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Journal of Microfinance Planning and Control

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Presentation of Content

In the first article we present, *System of Management of Safety: Master Program of Sanitization in a Company of the Region*, by FORNÉS-RIVERA, René Daniel, GONZÁLEZ-VALENZUELA, Elizabeth, LÓPEZ-FIGUEROA, Julio César and GONZÁLEZ-DEL REAL, Melanie Alexandra, with adscription in the Instituto Tecnológico de Sonora, in the next article we present, *Implementation of the lean ergonomics approach to process performance improvement*, by LÓPEZ-ACOSTA, Mauricio, GARCÍA-VILCHES, Susana, VELARDE-CANTÚ, José Manuel and CHACARA-MONTES, Allán, with adscription in the Instituto Tecnológico de Sonora, in the next article we present, *Intellectual Capital Management Model for Competitiveness in a Beach Hotel: Case Study in the City of Manzanillo, Colima*, by LINO-GAMIÑO, Juan Alfredo, BARRAGÁN-VÁZQUEZ, Carlos Hugo, LÓPEZ-JIMÉNEZ, Sergio Felipe and CHANG MUÑOZ, Eduardo, with adscription in the Universidad de Colima, and the Universidad de la Costa, in the next article we present, *Analysis of financial management for decision making in medium-sized enterprises in Ciudad Juarez, Chihuahua*, by MEJÍA-HERNÁNDEZ, Marisela, CASTILLO-GALEANA, Abelardo, DURÁN-ORTIZ, Martín Joel and VEGA-MARQUEZ, Fátima, with adscription in the Universidad Tecnológica de Ciudad Juárez and the Universidad del Caribe.

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System of Management of Safety: Master Program of Sanitization in a Company of the Region

Sistema de Gestión de Inocuidad: Programa Maestro de Sanitización en una Empresa de la Región

FORNÉS-RIVERA, René Daniel, GONZÁLEZ-VALENZUELA, Elizabeth, LÓPEZ-FIGUEROA, Julio César and GONZÁLEZ-DEL REAL, Melanie Alexandra

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Abstract

Safety is established as an essential part of the food industry because it guarantees that the products consumed are of quality and do not cause harm to health. The company studied does not have a Master Sanitation Program (PMS), an essential tool to perform health tasks in it. In order to meet the requirements established in ISO 22000: 2018, Food Safety Management System (SGIA), the company needs to have a PMS in its processes to improve its Food Safety Management System. The procedure of this investigation consisted of: identifying the main process; Sanitation processes; determine the percentage of compliance with the SGIA; determine SOPs; identify type of sanitation and frequency of cleaning of areas; establish training plan; and elaborate PMS. The main results were: determining the percentage of compliance with the SGIA through an audit through a checklist; realization of SOPs of each existing equipment in the process area; realization of an equipment cleaning matrix indicating the type of sanitization required; tabulation of plant areas including frequency of cleaning and preparation of PMS, concluding satisfactorily with the objective

Safety, Management, Sanitization

Resumen

La inocuidad se establece como parte esencial de la industria alimenticia ya que garantiza que los productos que se consumen sean de calidad y no causen daño a la salud. La empresa estudiada no cuenta con un Programa Maestro de Sanitización (PMS), herramienta esencial para realizar tareas de sanidad en la misma. Con el propósito de cumplir requisitos establecidos en la norma ISO 22000:2018, Sistema de Gestión de Inocuidad Alimentaria (SGIA), la empresa requiere contar con un PMS en sus procesos para mejorar su Sistema de Gestión de Inocuidad en Alimentos. El procedimiento de esta investigación consistió en: identificar el proceso principal; los procesos de sanitización; determinar el porcentaje de cumplimiento del SGIA; determinar SOPs; identificar tipo de sanitización y frecuencia de limpieza de áreas; establecer plan de capacitación; y elaborar PMS. Los principales resultados fueron: determinación del porcentaje de cumplimiento con el SGIA a través de una auditoría por medio de una lista de verificación; realización de SOPs de cada equipo existente en área de proceso; realización de una matriz de limpieza de equipos indicando el tipo de sanitización necesario; tabulación de áreas de la planta incluyendo frecuencia de limpieza y elaboración de PMS, concluyendo satisfactoriamente con el objetivo.

Inocuidad, Gestión, Sanitización

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Introduction

In the history of man, food has been the strongest evolutionary factor. Its progress dates back to about seven million years, during which time it underwent transformations. At first, it was based on fruits, but as the development of civilizations, it became more diverse and in addition to fruits and other vegetables, it included roots and nuts (Montaño, 2018). Globally, the snack market has a value of more than 26 billion dollars, according to Business Wire data. This is because they are used as a snack (High Level, 2018). According to Euromonitor International, Latin America has 12.1% of the global salty snack market. Growth is expected to be 6.2% from 2016 to 2021 since processed snacks have a high percentage of growth in all categories (Rioja-Scott, 2018).

Mexico registers the highest level in the world in purchases that are mainly aimed at soft drinks, cookies and the well-known “snacks or snacks”. The global average of visits for the purchase of mass consumption items is 100 per year; while the Mexican makes on average 260 annual visits (FORBES, 2018).

The snack or snack sector is one of the most relevant among Mexican consumers. The study emphasizes that 62% consume them several times a week, 23% daily and only 15%, once a week. There is a wide variety of snacks, which have different flavor characteristics, such as: potatoes, tortilla chips, wheat flour rinds, pork rinds, peanuts, etc. (Rioja-Scott, 2018).

Mexico continues to be one of the most important markets for ultra-processed foods since it is the country that has the highest consumption of this type of food per capita, with 214 kilos. Among what are considered ultra