, and build an extraordinary team (Edge, 2019).

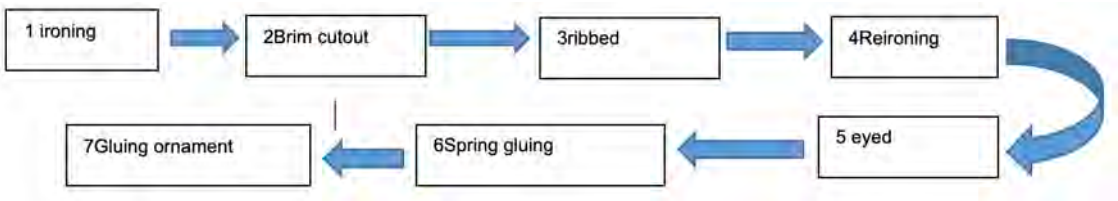
DMAIC Methodology

A structured problem-solving procedure widely used in processes, it is often associated with Six Sigma activities, and almost all Six Sigma implementations use the DMAIC process for project management and completion. However, DMAIC is not necessarily formally linked to Six Sigma and can be used independently of an organization's use of Six Sigma.

It is a very general procedure. For example, lean projects that focus on cycle time reduction, performance improvement, and waste elimination can quikly and efficiently use DMAIC. The letters DMAIC form an acronym for the five steps; Define, Measure, Analyze, Improve, and control.

The DMAIC structure encourages creative thinking about the problem and its solution within the definition of the original product, process, or service. When the process is performing so poorly that it is necessary to abandon the original process and start over, or if it is determined that a new product or service is required, then the DMAIC Improve step becomes a design step. One of the reasons DMAIC is so successful is that it focuses on the effective use of a relatively small set of tools. (Mongomery, 2013)

Figure 1 process of making the hat



Source: Own elaboration.

Results

There are problems related to the quality of its products in the Hat industry. Customers have identified defects that cause the rejection of orders, and then the

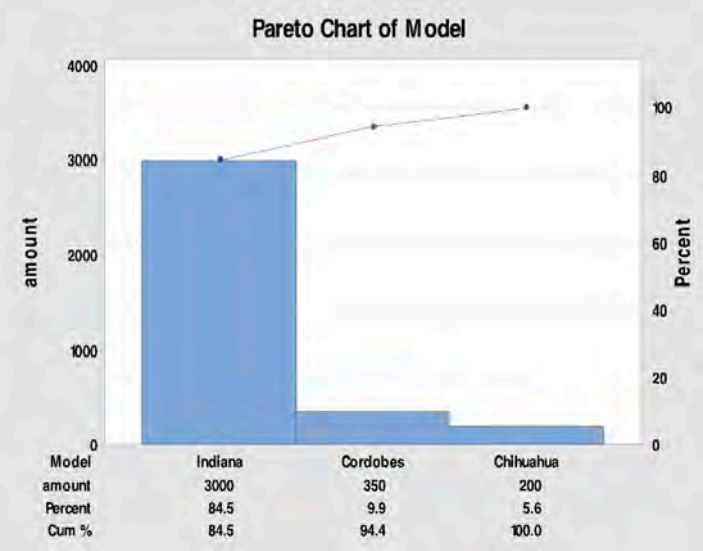
demand has been had during the last month regarding the products is presented. Three most requested models. Obtaining the following data (see table 1 and Graph 1)

Tabla 1. Demand data

Model	amount
Indiana	3000
Chihuahua	200
Cordobes	350

Source: Own elaboration.

Graph 1. Pareto diagram of the first level



Source: Own elaboration.

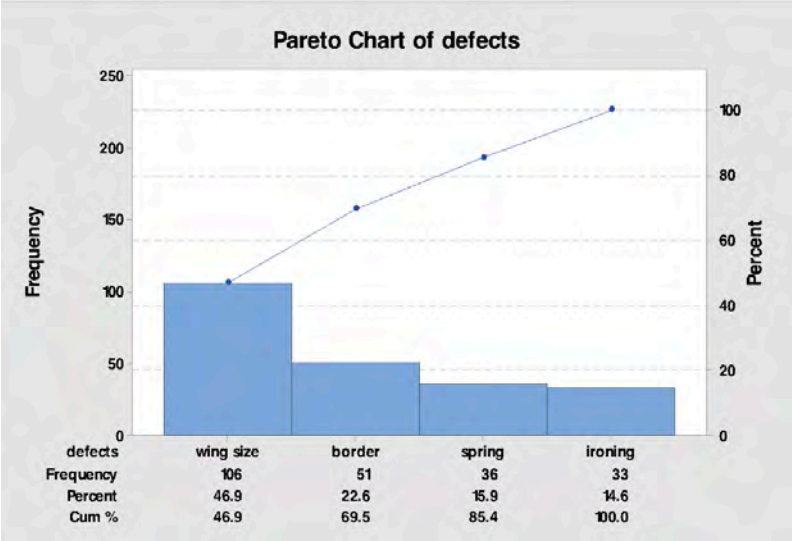
The Pareto Diagram shows the hat model with the most claims for defects in the Indiana model. Therefore, following up on the information provided by the first Pareto diagram, the analysis should focus on the defects that this model has presented to identify the problem with the most significant impact, obtaining the information presented in table 2 and Graph 2.

Tabla 2. Frequency and defects of the Indiana model

Defects	Frequency
wing size	106
spring	36
border	51
ironing	33

Source: Own elaboration.

Graph 2. Second level Pareto diagram



Source: Own elaboration.

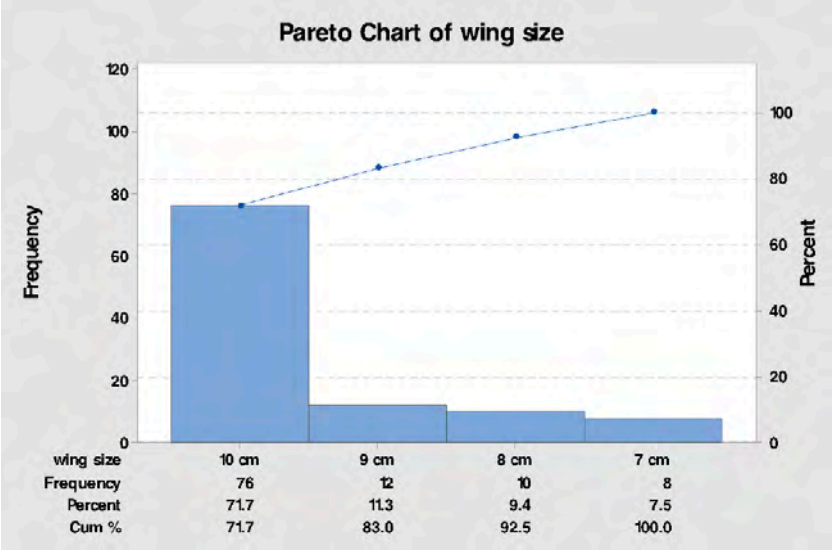
Following up on the information provided by the second Pareto chart, the analysis now corresponds to identifying in which of the wing measurements the most defects occur to identify the problem with the most significant impact. Listing the manufactured wing stockings and the number of defects they presented was done. Obtaining the following data. See table 3 and Graph 3

Table 3. Wing size of the Indiana model and its frequency

Wing size	Frequency
10 cm	76
9 cm	12
8 cm	10
7 cm	8

Source: Own elaboration.

Graph 3. Pareto diagram of the third level



Source: Own elaboration.

When representing the data in a third-level Pareto diagram, it is observed that the wing size in the Indiana model is the one with the most significant impact. It is the measurement of 10 cm, generating an accumulated percentage of 71.7%. Then the next step is to analyze the corresponding process responsible for wing clipping through the study of the measurement system, variance, and process capacity.

SERIES

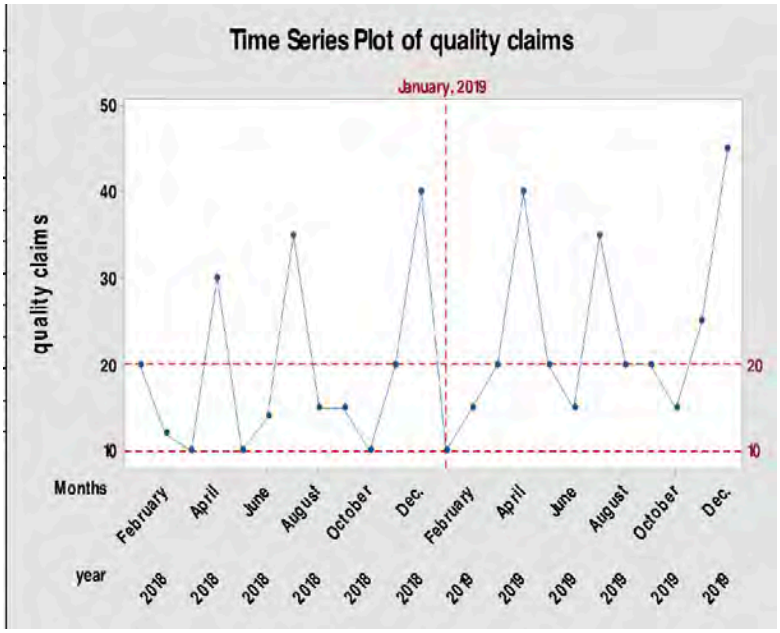
The series evidence the behavior generated by quality claims in the products. The objective is to have a maximum of 10 pieces rejected in 3 months (Table 4). Graph 4 shows the series, the SMART objective, and the average number of rejected hats. Based on the Pareto diagrams, the data obtained from the wing clipping operation (see table 5) corresponds to the most relevant fault detected.

Table 4. Claims for the last two years

Months	**quality claims**	**Months**	**quality claims**
January	20	January	10
February	12	February	15
March	10	March	20
April	30	April	40
May	10	May	20
June	14	June	15
July	35	July	35
August	15	August	20
Sep.	15	Sep.	20
October	10	October	15
Nov.	20	Nov.	25
Dec.	40	Dec.	45

Source: Own elaboration.

Graph 4. Claims time series



Source: Own elaboration.

The next step is systematically treating the data using the type 1 measurement system. It focuses on evaluating the variation present in the measurement system and evaluates the causes of bias and repeatability on the measures. By representing the measurement data in wing size, the type 1 study graph is obtained (see Graph 5).

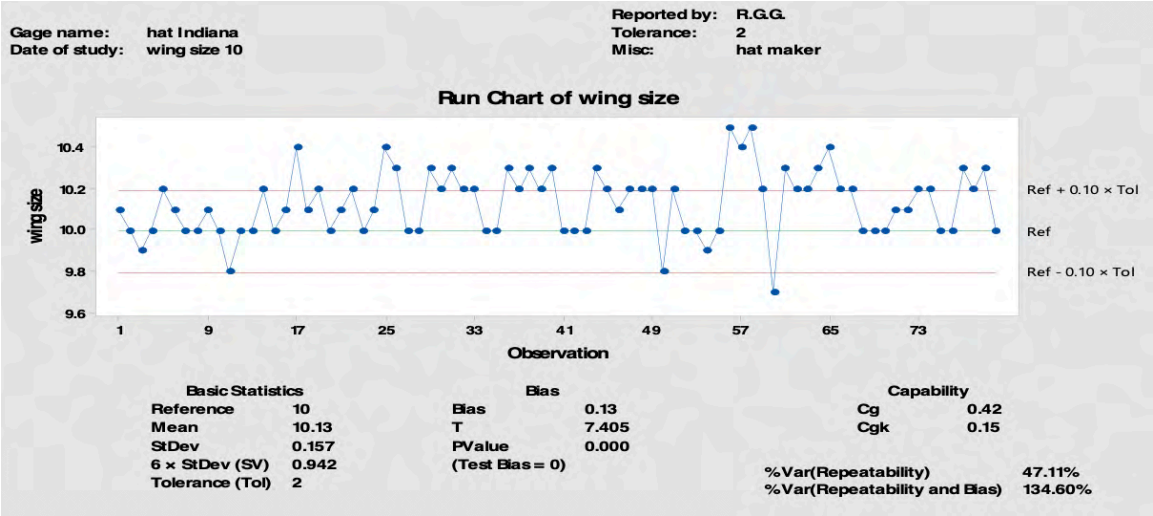
The corresponding interpretation of Graph 5 focuses on the indices cg, the potential capacity index of the measurement system, and cgk, the actual capacity index of the measurement system.

Table 5. Data of the wing trimming process. (cm)

Shows	Lot 1	Lot 2	Lot 3	Lot 4	shows	Lot 1	Lot 2	Lot 3	Lot 4
1	10.1	10.1	10.0	10.3	11	9.8	10.3	10.2	10.1
2	10	10.2	10.0	10.2	12	10	10.2	10.0	10.1
3	9.9	10.0	10.0	10.2	13	10	10.2	10.0	10.2
4	10	10.1	10.3	10.3	14	10.2	10.0	9.9	10.2
5	10.2	10.4	10.2	10.4	15	10	10.0	10.0	10.0
6	10.1	10.3	10.1	10.2	16	10.1	10.3	10.5	10.0
7	10	10.0	10.2	10.2	17	10.4	10.2	10.4	10.3
8	10	10.0	10.2	10.0	18	10.1	10.3	10.5	10.2
9	10.1	10.3	10.2	10.0	19	10.2	10.2	10.2	10.3
10	10	10.2	9.8	10.0	20	10	10.3	9.7	10.0

Source: Own elaboration.

Graph 5. Type 1 Gage Study for wing size



Source: Own elaboration.

Graph 6 can be interpreted as multiple points outside the tolerance limits, obtaining a cp= 0.43 and a cpk= 0.15, which indicates a very distant relationship about the tolerance range, and the measurements regarding the reference value are very high.

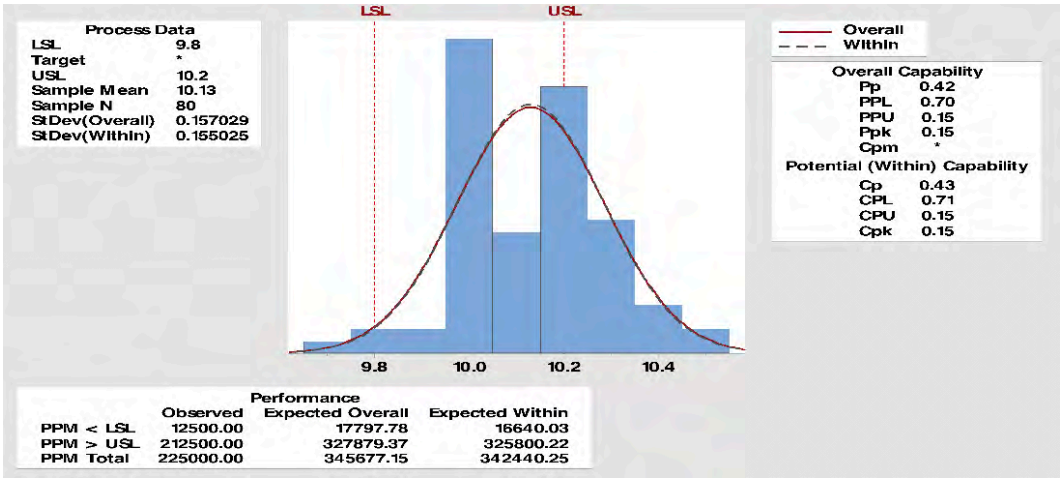
The measurement system must be attended to immediately to find out the reason for this behavior if it is caused by the measurement instrument not being properly calibrated or the operator did not correctly obtain the data. Then a histogram is constructed to determine the processing capacity in which a histogram with the established tolerance limits can be seen and a reference concerning the expected objective that the measurements equal to 10 cm should meet.

Finally, attention is on capacity, data processing, and performance indicators. (see Graph 6). A process is considered capable of meeting specifications when the natural variation of the process is less than the variation of tolerances. That is why the Cp index must be greater than one; otherwise, it is evident that the process does not meet specifications.

As seen in the report, several data are identified outside the specification limits, indicating that the process cannot meet the specifications. The box on the right side shows the long-term capacity indicators show a Pp = 0.43, which represents the general capacity of the process, with a Ppk < 1 that shows that the data is outside the specification limits, the short-term indicators show a value of Cp = 0.52 and a Cpk = 0.18. With the help of table 6 (Vara, 2009), the interpretation of the Cp index is carried out since the Cp index = 0.52 is

considered a process not suitable for the work, which requires serious modifications.

Graph 6. Report of process capacity indexes cp and cpk



Source: Own elaboration.

Table 6. CP-values for interpretation

Index value Cp	Process class or category	Decision (if the process is controlled)
Cp ≥ 2	World-class	It has six sigma quality
Cp ≥ 1.33	1	Suitable
1< Cp < 1.33	2	Partially adequate requires strict control
67.< Cp < 1	3	Not suitable for work. An analysis of the process is necessary. Requires serious modifications to achieve satisfactory quality
Cp < 0.67	4	Not suitable for work. Requires serious modifications

Source: (Vara, 2009).

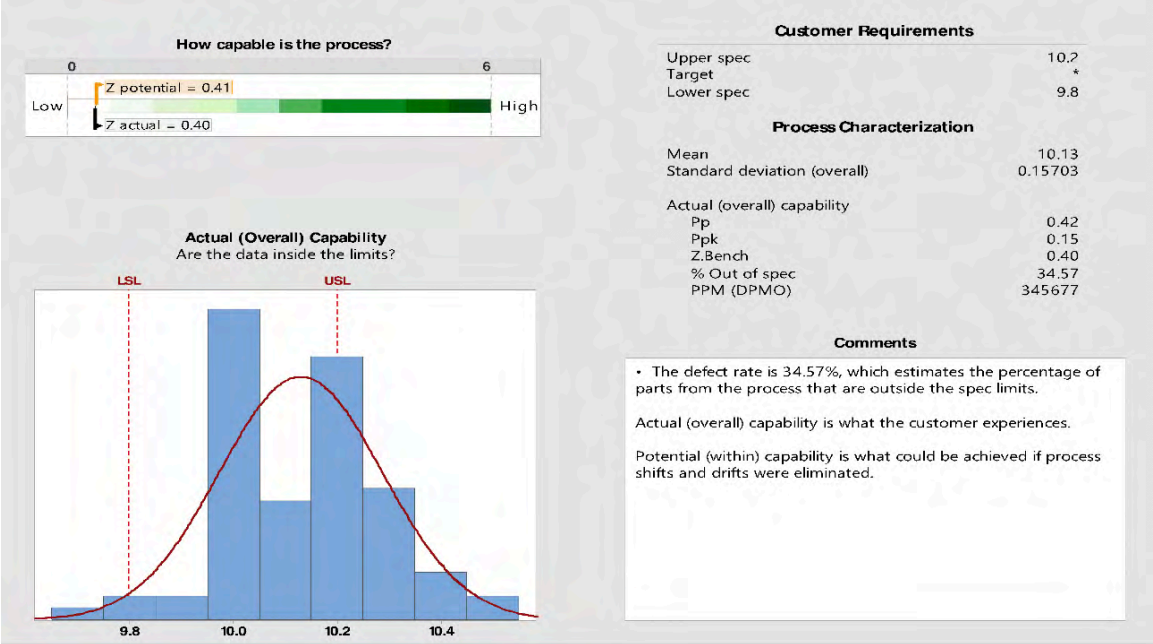
The box on the left of Graph 6 shows the data referring to the sample's mean, the number of data, and the standard deviation. Finally, at the bottom is the performance in % of defects per million opportunities, obtaining 1.25% below the LEI and 22.25% above the LES, with a total of 22.50% that will be rejected for being out of compliance. Graph 5 type I study the width 10 of the brim of the Indiana hat.

Within the capacity analysis, it is crucial to consider that the Ppk includes all the wide variations that the client experiences. When the Ppk is calculated, considering the standard deviation of all the process pieces is done. When the Cpk has calculated only the variability between the subgroups, then what the client receives and experiences over time is the Ppk.

Remember to use the analysis of process capability from the point of view of general capability, so when we talk about Cp and Cpk in the long term, we will talk about Pp and Ppk.

Graph 7 shows the interpretation of the process capability analysis, which indicates that the process cannot comply with specifications and the significant data difference for the expected mean. Highlighting that what is sought within the improvement system is to reduce variability (standard deviation) see Graph 8.

Graph 7. Process Capability Analysis



Source: Own elaboration.

Analysis of the R&R study (repeatability and reproducibility)

The subsequent treatment to be carried out is an R&R study for which two replicates are carried out with two operators to carry out the measurement experiment on the hats cut to 10 cm with a tolerance of 0.2 and 10 parts (hats) selected at random. That is part of the total variability of the process, good parts, bad parts, parts with many variations between one and the other, these characteristics of the parts are only known by those responsible for the study.

However, the operators do not know that information, so the result is if the operator can replicate their measurements. Therefore, the study's objective is to identify if the operators are consistent in their measurements of the same part, that is, repeatability, and if the variation between operators is consistent, that is reproducibility (Table 7).

Table 7. Measurement data for the R&R study

Replica	Operator	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
1	A	10.1	10.1	10.0	10.3	10.2	10.4	10.2	10.2	10.1	10.3
2	A	10	10.2	10.0	10.2	10.1	10.3	10.1	10.1	10	10.2
1	B	9.9	10.0	10.0	10.2	10	10.0	10.2	10.2	9.8	10.3
2	B	10	10.1	10.3	10.3	10	10.0	10.2	10.2	10	10.2

Source: Own elaboration.

The R&R analysis is carried out. The P-values for each characteristic are observed. Highlighting that the part*operator interaction has a value of 0.038 less than 0.05 to the level of significance that is margin allowed. Therefore, the interaction is significant for the R&R system and influences using the part*operator equipment when measuring a part (Table 8).

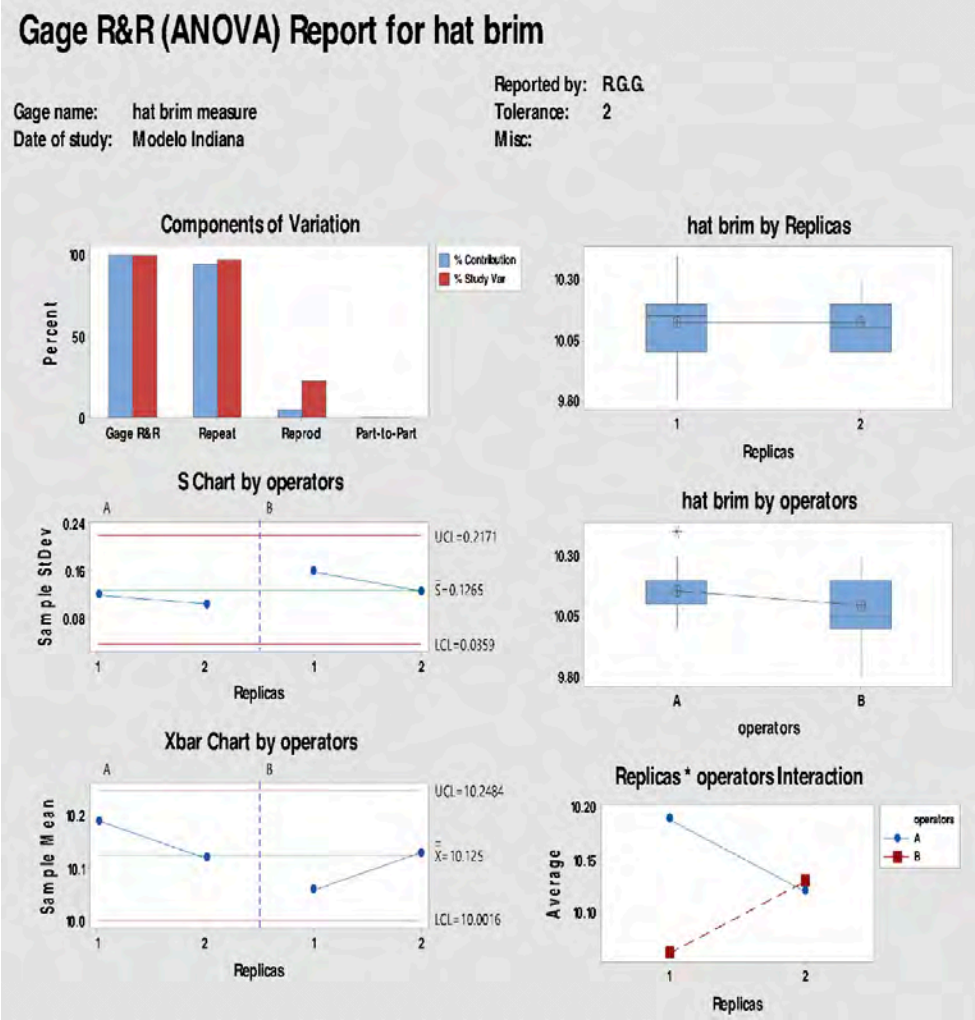
Table 8. Two-way ANOVA with interaction

Source	StdDev (SD)	Study Var (6 × SD)	%Study Var (%SV)
Total Gage R&R	0.134932	0.809594	100.00
Repeatability	0.131416	0.788498	97.39
Reproducibility	0.030602	0.183612	22.68
Operators	0.030602	0.183612	22.68
Part-To-Part	0.000000	0.000000	0.00
Total Variation	0.134932	0.809594	100.00

Source: Own elaboration.

Note: in Graph 8, attention must be paid to the P-value of the part*operator source to identify its significance with the measurement system. Within table 8, special attention should also be paid to the percentage of contribution where it is observed that the total RR is 75.48%, which is contributing to the variation of the process, and the part by part is 24.5%, which is lower and indicates that the measurement process cannot differentiate between each of the parts.

Graph 8. R&R measurement system



Source: Own elaboration.

Table 9 refers to the percentage of variation. The total RR is 86.88%, above the expected 30% of the tolerance. It is not acceptable, and the measurement system requires an improvement in terms of costs. The part to part percentage is 49.52% in an optimal case.

The part to part should be as high as possible, but the one obtained is low. It represents the ability of the measurement system to differentiate between the selected parts with the variation of the specifications having good and bad parts to understand how the measurement system works.

Table 9. Variance components

Source	VarComp	%Contribution (of VarComp)
Total Gage R&R	0.0182068	100.00
Repeatability	0.0172703	94.86
Reproducibility	0.0009365	5.14
operators	0.0009365	5.14
Part-To-Part	0.0000000	0.00
Total Variation	0.0182068	100.00

Source: Own elaboration.

In the example, it only has n = 1. The graphs 8 show how the measurement system works. In the upper left part, the variation component graph is located, where the R&R is expected to be the lowest possible and the part-to-part is higher, which does not occur in our measurement system, since the part-to-part is the lowest, the shape of the graph represents the exact shape of what happens with the R&R study.

Below is the graph R within the same Graph 8 that shows the range between the measurements per operator within the control limits, highlighting operator B, which has inconsistency when using the measurement system within this graph. The aim is to have the least possible variation since the operator's variation when repeating his measurements is observed, and operator B shows a behavior with many variations in the range of his measurements that may have problems with the measurement system.

Next, we have the Xbar graph; within this graph, it is expected that most of the points are outside the control limits indicating the variation that exists between the parts. In this case, there are no points outside the control limits, so the measurement system is not identifying the difference that exists between each of the parts, it was graphed, it is related to the result of the part by part of the various component graph because it shows much variation in the study.

On the upper right side of Graph 8, the graph of measurement by parts is observed. The differences between the parts can be seen. If the points are separated from each other, it indicates that the parts measurements present variation when measured by the operators. Below the previous graph is the graph of measurement by operator represented by the box-and-whisker plot, in which the line between operator a and operator b must be as straight as possible to ensure that the average of the measurements of the operators are the same, or are within the same range.

The median is closest to each of the operators. In this case, operator 1 has a median = 10.15 and operator 2 a median of 10.85, which gives us a line sloping towards operator B. Finally, we have the Part by Operator interaction graph that represents the reproducibility and the ability of both operators to have the measurement of each part in the same range, within which the operator B is measuring below the measurements of operator A, and this can be compared with the previous graph where the median of operator B is lower compared to operator A.

The analysis of the R&R system helps us to determine how much variation we are adding to the process when collecting data to improve it so that the data used for analysis adds value or if it is necessary to improve the way it is measured before seeking to reduce variation.

PROBABILITY PLOT

In this plot, the measurement data is analyzed to identify if the data follows a normal distribution. The graph 9 shows that the data does not follow a normal distribution, identifying points outside the confidence intervals, in the box of the Figure located in the upper right part, the value $P > 0.05$ is found, an indicator that verifies that the data follows a normal distribution. Graphic abstract.

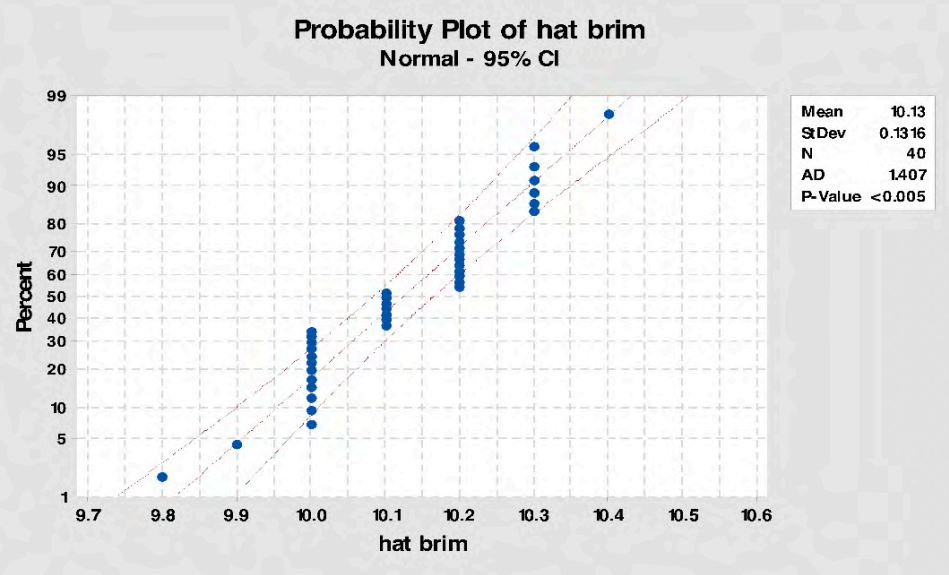
The graph 10 shows the summary results divided into four sections. Within the first session, the Anderson-Darling normality test is observed, which poses the following hypothesis test:

Ho: The data follow a specific distribution.

Ha: the data do not follow a specific distribution.

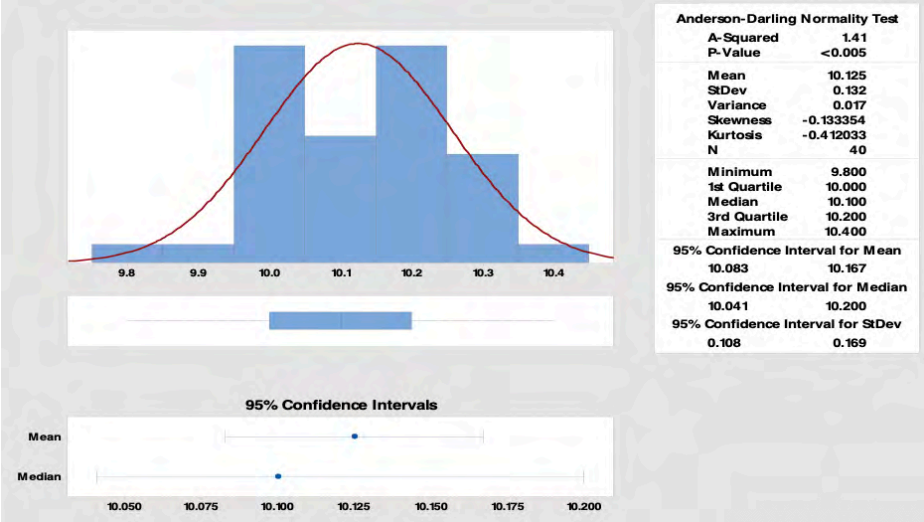
Observing the value of $P < 0.05$, Ho is rejected, and Ha is accepted because the data does not follow a normal distribution. In the second section of the data, the mean, standard deviation, and asymmetry are located, within the third section the minimum and maximum values of the data set, as well as the values between the first and third quartile, finally, within section 4 we observe the confidence intervals that are generated to the mean, median, and standard deviation. With the help of the graphs shown, it is possible to observe how the confidence interval is found (how far away) between the mean and the median. Graph 10 note: when the P-value is less than 0.05, the median confidence interval must be used.

Graph 9. Probability plot



Source: Own elaboration.

Graph 10. Graphic Summary



Source: Own elaboration.

ANALYZE THE CAUSES OF THE FAULTS DETECTED WITH THE HELP OF THE CAUSE-EFFECT DIAGRAM

The first activity carried out in the analysis stage focuses attention on the development of a brainstorming session, which allows the flow of free creative thought, providing ideas about the possible causes that affect the problem: error in the size of the wing.

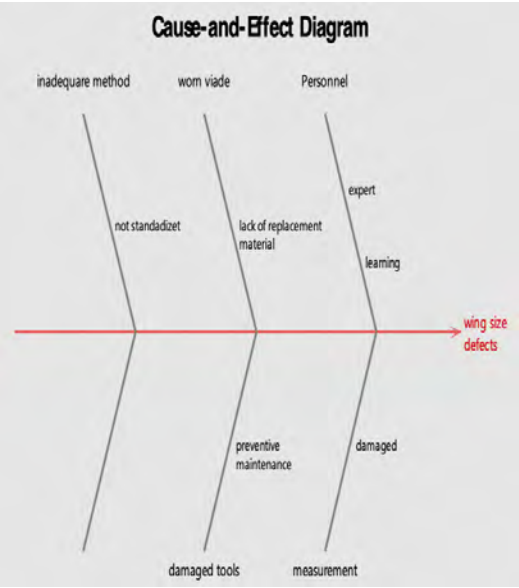
The results of the brainstorming session are presented in table 11. Grouping the causes by similarity, the idea is now presented in a cause-and-effect diagram (Ishikawa), and obtain a graphic overview that facilitates the detection of causes Graph 11.

Table 11. Result of the brainstorming session

	Evaluators				Total	Contribution percentage
	Ev 1	Ev 2	Ev 3	Ev 4		
Tool in poor condition	5	7	5	4	21	17 %
Poorly calibrated tool	8	7	5	6	26	20 %
Inexperienced operator	4	5	2	3	14	11 %
Worn cutting blade	4	5	6	4	19	15 %
Inefficient method	4	4	4	6	18	14 %
Multi-piece cuts	8	7	8	6	29	23 %
					127	100 %

Source: Own elaboration.

Figure 11. cause-effect diagram



Source: Own elaboration.

The cause-effect diagram is the method that relates the defined problem or effect with all the factors or possible causes that generate the effect under evaluation. With the help of the cause-and-effect graph in Graph 11, the potential causes that are causing errors in the wing trimming process are detected, causes related to the work method, the state of the tool used, its calibration, and the relation to the performance of the operator to carry out the process.

The diagram with the sub-causes found in each of the causes delves into the problem. In the case of labor, the effect is related to the operator's ability to perform his work. In the machinery part, identify the state in which the tool used for the process is found, as well as the maintenance it receives, in the measuring equipment if it is found in good condition, the materials involve the cutting blades for the process, if these are in good condition or there is an absence of new blades to replace one when it no longer performs an adequate cut.

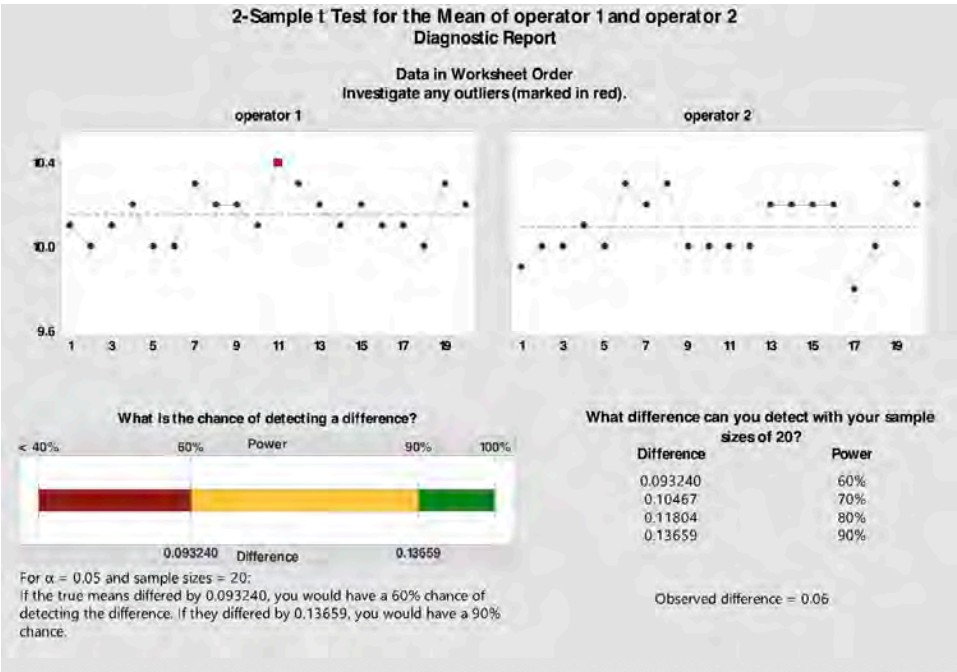
The fundamental part of the process is whether the proper way of carrying out the operation is being complied with or the process is no longer standardized. These effects have already been evaluated with the tools that have been used throughout the analysis of the process. Occupying the Ishikawa diagram in complement with the previously used tools helps not to take for granted the reasons that are believed to affect the process since the problem is evaluated from different perspectives that generate an evaluation based on reality in the behavior of the process.

2 T-TEST AND ANOVA

Next, the cause-effect diagram regarding the causes that generate the problem in the size of the wing, a 2 Sample t-test and ANOVA are carried out to evaluate the difference between the performance of measurements between the two operators in charge of the wing trimming process. As a result, there is indeed a significant difference in the performance of each of the operators.

In Graph 12 on the graph on the left side, the atypical values for operator 2 are observed. This Figure also shows the results that affirm the significant difference in the performance relationship for both operators. These results support the cause raised within the study of the cause-and-effect diagram. In which reference is made to the method, materials, labor, and tool used to carry out the trimming **process.**

Graph 12. Sample t-test diagnostic report



Source: Own elaboration.

Within table 12, operators reject or accept the null hypothesis with the complete ANOVA study's data. The P-value within table 13 again indicates that the measurements for both operators are different, indicating that the null hypothesis is rejected. Finally, in table 13, there is a summary of the factors, the sample size, and the confidence intervals for each factor.

Table 12. Summary of ANOVA

Null hypothesis	All socks are the same
Alternate hypothesis	Not all socks are the same
Significance level	$\alpha = 0.05$

Source: Own elaboration.

Table 13. Summary of the factors

Factor	N	Half	Desv.Est.	IC de 95%
operator 1	20	10.1775	0.1262	(10.1201, 10.2349)
operator 2	20	10.060	0.1273	(10.0026, 10.1174)

Source: Own elaboration.

The statistical treatments used in the phases are defined, measured and analyze. These have provided all the information related to the defect in wing size (characteristic of the product that generates rejection by customers for not complying with the measurement specification in the hats).

The capability indices obtained in the MSA analysis, the Cp, Cpk analysis, the R&R system analysis, the normality test, and the graphic summary have shown that the process is not capable of working within the established specifications and that there is significant variability in our measurement data, which reflect that behavior in each of the graphs.

The brainstorming and the Ishikawa diagram have allowed developing creative thinking and correct evaluation regarding the potential causes of the non-compliance effect with the wing size.

When performing the 2 Sample t-test and ANOVA again, it is detected that an improvement in the process responsible for carrying out the wing clipping is first needed. Because, as mentioned in the R&R analysis, the data used to evaluate the measurement system must add value.

Otherwise, the system could only worsen using data that does not present a normal distribution. The Graph 13 To demonstrates the severity of the wing size problem, which shows the sigma level of the process = 0.54, which means that 295,468 pieces per million opportunities will not be within the specification limits. The Graph presents in a general way the poor behavior that is present within the process.

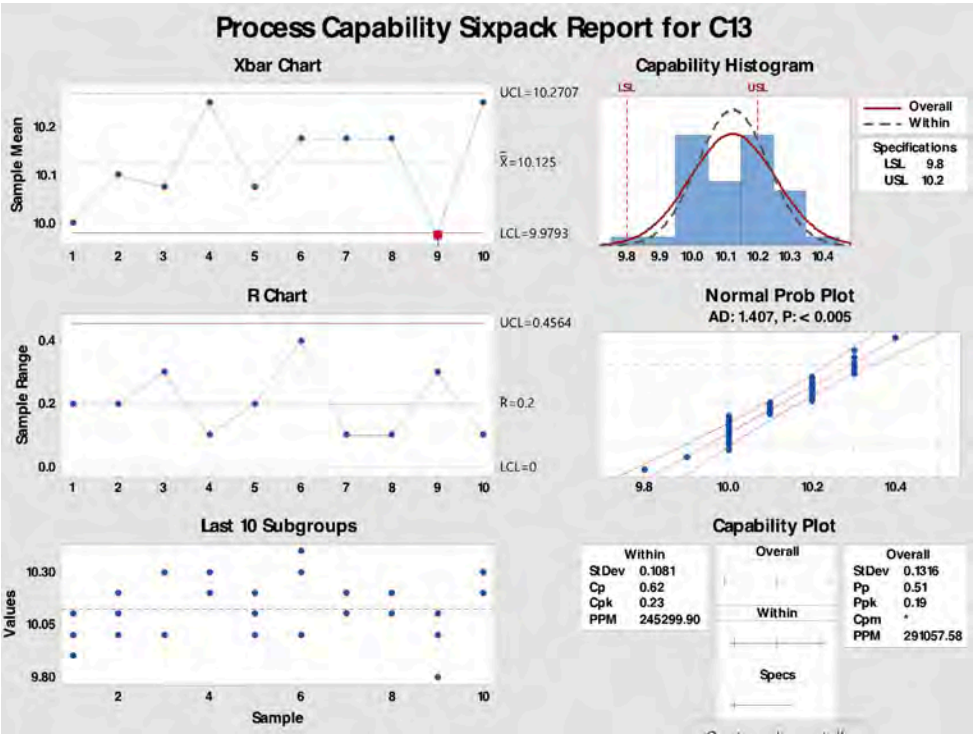
In order to meet the objective of the DMAIC methodology, attention must first be paid to the process involved that performs the clipping operation, improve the process and thus re-evaluate the measurement system. The next step is to describe the tools of lean manufacturing that will help improve the process and reduce the variability in the measurements. As mentioned in the cause-effect diagram analysis, the process can operate within specifications. Therefore, we will consider the workforce, the materials, the machinery (trimming tool), and the method.

Phase 4 improves. For this, it is necessary to determine the Lean Manufacturing tools to solve the frequent errors within the process. Three operating tools benefit the reduction of problems within the process. First, evaluating the Wing trimming that generates the defect is essential.

These three lean manufacturing operational tools are 5s, SMED, and TPM. The factors that generate the defect are the operator and the machinery (tool for the wing trimming operation). The work area and the conditions in which it is located contribute to generating errors in the operation. . It is the 5s, the essential tool that allows improving the conditions of the work environment. The first 3 S are focused on the work area, order, and cleannig the area where the operation is

carried out, and the last 2 S are focused on generating habits of responsibility and discipline in the operators.

Graph 13. SixPack of the measurement process (wing size).



Source: Own elaboration.

For this reason, it is necessary first to have a clean and organized work area with disciplined operators. For this, personnel must be trained regarding the 5s. The training process must be presented in a simply and intuitively so that the person receiving the training can correctly understand the information regarding the 5's, demonstrating through the training the benefits that will be obtained with implementing the project. This Training will take place within the branch facilities. At the end of the training, those responsible for implementing the tool must be assigned. Finally, a schedule of activities for each implementation stage must be generated.

The SMED (Single Minute Exchange of die). Matrix change in less than 10 minutes. It is used to reduce the time of changing parts. This tool provides a great advantage to reduce errors due to the size of the brim in the hat, lies in the optimization when making adjustments to the cropping tool to start making the brim cuts for the hat. It ranges from when the last good piece is removed from a wing size cutout (example: the last piece of the 9 cm wing) until the first good

piece is removed from the subsequent wing size measurement (example: the first piece good wing 10 cm,).

It includes relocating tools, calibrating tools, checking trim sheet conditions, measuring, and adjusting until the first flange measurement is correct. Work should be done to reduce the changeover time from one wing trim to another, the trimming tool calibration evaluation and the trim blade conditions assembled with the tool. Moreover, if it is necessary to replace the cutting blade, it must be done and recorded in a format, how many practical pieces could be cut with that blade and the day it is replaced.

The application of this powerful tool within the industry's improvement system seeks to reduce the preparation time of the cutting tool when it goes from one measure to another, as well as the adjustment of the measurement parameter to be able to carry out the measurement correctly.

Operation taking into account that during the time of change, the tool is adjusted to the new cut size that is requested, verify the state of the cutting blade that is assembled with the tool to avoid that during the process they start to come out hats with off-spec cutouts. It is essential to adapt this tool to the needs of the trimming process. If the tool's implementation is carried out correctly, when a study of the measurement system is carried out again, the variation between the measurements will not be as significant as that presented by the process.

The success of SMED implementation is in the form of interrelating the results of the statistical treatments carried out in the phases of DMAIC images (Pareto, MSA, Histogram, Ishikawa) to adapt the tool to the needs of the evaluated process.

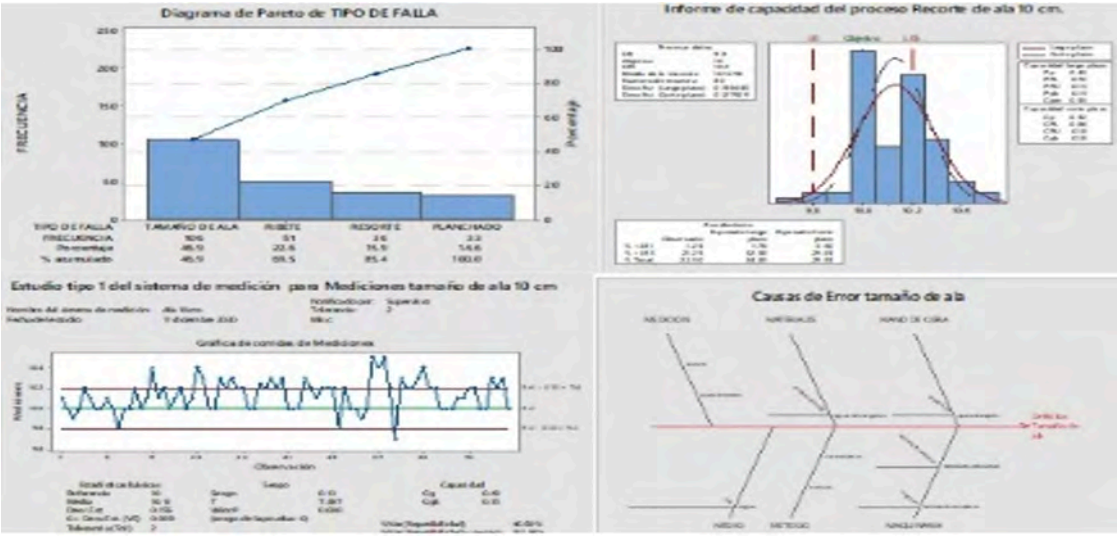
The 5s is an essential concept of organization and elimination of waste. The 5s must be applied to implement SMED correctly. Another of the tools is the TPM, whose objective within the evaluated operation is to preserve the tool used in the wing trimming process in good condition, optimizing its performance by reducing the variation in the tool.

First, it carries out the development of the TPM. Then, it is announced that the implementation will take place, followed by the education campaign not only to explain the TPM but also to break the effect of resistance to change, since the plantation does not mean an extra workload; on the contrary, it is about eliminating that extra workload that exists.

Next, it focuses on developing the TPM master plan, considering the needs evaluated in the previous stages to the process with defects. With the development of the master plan, the aim is to: Improve quality so that the tool provides low variation, Increase operation's productivity by working with a tool in good condition, and Reduce the number of defects when operating.

With the help of the three lean manufacturing tools, it is expected to have a significant impact on the improvement of the process that afflicts the finished product, improving the performance and efficiency of the operator and the correct use of the work tool, so that in this way it reduces the variability within the operation and the process becomes a process capable of meeting specifications.

Graph 14. Example of the statistical treatments carried out



Source: Own elaboration.

Control phase

Develop control formats to create a recorded history for future failures. The formats that were designed according to the needs of the improvement project, which include formats to collect data to evaluate the measurement system based on the DMAIC methodology and lean manufacturing, as mentioned at the beginning of the project, are in a transformation process to improve its processes. The products quality (for this reason, each of the formats is developed) to collect data of variables and consider the processes that can provide attribute type values.

CONCLUSIONS

The DMAIC methodology, Six sigma, and Lean Manufacturing are tools of the automotive industry; however, the adaptation to the artisan industry of the hat helps to contain the problem, improve quality, improve customer service, reduce waste, and increase productivity.

The Pareto diagram helps to productivity (Varzakas & Arvanitoyannis, 2007; Zasadzień, 2014). It helps to discover the problem with the most

remarkable occurrence. It contributes to afflicts the process and generates the evaluated defect. The analysis of the measurement system and process capacity and R&R evidenced the current state of the process, the conditions the process operated, and how the limits can be further defined to find the leading cause that generates the defect (Varzakas & Arvanitoyannis, 2007).

With the help of brainstorming and the cause-effect diagram, a visual scheme was used when evaluating the potential causes that gave rise to the defect, developing an environment of creative, critical thinking, and evaluation (Romeu, 2007).

The statistical treatment and the cause-effect diagram provided the necessary information on the potential causes. These demonstrated what could be the lean manufacturing tools to solve the problems. The result obtained using the 5s, the SMED, and TPM, was also positive. These three tools reduce the problems generated within the process.

For example, the SMED is a tool closely related to the statistical treatments of the DMAIC methodology. Finally, it can be mentioned that the adaptation of the DMAIC tool is highly recommended for process improvement. DMAIC helps keep the studied sector in the globalized market. The evidence it presents is fair and impartial based on facts and not assumptions.

RECOMMENDATIONS

1. It is necessary to hold monthly meetings in which the results obtained with the application of the improvement system are presented, evaluated, and determine if adjustments are necessary or if additional training is necessary to help improve even more results.

2. Correctly use the formats designed to record the behavior of the process, notify the supervisors of each process of the records, and likewise carry out a constant analysis of the statistical behavior that the activities present, since, if any behavior occurs, abnormal, it must be taken care of before the product is defective and generates problems of rejection by customers.

REFERENCES

Brusco, S., & Sabel, C. (1981). Artisan production and economic growth. *The dynamics of labour market segmentation*, 99-114.

Chouiraf, F., & Chafi, A. (2018, April). Lean manufacturing for handicraft production: A new production system to enhance productivity and competitiveness of craft enterprise. In *2018 4th International Conference on Optimization and Applications (ICOA)* (pp. 1-6). IEEE.

De Mast, J., & Lokkerbol, J. (2012). An analysis of the Six Sigma DMAIC method from the perspective of problem solving. *International Journal of Production Economics, 139*(2), 604-614.

Edge, J. (2019). *Lean Seis Sigma.* México: Mac Graw Hill.

Girmanová, L., Šolc, M., Kliment, J., Divoková, A., & Mikloš, V. (2017). Application of Six Sigma using DMAIC methodology in the process of product quality control in metallurgical operation. *Acta technologica agriculturae, 20*(4), 104-109.

Gutiérrez, H. (2010). *Calidad y productividad.* México: Mc Graw Hill.

Ibarra, V. M., & Ballesteros, L. L. (2017). Lean Manufacturing. *Conciencia Tecnológica* , 53.

Idole, J. C. (2013). *Lean Manufacturing concepto, técnicas e implementación.* Madrid, España: Creative Commons.

Juran, J. M. (1999). How to think about quality. JM Juran, AB Godfrey, RE Hoogstoel, and EG, Schilling (Eds.): *Quality-Control Handbook*. New York: McGraw-Hill.

Krishnan, B. R., & Prasath, K. A. (2013). Six Sigma concept and DMAIC implementation. *International Journal of Business, Management & Research* (IJBMR), 3(2), 111-114.

Mongomery, D. C. (2013). *Introduction To Statical Quality Control.* United States Of America: John Wiley & Sons. INC.

Navarro, E., Gisbert, V., & Pérez, A. I. (2017). Methodology and Implementation of Six Sigma. *3 C Empresa*, 73-80.

Niebel, B., & Freivalds, A. (2010). *Ingeniería Industrial Métodos, estandares y diseño del trabajo* . Ciudad de México: Mac Graw Hill.

Prashar, A. (2014). Adoption of Six Sigma DMAIC to reduce cost of poor quality. *International Journal of Productivity and Performance Management.*

Pérez, I. G., Marmolejo, N., Mejía, A. M., Caro, M., & Rojas, J. A. (2016). Mejoramiento mediante herramientas de la manufactura esbelta, en una Empresa de confecciones. *Ingeniería Industrial*, 24-35.

Romeu, J. L. (2007). A Six Sigma Analysis of a Cuban Transition. In Annual Proceedings (Vol. 17). The Association for the Study of the Cuban Economy.

Scrase, T. J. (2003). Precarious production: Globalisation and artisan labour in the Third World. *Third World Quarterly, 24*(3), 449-461.

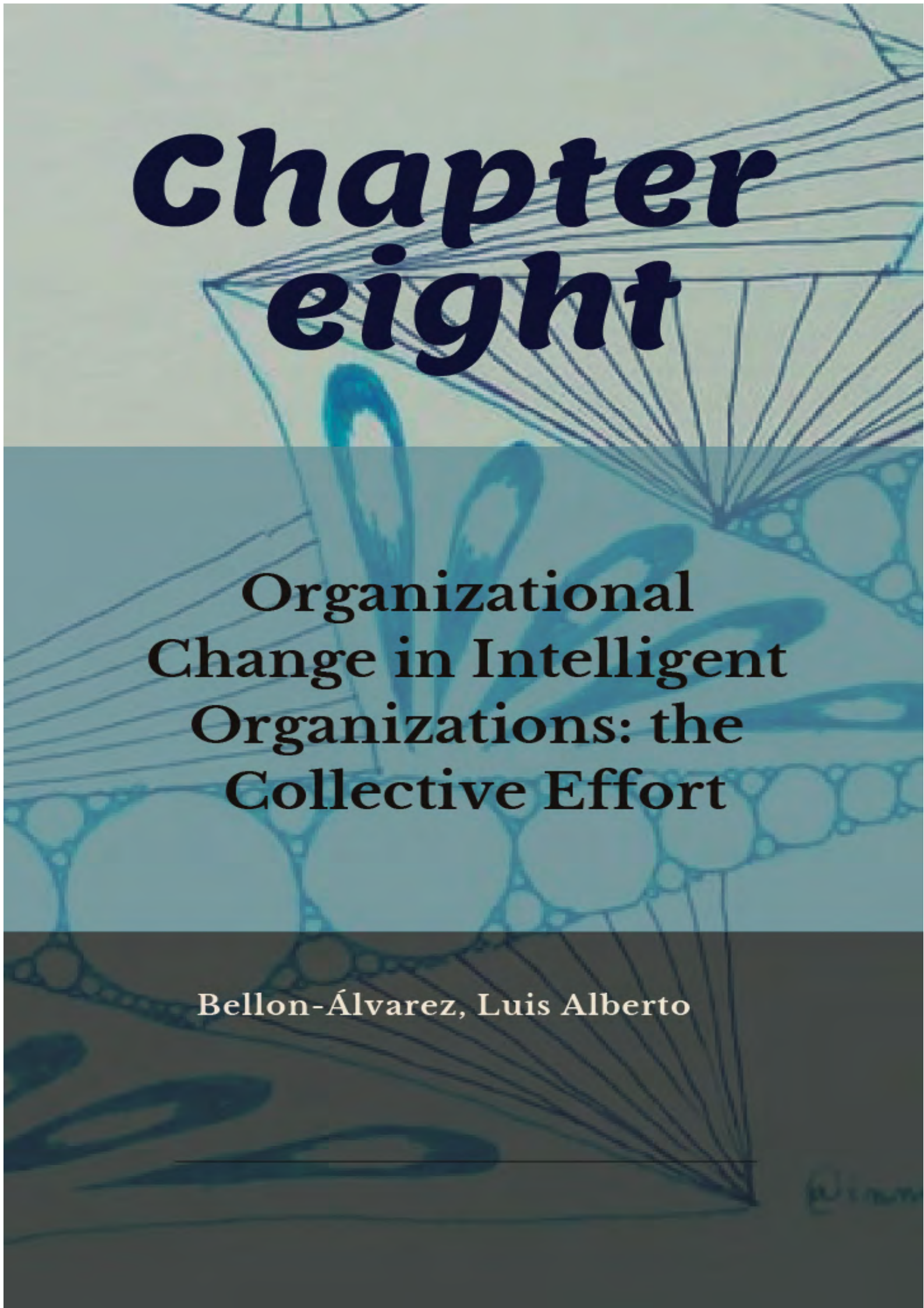
SIGconsulting. (junio de 2018). Recuperado el 12 de DICIEMBRE de 2020

Solís-Quinteros, M. M., Zayas-Márquez, C., Ávila-López, L. A., & Carrillo-Gutirrez, T. (2021). Lean Manufacturing as a Strategy for Continuous Improvement in Organizations. In *Lean Manufacturing*. IntechOpen.

Vara, H. G. (2009). *Control estadístico de la calidad y seis sigma.* México: Mac Graw Hill.

Varzakas, T. H., & Arvanitoyannis, I. S. (2007). Application of Failure Mode and Effect Analysis (FMEA), cause and effect analysis, and Pareto diagram in conjunction with HACCP to a corn curl manufacturing plant. *Critical reviews in food science and nutrition*, 47(4), 363-387.

Zasadzień, M. (2014). Using the Pareto diagram and FMEA (Failure Mode and Effects Analysis) to identify key defects in a product. *Management Systems in Production Engineering*, *4* (16), 153-156.



Chapter eight

Organizational Change in Intelligent Organizations: the Collective Effort

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Organizational Change in Intelligent Organizations: the Collective Effort

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Introduction

Humanity since its origins has been characterized by being in permanent evolution, which is why the world is also well-known for being in a continuous change process; although certainly in recent decades, we have witnessed how these changes that have been happening in society are progressively more vertiginous.

This phenomenon also affects the business world, so companies must also be prepared for such changes and have the ability to adapt to them. Above all, because the markets around the world are characterized by being increasingly competitive, firms to be successful and stand out in these markets must have the ability to adjust to the changes in the markets.

That is why the managers of every organization have a central role in the companies they lead since they are the ones who define the way to follow, that is why they must be able to have a clear future vision of what they want their company to be and the path to follow to achieve it.

For all this, the study of the process of organizational change in corporations is of great importance, since this allows knowing what factors influence the process of change, as well as knowing the obstacles that have to be resolved to achieve it, such as among other things, resistance to change, which is a widespread phenomenon that occurs among company personnel.

The point of view of the Organizational Intelligence study perspective reveals that changes are a kind of mutation that the company presents, and intelligent organization helps its people adapt to change, thanks to the fact that they can react more quickly to them, and in this way, they can anticipate those

changes. Thus, the knowledge base of companies is becoming a fundamental aspect for companies in today's business world.

THEORETICAL FRAMEWORK

The procedure by which any process of organizational change is established turns out to be quite complicated since business firms need to face a variety of obstacles of different kinds that hinder or make their implementation impossible.

Therefore, carrying out an analysis of organizational change is of the utmost importance. Furthermore, companies are in an incessant metamorphosis; therefore essential to understanding as well as possible how companies change and the reasons why these changes are consumed or not.

How an organizational change is carried out implies a much work since any change must face a series of problems that make its implementation difficult. Therefore, the importance of conducting this type of research. Furthermore, just as the world is constantly changing, companies are also changing for the aforementioned reasons. Consequently, it is necessary to understand how companies change and why these changes.

Organizational intelligence is described as the ability of organizations to carry out their daily activities and make decisions about unexpected conditions in a global environment characterized by change and dynamism. So, the companies that can resort to this are intelligent organizations.

Among the writers who study the organizational change from the study perspective of Organizational Intelligence are Senge (2006), Keskin and Balak (2020), Van Knippenberg, Dahlander, Haas and George (2015), Jarrahhi (2018), Ansari, Hold and Khobreh (2020), Rahdarpour and Sheykhi (2016), Al Shobaki, Abu Naser, Abu Auna and El Talla (2018), Schafer (2009), Holba, Bahr, Birx and Fischler (2019); that were examined in this document.

Organizational intelligence refers to the source of market advantage, which can be developed by the organization but cannot be successfully copied by others. This resource provides the following opportunity: for the company to develop, at the same time as the market develops, to predict the change and development of the market, and achieve a competitive advantage in the market.

Organizational intelligence includes a capability within the back end of an organizational system. For Kahkha, Purghaz and Marziyeh (2015), organizational intelligence is a combination of human intelligence and artificial intelligence that allows an organization to perform related tasks make important and rational decisions, which improve the performance and efficiency of the organization. While for Tang & Sivaramakrishnan (2003), organizational intelligence is defined as the mental strength to respond effectively to environmental issues.

It should be noted that organizational learning is a fundamental component of organizational intelligence. The organizational intelligence of an organization is based on the ability of that organization to learn and adapt (Gonzalez & Gonzalez, 2019). However, even if organizations can learn and adapt, this does not guarantee an increase in organizational intelligence. Organizational intelligence implies the interaction and harmony between the intelligence of the company members and the organization's technological infrastructure (Neyisçi & Erçetin, 2020).

The factor that facilitates people's activities within the organization is all their brainpower. In this way, organizational intelligence refers to the ability of a company to mobilize all the brainpower (Mahmoudi & Asgari, 2013). Therefore, the point of origin for organizations that want to capture change was intelligence, so the creation of intelligent organizations based on the characteristics of intelligent individuals has come on the agenda.

According to Karl Albrecht (2002), a company's success requires intelligent people, competent teams and innovative organizations. Albrecht also recommends organizational intelligence to prevent the group from slipping. Intelligent tools and intelligent human resources play an essential role in business performance. Therefore, the decision-makers in organizations use mechanisms that strengthen organizational intelligence today (Mahmoudi & Asgari, 2013).

Thus, organizational intelligence is an organizational capability that supports strategic decision-making. Intelligence and intelligent behavior are essential to business success in today's competitive world. Being thoughtful requires making the best strategic decisions for an organization, and intelligent behavior requires implementing these strategic decisions.

Therefore, intelligent organizational behavior removes all the complexities, competitive pressures, and inability to respond to environmental impacts that endanger the survival of an organization (Pazireh, Rahimi, Irani, & Bohlouli, 2019). The use of the concept "intelligent" in organizations gives them a competitive advantage, mainly because of the flexible and competitive circumstances that create the conditions they have and express their point of technological power (Kirn, 1995).

The concept of intelligent organization emerged in response to increasing environmental change, resulting from the rapid response of organizations to the changing digital economy. Keskin and Balak (2020) mention that innovative organizations can quickly adapt to the environment to face challenges.

In turn, Schafer (2009) stated that an intelligent organization must have three qualities. It is about having a clear strategic vision, a culture of merit that respects the idea of each person, and incentive programs that support them

(vision and culture). Schafer points out that these three qualities are necessary but not sufficient to create an intelligent organization. High organizational intelligence emerges when the right people to do the job gather around these three qualities (Schafer, 2009).

An intelligent organization is Internet-based and information-oriented, and can quickly adapt to new organizational challenges. The three dimensions of intelligent organizations, effective virtuality in information and communication technology, the ability to create organizational teams and bridge information, complexity, and rapid economic evolution confer their solution to environments (Filos, 2008).

So leadership into the intelligent organization must be thoughtful, in the sense that the organization's mood is understood, and silent signs of change are also detected. It requires foresight and sensitivity for leaders and managers to show a new kind of understanding.

This sensitivity does not simply equate to the difficulties associated with decision making but rather the environment in which leaders and managers recognize changing contexts and changes in operating environments and the leadership style required in different contextual settings. So it is observed that innovative organizations work constantly and develop the ability to adapt to unpredictable environments.

Embracing uncertainty in innovative organizations requires awareness that the future is full of uncertainties. Members of an intelligent organization also know how to deal with uncertainty and integrate it into reasoning processes. Therefore, uncertainty in an intelligent organization is understood, transmitted, and managed. (Matheson & Matheson, 2001).

The characteristics of intelligent organizations that Matheson and Matheson (2001) included in their work and that innovative organization must-have. They are collected into three main themes: goal achievement, understanding the external environment, and resource mobilization.

Achieving the goal is the culture of creation; generating is mainly that an intelligent organization needs to know the reason for its existence. The intelligent organization demands the proactive creation of new alternatives and does not take strategic measures before creating and converting multiple alternatives (Matheson & Matheson, 2001).

In Matheson & Matheson (2001), it is observed that implementing the principles of organizational intelligence correlates positively with business performance; and that intelligent organizations do not have the same level of intelligence that they observe works best. In this regard, Keskin & Balak (2019) point out that the intelligence levels of organizations are increasingly complex,

and the multidimensional structure and the presence of intellectual power capacity are increasing.

The future will increasingly belong to innovative organizations because it requires adapting capabilities to a constantly changing business environment. Increased competition, increased threats from new entrants, and substitute products; organize their organizational intelligence as an integral result of processing the intelligence of all the people who lead development (Bratianu et al., 2006).

The essential member characteristic of intelligent organizations are related to the interaction of the members involved in the field. Therefore, organizational intelligence needs to be examined as a more systematic force that organization members create together rather than the sum of their intelligence (Neyişçi & Erçetin, 2020).

Consequently, information and communication technologies are an influential factor in organizational exchange and innovation, and the effects of all this on the industrial exchange chain. Therefore, it is crucial to understand innovative organizations and the elements that contribute to them. Therefore, considering organizations' social and complex aspects, empirical studies examining the relationship between organizational intelligence and intelligent organizations in different industries and examples, will contribute to a good understanding.

To summarize, according to researchers of the study perspective of organizational intelligence, changes should be made in the company's management and its organizational systems only when necessary. They also point out that companies have to evolve until they reinvent themselves, which implies that what already exists is not modified, but instead that something new has to be created, which does not exist.

Therefore, managers must also reinvent themselves and their companies, developing a new environment that guides its members to accept a new future that was not supposed to be possible. In turn, according to the point of view of the organizational intelligence perspective, the ability to change is not bought.

The company must learn it on its own (Gonzalez & Gonzalez, 2019). The company's employees are the ones who create and change the company through the learning that is achieved when a change process is carried out that follows the perspective of organizational intelligence, which begins with its executives, who have a transcendental role in the said process of change in the company.

METHODOLOGY

In order to carry out the present study work, three phases had to be carried out: 1) a theoretic one, where the theoretical part of the topic is examined; 2) A

bibliometric study on the relationship between organizational change and organizational intelligence.; 3) An empirical analysis was carried out. As part of the empirical analysis, a compilation of the information obtained in this research project was made, for which a questionnaire was designed, which was made up of a series of closed questions, which covered the response alternatives to each questioning, being that questionnaire the research instrument used for this investigation.

This research was carried out using the method of bibliometric analysis, which consists of examining the semantic content of the bibliography of the topic to be studied in order to be able to make inferences from the coincidences in text bodies, keywords, authors, or the entire document in general, among others (van Raan, 2019).

According to Kulkarni et al. (2009) and Bar-Ilan (2008), to the application of the bibliometric analysis, the Scopus academic database, is one of the most used databases to carry out bibliometric analyzes (Olczyk, 2016); it allowed in this research to identify the most critical topics in the works found in that academic database, which was consulted.

To perform the search in the Scopus academic repository, the keywords used were: "organizational change" and "organizational intelligence". Therefore, to search the database, a search was refined using different criteria.

The search was done in all the fields of the publications. In this way, the following criteria were used for the general search: "Organizational Change" and "Organizational Intelligence" to provide a framework on the existing state at the time of the present investigation on the work approaches those topics. The VosViewer software also showed the maps with the connections between the publications found.

Unit of Analysis

Within the present study project, business organizations with the characteristics of being: 1) MSMEs were investigated. (1 to 250 employees). 2) Entities of the commercial sector and 3) Located in the Metropolitan Area of Guadalajara (Guadalajara, Zapopan, San Pedro Tlaquepaque, and Tonalá).

Sample

For this research, a non-probabilistic sampling was used, for which the questionnaire was administered as a research tool to 78 individuals who are part of the workforce of 78 Small and medium-sized firms in the commercial sector, who had an organizational change procedure.

Operationalization of Variables

Within the present investigation carried out, the variables were operationalized using graduated questions on the Likert Scale, which uses statements that indicate the attitude, positive or negative, concerning each

question. Furthermore, for the study, the people surveyed were asked to externalize their level of agreement or disagreement on each statement to establish how favorable or unfavorable their point of view is on the issues that were the object of study.

Problem Statement

This research aims to determine the effects and factors inherent to organizational intelligence, which influence the process of implementing an Organizational Change in commercial organizations installed in the AMG, whether they favor or hinder the said process. Therefore, for this project, the research questions formulated are:

What factors related to organizational intelligence intervened in an organizational change in commercial companies of the AMG?

What effects does organizational intelligence have on organizational change in commercial companies of the AMG?

Research objectives

To determine what factors inherent to organizational intelligence intervened in an Organizational Change in commercial companies of the AMG.

To find the effects of organizational intelligence on Organizational Change in commercial companies of the AMG.

Hypothesis

H1: Organizational intelligence contributes to implementing a process of organizational change in commercial companies of the AMG.

H2: The company's knowledge base favors organizational change through organizational intelligence in commercial companies of the AMG.

H3: Employee education helps to carry out an organizational change process in commercial companies of the AMG

Collection and processing of information

For this work, the investigation tool used was a questionnaire carried out according to the information obtained in the bibliography consulted. It was intended to determine which aspects associated of organizational intelligence influenced an organizational change in commercial companies. Therefore, a questionnaire of structured questions makes it possible to find those factors. Once the information was obtained, the results were examined and classified.

Cronbach's Alpha was used to verify the consistency and reliability of the research instrument. The KMO Sampling Adequacy Measure and the Bartlett Test were also obtained to determine that the variables are linked and viable to perform factor analysis.

For the empirical study of this research that aims to establish how organizational intelligence intervenes in an organizational change, the degree of significance of the ANOVA (analysis of variance) was determined, by linking

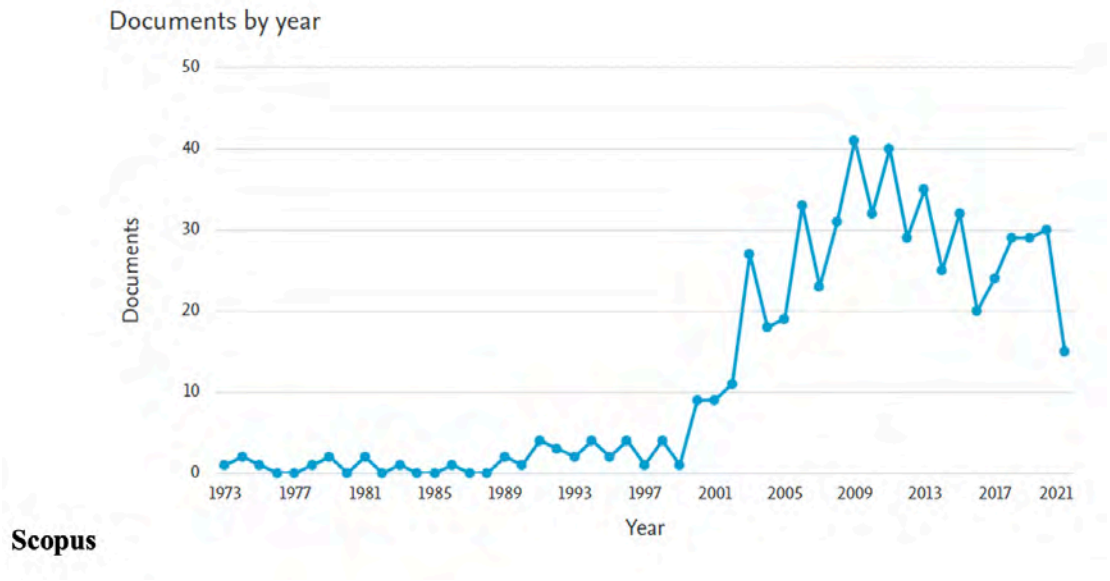
variables concerning organizational intelligence, with the effects that they could have in an organizational change, and with specific factors that contribute or obstruct the execution of a change of organizational culture.

Results and Discussion

The Scopus academic repository shows as of July 9, 2021, a total of 600 scientific documents (333 articles, 53 book chapters, 37 conference documents, 90 books, and 37 reviews) that have the terms of the topics under study, either in the title, the abstract or as a keyword, or in some other part of the document.

In addition, the Scopus database offers the possibility of downloading the bibliographic records of the patterns analyzed in various formats, which offer the possibility of carrying out an analysis on different platforms. The VOSviewer software was used for the information analysis, allowing visualizing the co-occurrence networks of the information obtained from the bibliographic records. (van Eck & Waltman, 2010).

Figure 1. Scientific production on Organizational Change and Organizational Intelligence in Scopus



Source: Own elaboration based on Scopus statistics.

With the relationship between organizational change and organizational intelligence, there are six hundred documents in the Scopus database with production from 1973 to 2021. As shown in figure 1, a significant increase in the publication of articles in the year 2003, having an increase in the year 2006,

reached its maximum point in 2009, although it had a significant reduction in 2016.

On the other hand, the main articles, taking the number of times, were cited as a reference for said classification. The article with the most citations is "Introduction: Epistemic communities and international policy coordination" which has 4014 citations and was published by the International Organization magazine in 1992, by Haas, who states, based on his analysis, that control over knowledge and information is an essential dimension of power and that the spread of new ideas and data can lead to new patterns of behavior.

The second most cited article is: "Reconceptualizing organizational routines as a source of flexibility and change", with 1886 citations, by Feldman and Pentland, published in 2003 in the Administrative Science Quarterly, points out that the variation, selection and retention of new practices and action patterns within routines allows them to generate a wide range of results, from an apparent stability up to a considerable change. It has implications for a wide range of organizational theories.

The third most cited article with 1014 citations is by Leidner and Kayworth, published in 2006 in the journal MIS Quarterly: Management Information Systems, and entitled "Review: A review of culture in information systems research: Toward a theory of information technology culture conflict" it indicates that understanding of culture is essential to the study of information technology in that culture at various levels, including national, organizational, and group, and can influence the successful implementation and use of information technology. They develop propositions about three types of cultural conflict and its outcomes. Finally, they suggest that the reconciliation of these conflicts results in a reorientation of values (table 1).

Table 1. Most cited articles on organizational change and organizational intelligence in Scopus

Author	Article title	Year	Number of citations
P.M. Haas	Introduction: Epistemic communities and international policy coordination	1992	4014
M.S. Feldman & B.T. Pentland	Reconceptualizing organizational routines as a source of flexibility and change	2003	1886
D.E. Leidner & T. Kayworth	Review: A review of culture in information systems research: Toward a theory of information technology culture conflict	2006	1014

Source: Own elaboration based on Scopus statistics.

For this project, it was decided to generate bibliometric maps based on co-occurrences, which are determined according to the number of times the keywords appear in the documents that were downloaded from the search made in the Scopus database and said data was used to create a network.

The indexed keywords were chosen when running the VOSviewer program; these keywords are automatically selected. It is worth mentioning that it is preferable to use this kind of keywords since in this way there is a clearer and complete of how is the dynamics that occurs in the field of study that is being analyzed since in this way they are not limited only to the keywords indicated by the author.

For this research, it was determined to carry out an analysis and counting procedure of co-occurrences based on the indexed keywords, choosing a minimum number of co-occurrences in the keywords ≥5, the choice of this threshold was determined taking into account that the result of co-occurrences was 1870 keywords, so if a lower threshold was chosen, the map would have too many matches, which would prevent an adequate analysis, since the labels would overlap with each other.

Table 2. Relationship of keywords by the importance of appearances and link strength

Keyword	Occurrences	Total Link Strength
Knowledge management	63	153
Organizational learning	46	101
Innovation	47	92
Societies and institutions	19	67
Organizational intelligence	23	53
Competition	11	44
Organizational change	25	44
Organizational cultures	8	44
Industrial management	10	41
Organization	12	35
Competitive advantage	9	33
Leadership	18	32
Organizational structures	9	32
Article	9	31
Project management	9	29
Surveys	6	29
Design/methodology/approach	7	27
Human	9	27
Organizational structure	8	26
Research	10	26

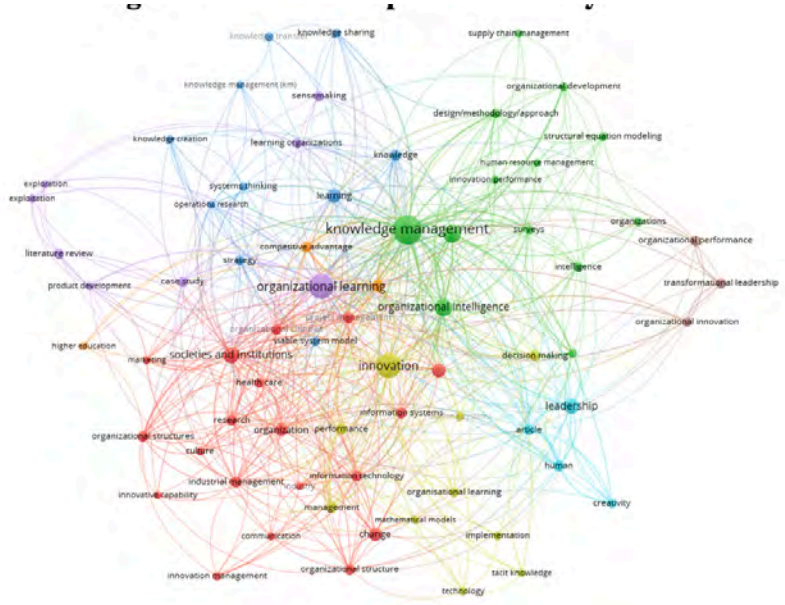
Source: Own elaboration based on VOSviewer

In figure 2, the keywords with the highest co-occurrence are observed since the VOSviewer highlights them with a larger label than the others. In this case, those that stand out the most are: "knowledge management", “organizational learning”, and “innovation”, which are strongly related to the keywords used for this research. In this manner, the map shows how the words are grouped and which cluster they belong to, which are indicated with colors.

In contrast, the overlay visualization map illustrates which subjects have been worked on over time and specifies which ones continue current. The years are represented by diverse colors. The themes that have been investigated in the

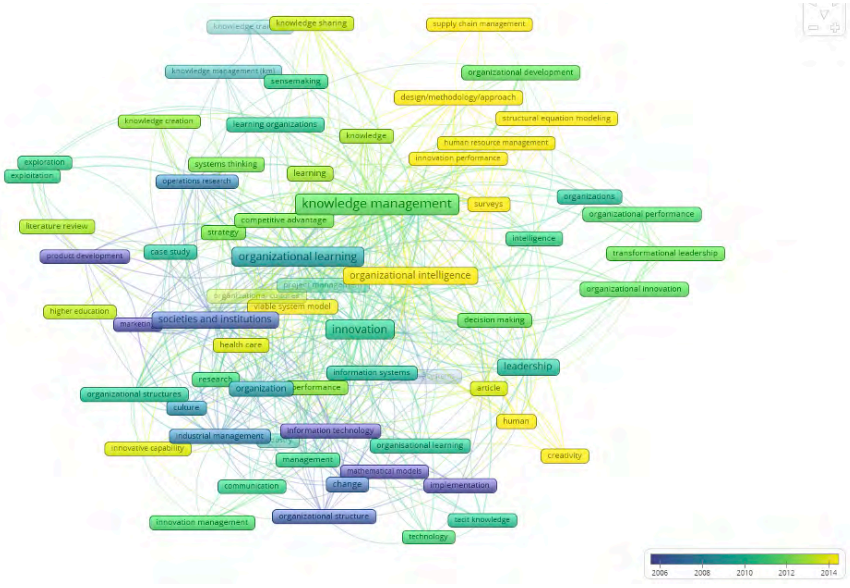
last 5 to 8 years appear in red, orange, and yellow, while the subjects with more than ten years are presented in green and blue (Fergnani, 2019).

Figure 2. Network map of indexed keywords



Source: VOSviewer 2020 software

Figure 3. Overlay visualization Map by Keywords



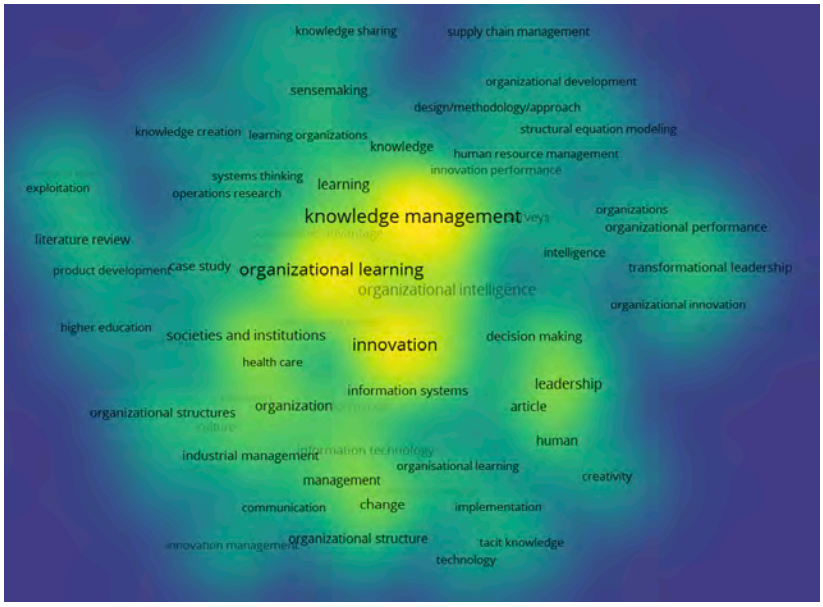
Source: VOSviewer 2020 software.

Figure 3 again demonstrates the keyword network; but, in this case, with a timeline view that reveals how the study of organizational change and organizational intelligence has advanced, the data found from the Scopus database indicate research results between 2006 and 2014.

Some of the study topics shown in figure 3 that are trending in contemporary years are organizational intelligence, human creativity, surveys, human resource management, supply chain management, innovation performance, structural equation models, design/methodology/approach, among others. For its part, change is a topic that has been studied for a long time but is still being studied nowadays.

In the density map, the VOSviewer software illustrates the intensity of work that each one of the keywords has according to the number of times they appeared in the documents consulted. The colors show which are the most mentioned keywords; red shows those with the highest intensity and blue those with the smallest amount of research; revealing the information in this way allows us to clearly appreciate which are the most important issues on the map (Fergnani, 2019; Van Eck & Waltman, 2010).

Figure 4. Density Map by Keywords.



Source: VOSviewer 2020 software.

Figure 4 shows the density map of the keywords that are most relevant based on the number of publications in which they appear, in which, as in the network visualization map, it can be seen that the most relevant are knowledge

management innovation, then comes organizational learning, followed by the word organizational change and organizational intelligence.

Clusters

The VOSviewer software also classifies the groups of keywords shown in the bibliometric maps and calls them a cluster; in figure 2: "Network map of indexed keywords", the clusters are shown with different colors, since each group of keywords that make up a cluster, the software assigns them a color. A group or cluster is a series of elements that belong to a map and whose feature is that they cannot be part of different clusters at the same time, the keywords that exist in a cluster determine that it is an attribute, and these are enumerated according to the clusters that emerge from the density map. (Van Eck & Waltman, 2018).

The clusters are concentrated in such a way that the keywords that include them are more likely to cite them in the same document or article; since the different clusters are identified, the line of study that they follow is determined according to the keywords that they integrate it because these can be interpreted as macro-areas of research, which is why they are named according to the field of study to which the most important keywords within the group correspond. (Skute et al., 2019).

In this way, the clusters were generated according to the results of the Scopus database and were processed in the VOSviewer program; the search words used being: "organizational change" AND "organizational intelligence", the Bibliometric map created 8 clusters, which serve as a guideline to know how the research object proposed for this research work is studied.

Cluster 1. This cluster has 19 items where the indexed keywords with the greatest weight were: change, industrial administration, innovative capacity, innovation management, organizational culture, organizational structure. So it can be determined that this line of research focuses on studying organizational culture.

Cluster 2. The works of this cluster have 13 items where the most relevant indexed keywords were: organizational change, organizational development, organizational intelligence, knowledge management, human resources management; the trends being investigated in this cluster are related to organizational change and organizational intelligence.

Cluster 3. This cluster has ten items of which the indexed keywords are: knowledge, knowledge management, knowledge creation, knowledge sharing, knowledge transfer. This cluster focuses on studying knowledge management.

Cluster 4. This cluster has ten items, and the most important indexed keywords are decision making, implementation, innovation, management,

organizational learning, learning systems, performance. This cluster is oriented to study business administration.

Cluster 5. In this cluster, there are eight items, the indexed keywords being: learning organizations, organizational learning, product development, exploration. This cluster studies learning organizations.

Cluster 6. In this cluster, there are four items; the indexed keywords are article, creativity, human, leadership. This cluster studies leaders in organizations.

Cluster 7. This cluster contains three items, the indexed keywords being: competition, competitive advantage, leadership. This cluster focuses on studying competitiveness.

Cluster 8. In this cluster, there are three items, and the indexed keywords are organizational innovation, organizational performance, transformational leadership. This cluster analyzes organizational performance.

Field Research Results and Conclusions

As part of this research work, a study of organizational intelligence was made as a current study that examines the process of organizational change; and within the research instrument that was used, certain questions that analyze the organizational change from the perspective of organizational intelligence were considered in that questionnaire.

This study was carried out through personal surveys with employees who participated in the process of organizational change in the companies considered; they were administered the questionnaire that was made for this work and that was used to study the exposed hypotheses. Therefore, for the study, certain questions related to the perspective of organizational intelligence were considered. Additionally, Cronbach's Alpha was determined, as well as the Bartlett Test and the KMO.

According to the statistical result of reliability, Cronbach's Alpha turns out to be highly consistent, 83.8% of reliability, because it is close to number 1, in addition to the fact that the variables of the instrument were applied consistently, that is, that the general trends and correlations can be explained. In-depth through multivariate analysis, for which it is necessary to understand the level of adjustment between the groups following a KMO factorial analysis and Bartlett's test.

Table 3. Cronbach's Alpha of the Organizational Intelligence variables. Reliability statistics

Cronbach's Alpha	Number of elements
.838	16

Source: Own elaboration based on the results of SPSS.

Table 4. KMO and Bartlett's test

Kaiser-Meyer-Olkin measure of sample adequacy.		.718
Bartlett's Sphericity Test	Approximate Chi-Square	358.430
	gl	120
	Sig.	.000

Source: Own elaboration based on the results of SPSS.

If. Sig. (p-value) <0.005 H0 is accepted (null hypothesis) > factorial analysis can be used.

If. Sig. (p-value) > 0.005 H0 is rejected > factorial analysis cannot be used.

The results indicate that the level of significance obtained when being zero is representative since the closer it is to zero, the more satisfactory the test will be.

Table 5. Communalities

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Benchmarking intensity	850					
Benchmarking Frequency	831					
Intensity of Education in the employees		775				
Shared Vision Frequency		710				
Shared Vision Intensity			687			
Frequency of Education in employees			685			
Team Learning Frequency			684			
The staff has access to all the information they need to do their job of the change			663			
Team Learning Intensity			661			
The organization is becoming more aware of its knowledge base			653			
The change followed a learning orientation instead of handing it over to an authoritarian leader			652			
Learning organizations were an important factor in effecting culture change			631			
Change in the company is the result of organizational learning				564		
As a result of the change, the employees developed new skills and abilities				551		
This company is a smart organization				523		
There is a learning approach within the organization					422	

Source: Own elaboration based on the results of SPSS

The most significant variables are the Benchmarking Intensity, followed by its frequency, which indicates that Benchmarking significantly benefits an

organizational change process that is carried out through organizational intelligence. The frequency and intensity of the Shared Vision, on the other hand, are also significant variables with respect to organizational intelligence since both staff and managers are required to have the same focus in the process of change in companies.

The interviewees were asked if they think that their company is an intelligent organization with a focus on learning in order to determine if this was a determining factor when deciding that the company made the organizational change.

This when considering that due to the changes that have occurred in society, culture, technology, and international markets, they have been aspects that have served to generate innovative ways of operating a company, due to the growing importance of the fact that companies constantly increase their knowledge base, since this contributes significantly to managers being able to make better decisions.

Additionally, the interviewees were also asked if the knowledge base of the organization was a factor that influenced the decision to make a change in their organizations and to what extent it helped to carry out such a change. Since, according to the perspective of organizational intelligence, it is necessary to have a deep knowledge of the markets; in order to have elements to be able to predict the future, which allows for better management of the change process in the company.

In the instrument used, certain hypotheses and questions were taken into account that examines organizational change from the perspective of the current study of organizational intelligence, and they are:

H1: Organizational intelligence contributes to the implementation of a process of organizational change in commercial companies of the AMG.

According to the results obtained, an existing relationship was discovered between the company is an intelligent organization with: the organization has values that reinforce its identity, good human resources; the change had a learning orientation instead of giving a command to an authoritarian leader, the change in the company is the result of organizational learning; adequate information is available; and concluding that, as a result of the change, it is important that workers develop new skills and abilities.

This indicates that those factors related to organizational intelligence influence the implementation of organizational change. Therefore, H1: Organizational intelligence contributes to the implementation of a process of organizational change in commercial companies of the AMG, is accepted. (See Table 6).

Table 6. This company is an intelligent organization; that is focused on learning and constantly increases its knowledge base

ANOVA						
		Sum of squares	gl	Quadratic mean	F	Sig.
The organization has values that reinforce its identity	Between groups	11.604	2	5.802	15.024	.000
	Within groups	22.783	59	.386		
	Total	34.387	61			
Good human resources	Between groups	9.399	2	4.700	7.008	.002
	Within groups	39.569	59	.671		
	Total	48.968	61			
Adequate information is available	Between groups	5.825	2	2.912	5.753	.005
	Within groups	29.869	59	.506		
	Total	35.694	61			
As a result of the change, the employees developed new skills and abilities	Between groups	5.541	2	2.771	7.915	.001
	Within groups	20.653	59	.350		
	Total	26.194	61			
The change followed a learning orientation instead of handing over to an authoritarian leader	Between groups	6.215	2	3.108	7.196	.002
	Within groups	25.478	59	.432		
	Total	31.694	61			
Change in the company is the result of organizational learning	Between groups	4.675	2	2.338	10.877	.000
	Within groups	12.680	59	.215		
	Total	17.355	61			

Source: Own elaboration based on the results of SPSS.

Regarding this aspect, one of the biggest management challenges is how intelligent organizations are created and managed (Rahdarpour & Sheikhi, 2016). Filos (2008) stated that the intelligent management of the organization requires a more "fuzzy" approach to manage intelligent resources such as people, available information, the knowledge base, and creativity. Smart business organizations today consider customers, suppliers, regulators, and even competitors who can make significant contributions to their success as stakeholders.

One of the most important challenges of organizational intelligence for companies trying to create a sustainable environment based on profit is the use of human intelligence, trust, and interaction within the organization. It is suggested that this problem can be solved with human intelligence, which includes knowledge and skills and self-regulatory mechanisms offered by culture (Vveinhardt & Minkute-Henrickson, 2005).

On the other hand, collaborative organizational work involves human resources and machine-based problem-solving tools. An organizational intelligence model was developed that combines human and machine computing capabilities and problem-solving (Kirn, 1995).

Organizational intelligence, which is the intellectual power capacity of an organization, is seen as the next limit to separate winners from losers. The ability to make smart decisions and quickly adapt to changing situations is one of the greatest competitive advantages of the 21st century. Organizations that are

strongly rooted in the principles of intelligent organizations can adopt best practices for decision making, and those who implement them can produce better results. (Matheson & Matheson, 2001).

In fact, the intelligence of an organization is not only to adapt to situations. It must be able to influence and shape the environment, restructure itself and achieve the sustainability of a larger whole embedded in it, which includes abilities such as power contribute (Schwaninger, 2019). Therefore, organizational intelligence and learning orientation are considered to influence intelligent organizations.

Table 7. The organization is becoming more aware of its knowledge base

ANOVA						
		Sum of squares	gl	Quadratic mean	F	Sig.
Accept taking calculated risks	Between groups	7.506	2	3.753	6.879	.002
	Within groups	32.188	59	.546		
	Total	39.694	61			
Shared vision	Between groups	8.472	2	4.236	7.242	.002
	Within groups	34.512	59	.585		
	Total	42.984	61			
Competitively, the company is performing better than before the change	Between groups	7.014	2	3.507	9.229	.000
	Within groups	22.421	59	.380		
	Total	29.435	61			
There is a learning approach within the organization	Between groups	3.940	2	1.970	7.803	.001
	Within groups	14.898	59	.253		
	Total	18.839	61			
Difference between what is said and done	Between groups	7.923	2	3.962	49.239	.000
	Within groups	4.667	59	.080		
	Total	12.590	61			
The change followed a learning orientation instead of handing over to an authoritarian leader	Between groups	7.631	2	3.815	9.355	.000
	Within groups	24.063	59	.408		
	Total	31.694	61			
Change in the company is the result of organizational learning	Between groups	3.422	2	1.711	7.245	.002
	Within groups	13.933	59	.236		
	Total	17.355	61			

Source: Own elaboration based on the results of SPSS.

The responses of the respondents show that intelligent organizations are a very important factor that must be considered if an organizational change is sought. For this, it is required that companies have an approach towards learning and generate mechanisms to increase their knowledge base, as well as knowing how to put all that information to good use. (See Table 6).

H2: The knowledge base of the company favors organizational change through organizational intelligence in commercial companies of the AMG.

In accordance with the results obtained in this study, it was discovered that there is a relationship between the organization is increasingly aware of its

knowledge base with: Accept taking calculated risks, Shared vision, Competitively the company is working better than before the change, It has a learning approach in the organization, The change is a result of organizational learning, The results of organizational culture change are measured, The change was oriented towards learning instead of giving a command to an authoritarian leader.

This shows that the knowledge base generated by a company that is characterized by being an intelligent organization favors the implementation of organizational change; For this reason, it is essential that the company's management enter into the process of organizational change and that they train the personnel, so that they have all the information and adequate training to be able to correctly carry out their functions and so that they can actively participate in the process of change in their organizations. For this reason, H2: The knowledge base of the company favors organizational change through organizational intelligence in commercial companies of the AMG, is accepted. (See table 7).

Risk management is a key indicator of intelligence: smart organizations focus on risks and develop adequate adaptation mechanisms for them by calculating how to deal with those risks. In terms of strategic human resource management, organizational intelligence offers a radical challenge. If the company's knowledge base is increased, it becomes an asset in terms of organizational competitiveness (Argyris, 2010). The ability to manage competencies is at the heart of any intelligent organization (Fernández & Rainey 2006; Fernández & Pitts 2007).

H3: Employee education helps to carry out an organizational change process in commercial companies of the AMG.

The results found in this research show that there is a relationship between Employees education with: Employees were willing to change, Employees reaction to the change was favorable, Change agents in this organization can deal with simple problems, Good human resources, Adequate information is available, Shared vision, Accept taking calculated risks, Anticipate the future and its changes, Adaptation, The organization faced many pressures to achieve change.

This reveals that those variables related to organizational intelligence help the establishment of organizational change. For that reason, H3: Employee's education helps to carry out an organizational change process in commercial companies of the AMG, is accepted. (See Table 8).

Table 8. Employee education

ANOVA						
		Sum of squares	gl	Quadratic mean	F	Sig.
Employees were willing to change	Between groups	11.599	3	3.866	7.101	.000
	Within groups	31.578	58	.544		
	Total	43.177	61			
Employee's reaction to the change was favorable	Between groups	10.006	3	3.335	6.680	.001
	Within groups	28.962	58	.499		
	Total	38.968	61			
Change agents in this organization can deal with simple problems	Between groups	8.202	3	2.734	5.443	.002
	Within groups	28.131	56	.502		
	Total	36.333	59			
Good human resources	Between groups	9.661	3	3.220	5.707	.002
	Within groups	32.726	58	.564		
	Total	42.387	61			
Adequate information is available	Between groups	8.052	3	2.684	5.631	.002
	Within groups	27.642	58	.477		
	Total	35.694	61			
Shared vision	Between groups	8.230	3	2.743	5.009	.004
	Within groups	31.770	58	.548		
	Total	40.000	61			
Accept taking calculated risks	Between groups	263.927	3	87.976	7.714	.000
	Within groups	661.509	58	11.405		
	Total	925.435	61			
Anticipate the future and its changes	Between groups	11.493	3	3.831	6.660	.001
	Within groups	33.362	58	.575		
	Total	44.855	61			
Adaptation	Between groups	11.027	3	3.676	5.817	.002
	Within groups	36.651	58	.632		
	Total	47.677	61			
The organization faced many pressures to achieve change	Between groups	7.660	3	2.553	5.286	.003
	Within groups	28.017	58	.483		
	Total	35.677	61			
		263.927	3	87.976	7.714	.000

Source: Own elaboration based on the results of SPSS.

The results of this research indicate that an intelligent organization encourages the participation of workers in the decision-making process to achieve the necessary understanding to make the alignment of objectives and authorization effective (Matheson & Matheson, 2001).

The final element in resource mobilization in a smart organization is the open flow of information. An open flow of information is needed for the design and development of innovative products, services, and processes. The knowledge base flows rapidly within a more permeable organization, and this flow of information in the organization can be improved by applying standards of competence and excellence.

The increasing demands of consumers force organizations to be more efficient and competitive, which causes such companies to be more open to changes that occur in the company and in the market.

CONCLUSIONS

The business world that exists today has the characteristic that it is in constant change. What can be observed when seeing how competition is increasing in all markets and industries worldwide. This favors the decision-making power of buyers since they increasingly have a greater variety of options to choose from, which in turn translates into an increase in consumer expectations.

Therefore, it is essential that companies are increasingly efficient in their processes. Therefore, this world characterized by these continuous changes causes great uncertainty in the markets and businesses, and companies must know how to deal with these changes and anticipate them thanks to the knowledge base that they have as a result of the learning obtained through his experience in the business.

Continual changes in the corporate environment reveal the unpredictability of business. This generates that considerable changes must be created in companies, develop new production processes, devise new products that exceed customer expectations.

Organizations cannot remain stagnant. They have to continually learn because if they don't, competitors will overtake them. The most successful companies are characterized by anticipating changes, and even promoting them, in order to become leaders in the market, forcing competitors to adapt to changes. Carrying out an organizational change can be costly, but if it is carried out correctly, its benefits will be greater, which will make companies more efficient, reduce costs, and make the organization more competitive.

The results of this study allow us to conclude that the three hypotheses are accepted:

H1: Organizational intelligence contributes to the implementation of a process of organizational change in commercial companies of the AMG.

H2: The knowledge base of the company favors organizational change through organizational intelligence in commercial companies of the AMG.

H3: Employee education helps to carry out an organizational change process in commercial companies of the AMG.

In this research that relates the influence of organizational intelligence with a process of organizational change, it was found that organizational intelligence needs management efficiency, adding a change in the direction of the new logic of the digital economy era. An unpredictable environment implies that companies adapt and anticipate changes, which will help them to carry out the organizational change.

In turn, they were found as factors that benefit organizational change from the point of view of organizational intelligence: the change is the result of

organizational learning, the change had a learning orientation instead of giving a command to an authoritarian leader, the base knowledge of the company and learning organizations were important factors in effecting culture change.

Thus, the organizational intelligence perspective indicates that a company changes when its people behave differently. The employees are the ones who have to create and change the company through learning and using their education and knowledge base. This starts with the management since they have a fundamental role within the company itself.

Research shows that organizational intelligence is an increasingly present factor and that it contributes to the process of implementing organizational change. This phenomenon influences all types of companies to carry out an organizational change since organizational intelligence requires business firms to have a focus on learning, so they must constantly be looking to increase their knowledge base.

The companies will be more competitive as they increase their knowledge base and take advantage of all the information they have in order to make better decisions, which will allow them to improve the performance of the company and be more competitive. In turn, organizational intelligence is a highly relevant instrument with which corporations can improve their operations and business performance, providing better service, being more efficient in their processes, and achieving greater competitiveness.

There is no way to predict what will happen in the future, but it is feasible to prepare for what the future brings. Correct preparation of the companies will allow them to face those challenges that the future holds. Every organization must be able to adapt to changes. Making an organizational change is a way of subsisting that companies adopt to continue in the markets.

References

Al Shobaki, M. J., Abu Naser, S. S., Abu Amuna, Y. M., & El Talla, S. A. (2018). The availability of smart organization dimensions in technical colleges in Palestine. *International Journal of Engineering and Information Systems, 2(*1), 49-64.

Albrecht, K. (2002). *Power of minds at work: Organizational intelligence in action*. New York. USA: AMACOM Books.

Ansari, F., Hold, P., & Khobreh, M. (2020). A knowledge-based approach for representing jobholder profile toward optimal human-machine collaboration in cyber physical production systems. *CIRP Journal of Manufacturing Science and Technology, 28*(1), 87-106.

Argyris, C. (2010). *Organizational traps: Leadership, culture, organizational design.* Oxford University Press.

Bar-Ilan, J. (2008). Informetrics at the beginning of the 21st century—A review. *Journal of Informetrics, 2*(1), 1-52.

Bratianu, C., Vasilache, S., & Jianu, I. (2006). In search of intelligent organizations. *Management & Marketing, 1*(4), 71-82.

Fergnani, A. (2019). Mapping futures studies scholarship from 1968 to present: A bibliometric review of thematic clusters, research trends, and research gaps. *Futures, 105*(2019), 104-123.

Fernandez, S., & Rainey, H. G. (2006). Managing successful organizational change in the public sector. *Public Administration Review, 66*(2), 168-176.

Fernandez, S., & Pitts, D. W. (2007). Under what conditions do public managers favor and pursue organizational change? *The American Review of Public Administration, 37*(3), 324-341.

Filos, E. (2008). Smart organizations in the digital age. *Knowledge management: Concepts, methodologies, tools and applications*, 48-72, San Diego: IGI Global. http://www.filos-europe.com/erastos/documents/EN/EFSmartOrgs.pdf (Erişim Tarihi: 24.07.2020).

González, T., & González, S. (2019). Apprenticeship system for the internationalization: Jalisco handicraft production companies. *Independent Journal of Management & Production, 11*(4).

Haas, P.M. (1992) Introduction: Epistemic communities and international policy coordination. *International Organization, 46*(1), 1-35.

Holba, A.; Bahr, P.T.; Birx D.L. & Fischler M.J. (2019), Integral Learning and Working: Becoming a Learning Organization. *New Directions for Higher Education, 185*(185), 85-99.

Jarrahi, M. H. (2018). Artificial intelligence and the future of work: Human-AI symbiosis in organizational decision making. *Business Horizons, 61*(4), 577-586.

Kahkha, A. O., Pourghaz, A., & Marziyeh, A. (2015). Examining the relationship of organizational intelligence with innovation management and career advancement in an organization. *Journal of Behavioral and Brain Science, 5*(1), 395-404.

Keskin, H., & Balak, D. (2020). Smart Organizations from Organizational Intelligence Perspective. *Business and Economics Research Journal; Bursa, 11*(4): 1083-1096.

Kirn, S. (1995). *Organizational intelligence and distributed AI*, Arbeitsberichte des Instituts für Wirtschaftsinformatik, Westfälische Wilhelms-Universität Münster, No. 40, Inst. für Wirtschaftsinformatik, Münster.

Kulkarni, A. V., Aziz, B., Shams, I., & Busse, J. W. (2009). Comparisons of citations in Web of Science, Scopus, and Google Scholar for articles published in general medical journals. *JAMA, 302*(10), 1092–1096.

Mahmoudi, H. S., & Asgari, M. H. (2013). Investigation of relationship between organizational intelligence and agility of high school administrators in Mazandaran Province, Iran. *International Research Journal of Applied and Basic Sciences, 5*(7), 905-911.

Matheson, D., & Matheson, J. E. (2001). Smart organizations perform better. *Research Technology Management, 44*(4), 49-54.

Neyişçi, N., & Erçetin, Ş. Ş. (2020). Sosyal ağ etkileşiminin örgütsel zekâ düzeyine etkisi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 35*(2), 354-374

Olczyk, M. (2016). A systematic retrieval of international competitiveness literature: A bibliometric study. *Eurasian Economic Review, 6*(3), 429–457.

Pazireh, T., Rahimi, G., Irani, F. N., & Bohlouli, N. (2019). Model developement for establishment of smart organizations: Case study of the social security organization. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies, 10*(4), 559-565.

Rahdarpour, J., & Sheykhi, A. (2016). Relationship between organizational intelligence, organizational learning, intellectual capital and social capital using SEM. *International Journal of Humanities and Cultural Studies, 2*(4), 2076-2086.

Senge, P. M. (2006). *The fifth discipline: the art and practice of the learning organization*. Doubleday/ Currency.

Schafer, M. A. (2009). *Organizational IQ: Characteristics common to smart organizations and applicability to the U.S. Military*. Mba Professional Report.

Schwaninger, M. (2019). Governance for intelligent organizations: A cybernetic contribution. *Kybernetes, 48*(1), 35-57.

Tang, Z., & Sivaramakrishnan, S. (2003). *Creating an intelligence infrastructure for intelligent organizations.* AMCIS 2003 Proceedings. Paper 360. http://aisel.aisnet.org/amcis2003/360 (Erişim Tarihi: 24.07.2020).

Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics, 84*(2), 523-538.

Van Knippenberg, D., Dahlander, L., Haas, M., & George, G. (2015). From the editors information, attention, and decision making. *Academy of Management Journal, 58*(3), 649-657.

Van Raan, A. (2019). Measuring Science: Basic Principles and Application of Advanced Bibliometrics. In Glänzel, W., Moed, H. F., Schmoch,U., & Thelwall, M. (Eds.), Springer *Handbook of Science and Technology Indicators*. (237–280). Springer International Publishing.

Vveinhardt, J., & Minkute-Henrickson, R. (2005). Transformation of a learning organization into a smart organization: Expansion of human resource by intellectual capital. *Proceedings of EDULEARN 15 Conference 6th-8th July 2015,* Barcelona, Spain.

chapter nine

The Colombian Textile Industry Behavior: The Fatalistic One

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The Colombian Textile Industry Behavior: the Fatalistic One

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Introduction

In developing countries, Clusters or territorial agglomerations of companies engaged in the same or complementary activities to produce a good or a set of interrelated goods are quite common in a wide range of industrial sectors. They have been the subject of numerous research studies (Waits, 2000; Roberts & Enright, 2004; Yu & Jackson, 2011; Chatterji, Glaeser & Kerr, 2014; Gagné et al., 2010; Wolfe & Gertler, 2004; Belussi, 2018).

Case studies documenting the characteristics of Clusters have increased in recent years since they allow finding essential information on their characteristics and needs to support the direction of industrial policy to boost the competitiveness of companies and territories.

Most of the Clusters in developing countries are made up of MSMEs in productive specialization, characterized by weak relations between companies within the sector and with other productive sectors and with the territory, its institutions, and the community to which they belong.

It is common for these productive organizations to have a low division of labor, little product differentiation, compete in the same markets, and compete on price. Nevertheless, the above characteristics are considered a still incipient model of the local productive system, which could be more complex to be more competitive for local Development (Garofoli, 2009a).

For developing countries, boosting the competitiveness of local production systems (Clusters) can be of great help in their industrialization process since they make the mobilization and use of scarce resources (human and financial) possible, facilitate specialization and investment by stages and enhance complementarities (Schmitz & Nadvi, 1999).

The study of the Textile/Clothing Cluster of Medellin and the Aburrá Valley contributes to illustrate the phenomenon of light industrialization in Latin America, given its representativeness in Colombia, the tradition and importance

of its companies, some of them with more than 100 years of existence, and because the territory managed to have a more integrated productive chain than that which could be consolidated in other regions.

Furthermore, the research contributes to understanding the trajectory and dynamics of these industries in the context of integration into the world market in the absence of articulated industrial development policies and local capacities for development.

In Colombia until the end of the 1960s, the textile industry occupied first place in value-added and employment generation. By 1968, the participation of the textile industrial agglomeration of Medellin and Antioquia in the total national textile industry was the highest among all the regions, with almost 60% of the workers, 69% of the value-added and 63% of the national production of the textile sector (Dane, 1974).

Since the economic and commercial integration of the country in 1990, the textile-garment production chain has been losing participation both in the manufacturing industry and in the gross domestic product (GDP). As a result, exports have also been decreasing (Harrison & McMillan, 2007; Ahumada & Andrews, 1998; Fieler, Eslava & Xu, 2018).

In addition, both legal and illegal imports of this industry have been increasing, due to the termination of the Multifiber Agreement in 2005, which resulted in the liberalization of export quotas and the re-composition of participation in world trade in favor of low-cost producing countries.

The research results suggest that the country and the region did not have active policies to promote the development of the Textile/Clothing Cluster within the framework of productive restructuring and insertion in the global chain.

Instead, following neoliberal "recipes", Latin American economies used macroeconomic adjustment policies, opened their markets, sought to increase the value of exports, but ignored how the export sector was articulated with the productive national system and neglected State intervention to promote the development of innovation, science, and technology and to regulate market failures.

TEXTILE-APPAREL CHAIN: GLOBALIZATION AND PRODUCTIVE TRANSFORMATION

The textile-garment chain has been very representative in the industrialization process of different countries, beginning with England, the cradle of textile industrialization, as well as for a large part of the European continent, the United States, Japan and, since the middle of the last century, for

the newly industrialized countries of East Asia (South Korea, Hong Kong, Singapore, and Taiwan).

The weight that exports of the textile-clothing chain have had is essential in the total world trade, characterized by their dynamism (Kanungo, 2012), in such a way that for 2018, clothing exports were, according to the WTO, the most dynamic manufactured product with a growth of 3.3%.

The textile-garment production chain continues to be fundamental for its contributions to the generation of employment, income, and foreign exchange, given the interconnections it has with the economic system and the backward and forward linkages with other industries such as the mechanical-textile industry; the chemical industry, and the agricultural sector for the production of fibers; the computer and communications industry for the production of equipment and support technologies; with the design industry, fashion, marketing, logistics, and distribution, among others.

Given the historical importance of the textile and apparel chain for the industrialization of countries, protection policies and demands for market liberalization (depending on the different interests at stake) have always been present. Thus, the discussion for the termination of quotas imposed on exports from developing countries was extensive.

The Multifiber Agreement (MFA) from 1974 until 2005 controlled the textile and clothing international trade. When these industries assumed the rules of the General Agreement on Tariffs and Trade (GATT), within the framework of the World Trade Organization (WTO); this led to the liberalization of the textile and apparel sector with the dismantling of quotas that prevented developing countries from exporting freely to the markets of developed countries (United States, Canada, and the European Union).

In the discussion on trade integration, it was considered that developing countries, and especially the poorest ones, would benefit the most from the possibilities of participating in the apparel industry, given their technological and organizational characteristics: (a) because it is an industry intensive in unskilled labor and especially of female population, (b) because from the garment industry it is possible to generate a process of industrialization, given the relatively low costs of machinery, which allow the productive units to acquire it to place themselves at the base of the industrializing ladder, and (c) since it is a flexible industry, it is possible to achieve adaptations according to the constant changes of the market (Nordås, 2004).

Thinking of industrialization as a gateway to development, Albert Hirschman (1961) proposed that policies should favor industries with numerous productive linkages both backward and forward because these lead to new

investment decisions, which, characterize economic growth when they occur sequentially.

However, Hirschman also recognized that the "technological strangeness" between industries made it difficult to activate the "backward" effect dynamics in the textile-apparel linkage. Especially regarding machinery and textile fibers based on the chemical industry, which is why he called attention to the need for industrial development policies to work on the identification and subsequent actions that would clear the way for these linkages (1968).

With the rise of the globalization process, the trade liberalization of economies, and the inclusion of many developing countries in the manufacture of labor-intensive goods for export, large buyers and manufacturing companies with experience in the markets have become leaders.

They have implemented strategies of relocation and/or decentralization of production at the international level, taking charge of building global production networks. In the organization of the global apparel chain, which began to take shape from 1960 onwards, Gereffi (1999, 2001) identified three forms of production networks, which can be built to incorporate the supply of unskilled labor into the export production system:

A) "Maquila production model": in this form of production organization, own-brand manufacturers (market leaders) incorporate suppliers into their production networks to perform simple assembly activities of imported parts.

B) "Full package production model": in which suppliers can add more excellent value, through a series of activities downstream in the production chain, such as designs, samples, purchase of inputs, production processes, to be delivered at the place and with the brand stipulated by the buyer.

C) "Original brand production model": highly demanding since it is characterized by integrating forwarding linkages, and requires financial leverage, production experience and high organizational, design, fashion, branding, distribution, and commercial capabilities.

Most of the poorest countries that have entered these global networks as manufacturers since 1980 have done so since their comparative advantages, such as their large low-skilled unemployed labor force, in most cases as assemblers of imported inputs (maquila).

The consequences of this form of interrelation are displacement or very tangential participation in world trade. Few productive linkages that do not generate better jobs within countries, very little value- added and income to contribute to development; while the leading companies in this chain, generally originating in developed countries, have redefined their strategic businesses around the most knowledge and investment intensive activities, such as design,

fashion content, branding and marketing of final products, generating the most significant value-added.

The radical innovations in the textile industry have undergone in its spinning and weaving processes. It as well as the permanent advances in information and communication technologies, electronics, robotics, among others, added to the demand for significant organizational and financial capabilities, have become barriers to entry, making it difficult for most developing countries, including Latin America, to establish integrated regional production chains to ensure long-term competitiveness.

Countries such as China, India and Brazil are exceptions, which with the help of public policies, have managed to build complete national production chains and agricultural bases to produce natural fiber (Lurashi, 2010).

Textile-apparel chain in Colombia and Antioquia

The textile and apparel industry has been one of the pillars of Colombian industrialization since the first decades of the 20th century and continued to consolidate until the end of the 1960s when it occupied the first place in value-added and employment generation in the country.

Therefore, the genesis of the Colombian textile industry behavior during the 20th century needs to be comprehensive. It is to necessary to study the industry of Medellin and Antioquia, since it was there where the first and most important textile factories were born at the beginning of the last century; their history and performance generated determining features and characteristics for the national industry, which by 1968 had 69% of the value-added, participated with 60% of the workers and 63% of the national production in the textile sector (Dane, 1974).

From the accumulation of capital from coffee exports and mining, a generation of merchant families with an entrepreneurial spirit was born in Antioquia, pioneers in the industrialization of the country's textile industry, founding the first companies as early as 1902.

As a result, the city of Medellin, capital of Antioquia, has been considered the "industrial city of Colombia" and recognized in Latin America as the "Fashion Center" due to the tradition of its textile-apparel industry and the positioning of important fairs and events that promote the different products and service activities that support the chain. The leading fairs: “Colombiamoda” and “Colombiatex de las Americas” have more than 30 years of existence.

The apparel industry, which began in Antioquia as an activity of productive integration, took advantage of the externalities of the textile sector. It was consolidating and gaining weight in the production chain, thanks to its characteristics of greater flexibility and lower capital requirements; from the

commercial integration of the country and with its participation in the relocation process, joining the network of the textile chain of the American continent, which was structured from the commercial treaties and tariff preferences defined by the United States.

Colombian garment manufacturers incorporated to produce under the maquila model, characterized by the manufacture of primary assembly products with imported inputs; They were favored with the Agreement on Tariff Preferences (ATPDEA) enacted in 2002.

However, the termination of the quotas of the Multifiber Agreement recomposed the world participation of textile and apparel imports in favor of Asian products, especially Chinese. Asian products with meager prices, with which the national product could not compete; aggravated because most local companies did not have value-added products that would allow them to escape price competition.

Because of the low capacity to compete in the framework of trade integration, the participation of textile and apparel production in the national industrial GDP decreased from 9.8% in 2005 to 7.6% in 2014; exports decreased, and the trade balance went from positive to negative and direct employment fell by (-42%); dropping from 628,000 people in 2005 to an estimated 366,000 in 2014 (INEXMODA, 2015).

Results of the Research on the Textile/Clothing Cluster of Medellín and the Aburrá Valley

The research studied the transformation of the agglomeration of textile and apparel companies and other productive activities and support services for the chain, known as the Textile/Clothing, Design and Fashion Cluster (TCDM).

Which is 2010 had 10,217 companies, characterized by a heterogeneous business structure; less than 1% were large companies with significant participation in the activities of the first links (transformation of fibers/inputs/textiles), 8% were small and medium-sized companies, and 91% were micro-enterprises; mainly dedicated to clothing and marketing (ESUMER, 2011).

Methodology

Given the multidimensionality of the object of study, a methodological triangulation was carried out with the support of primary and secondary sources, which yielded quantitative and qualitative information. Statistical sources of the responsible institutions were consulted, and information from the commerce chambers' commercial registry and recent specialized research studies.

The preliminary information was collected through 71 interviews, in two campaigns, with different objectives, questionnaires, and periods. The problem

tree methodology was used to organize of the information and analyze the problems of the productive agglomeration (Medina, 2018).

Productive transformation of the Textile/Clothing Cluster of Medellin and the Aburrá Valley

An analysis of the behavior of the number of companies and their participation in the total textile/apparel chain, by comparing the companies registered in Medellin and the municipalities of the northern Aburrá Valley at two different times in the present century: 2006 and 2011, that is, seven years after the termination of the Multifiber Agreement, allows us to recognize the following changes:

A) In only five years, the number of companies dedicated to "spinning and synthetic and artificial fibers" activities is reduced from 50 to 36, i.e., 14 companies are lost, equivalent to 28% of the companies and the share of these activities in the total chain going from 0.71% to 0.51% between 2006 and 2011.

B) Companies dedicated to garment manufacturing also decreased by 300. 10% of companies closed and it registered in 2006. They reduced their participation in the production chain from 45.2% in 2006 to 40.8% in 2011.

C) At the same time, it is evident that the number of companies dedicated to the trade of inputs and apparel products is growing, as well as their participation in the production chain, which increased from 44.8% in 2006 to 48.7% in 2011, i.e., nearly half of the registered establishments. The number of companies dedicated to the "wholesale trade of inputs and apparel products" grew 23%, increasing their participation in the business structure of the chain from 6% to 7.3%, while the number of companies dedicated to the "retail trade of inputs and apparel products" increased by 7.5%, from 38.8% to 41.4% of the companies registered in the production chain.

D) In general, the total number of companies in the cluster remained stable, and the composition by company size also remained the same.

The results obtained show that there has been a transformation in the structure of the textile-garment production chain analyzed, since there has been a loss of companies dedicated to manufacturing and industry, while the number of establishments dedicated to the trade of inputs and garment products has increased.

The structural change observed in the Cluster deserves all the attention since two components are observed:

A) Disintegration of the production chain and specialization in the apparel link

The local chain reconfiguration has been occurring since the last decades of the last century continues with the decrease in the number of fibers, textile, and inputs links. It was producing a Cluster specialization in the apparel

industry and a greater disintegration of the chain since companies manufacture fibers and textile inputs. Which are fundamental for diversification, differentiation, and more significant value addition in the links that continue forward in the chain, have been lost.

The loss of productive activities in the input and textile industry links, which has generated a concentration of the industry in the apparel link, places the Cluster at a disadvantage concerning others that have a more integrated production chain, making it more dependent on imported inputs, which hinders the possibilities of advancing in the differentiation of final products.

In addition, the loss of input and textile manufacturing companies reduces the capacity to mobilize resources among complementary local companies, as well as the possibilities of taking advantage of external economies, introducing learning, innovation, and technological development, improving quality, and increasing productivity and efficiency of the local production system.

The dedication of a smaller number of companies to spinning and weaving activities in the Cluster is due to the greater technological complexity and demand for financial and organizational resources, typical of the textile industry, which has not been able to be overcome locally.

As it happens to other productive systems in most developing countries, it is easier to meet the domestic demand for textile inputs and products with imports than to produce them locally. Between the years 2016-2020, Latin America and the Caribbean have been responsible for 7.5%, on average, of textile imports and 3.2% in apparel on a global scale (WTO, 2021).

Countries such as China, India, and Turkey, which have increased their share of world exports of textile and clothing products, have been integrated into the global chain in a very different way in recent decades, particularly with the termination of the Multi-Fiber Arrangement (MFA).

They have developed a more significant number of productive activities in the value chain within their economies, generating more significant value-added internally, which is also reflected in more jobs along the apparel, textile manufacturing, production in the agricultural sector (cotton), input industries, machinery and equipment, and related services.

The development of industries along the different links of the chain and especially the "backward" links have enabled manufacturers in these countries to participate in the global chain for production under the complete package (OEM) model (Luraschi, 2010).

On the other hand, Latin American countries, specialized for many years in basic assembly. As a result, they did not develop backward linkages with the textile input industry internally to have more integrated production chains and expand the possibilities of action in the face of growing competition.

According to Condo et al. (2004), the region's incorporation into the export industry seems responsible. They did so through tariff preference schemes and trade treaties adopted with the United States. In addition, they allowed the institutionalization of preferential access of its textile goods to Latin American markets, through the "rules of origin", guaranteeing the northern country the use of its raw materials and textile products in the region's productive processes, which may have contributed to discourage the creation of more significant links with backward productive links in the local and regional economies.

The productive systems that have managed to transform themselves and improve their competing possibilities by integrating new activities and articulating of more demanding productive processes in terms of technology and human resources qualification, both in the primary industries of specialization and the industries of inputs and related services generate more excellent value-added in the territory and, therefore, better income for business people and workers, contributing to economic development.

Such is the case of industrial districts, models of productive organization that are characterized by the close connection of the different subsectors that make up the local economic system; in such a way that investment opportunities are generated for the transformation of the productive structure, with its multiplier effects (Garofoli, 1991; Scott & Garofoli, 2007).

B) Decrease in the share of companies engaged in processing and increase in the trade sector

The low capacity of most of the local companies to compete in the international market and even in the domestic market with imported products, added to the internal distortion of prices, aggravated by problems of smuggling and under-invoicing, discouraged the industry, generating a structural transformation in which the number of companies engaged in trade activities increased. This situation extends to the apparel link, where some companies have closed down, and some have opted to become traders of what they used to produce.

The adverse effects on the Textile/Clothing Cluster of the termination of quotas for large volume producers (Multifiber Agreement) and the consolidation of East Asia and especially China as the largest exporters in the chain (Morris & Barnes, 2009; Hall, 2006; Gereffi, 2014) can be explained as a) an increase in the supply of products in the chain and, therefore, in competition in the domestic market, b) a decrease in sales by local companies, c) a decrease in prices and profitability.

All of this, together with internal problems such as smuggling, triggers a significant crisis for the domestic industry, which cannot compete on price. Moreover, since most local manufacturers had not made the necessary

adjustments to innovate, add more excellent value and differentiate themselves, they competed in the market by manufacturing similar products, and faced fierce competition based on low prices.

Manufacturers in the textile-garment agglomeration of Medellín, which did not have high value-added products, were faced with competing in the international division of labor with producers in countries with meager wages and lower costs. Faced with falling international prices, the cluster's manufacturers lost market share, exports fell and dependence on sales in the domestic market grew from 60% to 80% between 2008 and 2011. (INEXMODA, 2012).

From 2008 onwards, after the fall in exports and the arrival of essential brand stores and international capital that acquired national chain stores in the domestic market, local companies with their brands decided to transform their business model, prioritizing the strengthening of their brands over the maquila manufacturing model, in which they had been participating. The concentration on serving the domestic market, opening their stores to market their brands, and increasing points of sale through franchises, came as strategies for local brands to serve the domestic market.

Contrary to what is happening in the local Textile/Clothing Cluster, the productive transformation, through the strengthening and deepening of the industrial structure, to be able to respond to market demands, through the mobilization of resources and capacities for innovation and technological development of capital goods and inputs used in the productive processes, was a determining factor in the regions where the light industry districts were consolidated. During this stage, many small specialized companies were born, and the integration of sectors, industries, and collateral productive activities that previously did not exist or were not strong in the territory (Garofoli, 2009b).

TRANSFORMATION OF THE BUSINESS MODEL OF THE MAJOR BRANDS AND CONCENTRATION IN THE DOMESTIC MARKET

Driven by the crisis generated in the production system, the major national brands, which had dedicated a large part of their installed capacity to the manufacture of products for leading brands in the global chain, decided to transform their business model.

They were seeking to position their brands, prioritizing them over maquila production and concentrating on serving the domestic market, given the difficulties in competing and the fall in exports. As a result, they increased the dependence on the domestic market for the sales of national producers.

Local manufacturers with their brand, which had had as one of their main sales channels the large national chain stores, were displaced in 2007 with the

acquisition of these stores by international capital and the arrival in the country of important global brands and department stores with great experience in marketing and fashion, which transformed the expectations and interest of the local consumer.

This new scenario promoted changes in the business models of both chain stores and national brands, which focused on positioning their brands and serving the local market. (INEXMODA, 2015).

The new strategy of the large chain stores, previously owned by national capital, resembled by 2014 that of the so-called "marketers": leaders of the global chain, converted into owners of locally positioned brands, with their points of sale, but without factories; they had the work team and procedures to subcontract production, guarantee quality and compliance with standards and delivery times by the maquiladora workshops, which were located in the Metropolitan Area and even in other municipalities of Antioquia and Colombia.

This strategy of positioning own brands by the chain stores limited the access of national producers, who previously used this sales channel. Some of the strategies used by local producers in the face of the difficulty of accessing the domestic market through traditional sales channels were:

A) Own-brand manufacturers with capacity, sought to move into a leading role in the national chain, dealing directly with marketing. Opening stores in different parts of the city and the country (20% of the clothing and marketing companies in the Cluster integrated within themselves both the activities of clothing and trade; to improve their competitiveness).

B) Some producers who did not have their brand positioned, nor the capacity to do so, began to use their installed capacity, specializing in productive activities and becoming suppliers for national brands.

C) Another part of the producers has abandoned manufacturing activities and have become marketers (importers and distributors) of the products they produce.

D) Other manufacturers use various channels, such as the development of their own sales force, third parties, and some specialized distributors, to penetrate alternative markets, such as those outside the large cities, in rural areas and municipalities in other departments where the large commercial chains do not yet have access. However, more and more competing firms are arriving in these markets.

LIMITATIONS FOR THE COMPETITIVENESS OF THE TEXTILE/CLOTHING CLUSTER OF MEDELLÍN AND THE ABURRÁ VALLEY

The low capacity of the Textile/Clothing Cluster to compete in the global market and to continue contributing significantly to the economic development

of the territory is evidenced by the negative behavior of the different indicators, which once showed the strength of an agglomeration source of income (foreign exchange, profits, taxes, salaries) and generator of initiatives that improved the quality of life of a significant part of society.

The low capacity of the Textile/Clothing Cluster to compete in open market conditions is mainly due to two direct causes:

1. Limited capacity for innovation, technological development, and value-addition by companies.
2. Business culture has favored imitation over innovation and the development of new products during the long period of market protection.

Micro, small and medium-sized enterprises (MSMEs), representing 99% of the business fabric, have scarce financial and human resources. They are not being supported by public policies to access universities' research and innovation services and technology development centers.

In addition, the low level of innovation and technological development that has contributed to the thinning of the initial links in the chain: fiber and inputs and textiles, in turn, affects the competitiveness of the apparel industry since it does not have a broad local supply of inputs at competitive prices that can promote the design of differentiated products to add more excellent value.

Poor productive articulation inhibits joint actions and collective efficiency

Two causes are recognized: first, the lack of a vision of competitiveness shared by business people from the different links and support institutions, which promotes the transfer of knowledge and complementarities to achieve the proposed development objectives.

Second, the low capacity to organize the division and specialization of labor because of the isolated production culture of companies and the embryonic development of MSMEs to respond to the global market demands, which does not facilitate the strengthening of cooperation networks to solve obstacles jointly (Granados & Alvarado, 2009).

Conclusions: the fundamental role of policies for productive development

The study of the productive transformation of the Textile/Clothing Cluster of Medellin (Colombia) and the review of the limitations to competitiveness, as proposed in this article, necessarily leads to the review of the policies implemented in the country after the opening and integration to the world economy, as a result of the neoliberal thinking that promoted the liberalization of markets, accelerated the expansion of the international financial

sector, determined the reduction of government social expenditures and its intervention in the productive sector.

This policy of openness was carried out on the "recommendation" of the international financial institutions, as if it were a magic recipe to solve the problems afflicting developing countries, without the latter being able to address the particular needs of their production systems.

Contrary to what the neoliberal reforms adopted by Latin America preached, developed countries advanced in industrialization through a solid economic direction, using interventionist commercial, industrial, and financial policies; import control, export promotion, state support for research, science & technology, and subordinated the financial sectors to the needs of industrial development (Chang & Grabel, 2004).

According to the analysis developed, the textile-apparel Cluster could not govern its productive transformation. It was articulated to the global apparel chain through its comparative advantages, without having the necessary policies to promote the generation of dynamic competitive advantages.

The Colombian textile apparel chain did not have public-private agreements within the framework of an industrial policy that would promote innovation, scientific/technological development, value-addition, and the articulation of the productive system.

On the contrary, the textile sector lagged behind the advances of its international competitors. At the same time, while the apparel companies did not have a competitive local textile industry capable of providing them with differentiated inputs and in the required conditions to advance in value-addition.

The Cluster understudy has been undergoing a productive transformation opposite to that achieved by the most competitive local productive systems. They have made their internal structure more complex, reinforcing the articulation of companies within the same productive chain and incorporating new activities belonging to productive sectors that were not previously present in the local system to improve their capacity to respond to market demands.

The above results suggest the textile industry's inappropriateness to global trade, without having guaranteed in the country and the region, endogenous capacities and policies to valorize internal resources, ensure intersectoral articulation, direct investments, technological development, innovation and restructure the productive system.

Although in the last decades, different planning scenarios have been designed in Colombia to reach a consensus among sectoral, public, and private interests, the country has not been able to agree on a development vision that would allow the construction of an industrial policy to promote modernization, technological development, and value-addition.

This study can be added to many others carried out in Colombia and other Latin American countries, which face the enormous challenge of advancing in the generation of better living conditions for their population.

The results of the research suggest that in Colombia, it is not possible to continue applying the same kind of economic policies that follow international "recipes", ignoring the importance of having effective and technological development policies that respond to the needs and particularities of the local systems and that carefully attend to how they are articulated with their export sector.

REFERENCES

Ahumada, C., & Andrews, C. W. (1998). The impact of globalization on Latin American states: The cases of Brazil and Colombia. *Administrative Theory & Praxis*, 452-467.

Belussi, F. (2018). New perspectives on the evolution of clusters. *European Planning Studies, 26*(9), 1796-1814.

Chang, H. J., & Grabel, I. (2004). Reclaiming development from the Washington consensus. *Journal of Post Keynesian Economics, 27*(2), 273-291. https://www.tandfonline.com/doi/abs/10.1080/01603477.2004.11051434

Chatterji, A., Glaeser, E., & Kerr, W. (2014). Clusters of entrepreneurship and innovation. *Innovation policy and the economy, 14*(1), 129-166.

Departamento Administrativo Nacional de Estadísticas. (1974). *La economía antioqueña en cifras*, Medellin: Departamento Administrativo Nacional de Estadísticas.

Fieler, A. C., Eslava, M., & Xu, D. Y. (2018). Trade, quality upgrading, and input linkages: Theory and evidence from colombia. *American Economic Review, 108*(1), 109-46.

Gagné, M., Townsend, S. H., Bourgeois, I., & Hart, R. E. (2010). Technology cluster evaluation and growth factors: literature review. *Research evaluation, 19*(2), 82-90.

Garofoli, G. (1991). *Modelli Localli de Sviluppo*. Milano: Franco Angeli.

Garofoli, G. (2009a). Regional and Local Development. Scienze Regionali, Italian *Journal of Regional Science, 8*(3), 35–58

Garofoli, G. (2009b). Las experiencias de desarrollo económico local en Europa: las enseñanzas para América Latina. *URB-AL III*, 25. http://www.conectadel.org/wp-content/uploads/downloads/2013/03/15Desarrollo_economico_local_en_Europa_GAROFOLI_1.pdf

Gereffi, G. (2001). Las cadenas productivas como marco analítico para la globalización. *Problemas del desarrollo. Revista Latinoamericana de Economía*, *32*(125). https://doi.org/10.22201/iiec.20078951e.2001.125.7389

Gereffi, G. (2014). Global value chains in a post-Washington Consensus world. *Review of international political economy*, 21(1), 9-37.

Granados, V. M. A. M., & Alvarado, T. E. G. (2009). El vínculo empresarial en ausencia del mecanismo de cooperación y su impacto en el desarrollo. El caso de la industria de la confección mexicana. *Revista de Ciencias Sociales (Cl)*, (22), 7-21.

Hall, J. A. (2006). "*China Casts a Giant Shadow" The Developing World Confronts Trade Liberalization and the End of Quotas in the Garment Industry*. J. Int'l Bus. & L., 5, 1.

Harrison, A., & McMillan, M. (2007). On the links between globalization and poverty. *The Journal of Economic Inequality*, *5*(1), 123-134.

Hirschman, A. O., & de Silva Herzog, M. T. M. (1961). *La estrategia del desarrollo económico (Vol. 2)*. Mexico: Fondo de Cultura Económica.

Hirschman, A. (1968). La economía política de la industrialización a través de la sustitución de importaciones en América Latina. *Revista El Trimestre Económico*, *35* (140), pp. 625-658.

Inexmoda. Observatorio Económico. (2012). *El sector Textil Confección en Colombia Retos y Oportunidades*, Colombia: Inexmoda.

Inexmoda. (2015). *Evolución del negocio de la moda. Trascendiendo límites con prospectiva [Infográfico]* Colombia: Inexmoda.

Institución Universitaria ESUMER. (2011). *Investigación de las características económicas de la cadena productiva hacia un sistema moda en Medellín y el Valle de Aburrá*, Colombia: Institución Universitaria ESUMER.

Kanungo, A. K. (2012). China's Textiles Sector: Performance and Challenges. *Transnational Corporations Review, 4*(2), 61-89.

Luraschi, A. (2010). *Industria tessile, competitività, sviluppo economico: insegnamenti dal caso indiano*. Doctoral Dissertation. Università degli Studi dell'Insubria].

Medina Jiménez, L. (2018). *Industrias ligeras y aglomeraciones territoriales en Latinoamérica: el caso del cluster textil de Medellín (Colombia)*. Doctoral Dissertation, Dipartimento di Economia, Dottorato in Economia della Produzione e dello Sviluppo, Universitá degli Studi dell'Insubria, Varese.

Morris, M., & Barnes, J. (2009). *Globalization, the changed global dynamics of the clothing and textile value chains and the impact on Sub-Saharan Africa.*

Nordås, H. K. (2004). *The Global Textile and Clothing Industry post the Agreement on Textiles and Clothing*. (No. 5). WTO, discussion paper, p. 36. http://www.wto.org/english/res_e/booksp_e/discussion_papers5_e.pdf

Ocampo, J. (2011). Seis décadas de debates económicos latinoamericanos. *Initiative for Policy Dialogue*, 25-25. http://policydialogue.org/files/events/background-materials/SEGIB-PNUD_Ocampo-final.pdf

Roberts, B. H., & Enright, M. J. (2004). Industry clusters in Australia: recent trends and prospects. *European planning studies*, *12*(1), 99-121.

Scott, A. & Garofoli, G. (2007). The regional question in economic development. In A. Scott & G. Garofoli (eds.), *Development on the ground* (pp. 1-22). New York: Routledge.

Schmitz, H. y Nadvi, K. (1999). Clustering and industrialization: introduction. *World Development*. *27*(9), pp. 1503-1514.

Waits, M. J. (2000). The added value of the industry cluster approach to economic analysis, strategy development, and service delivery. *Economic development quarterly*, *14*(1), 35-50.

Wolfe, D. A., & Gertler, M. S. (2004). Clusters from the inside and out: local dynamics and global linkages. *Urban studies*, *41*(5-6), 1071-1093.

Yu, J., & Jackson, R. (2011). Regional innovation clusters: A critical review. *Growth and change*, *42*(2), 111-124.

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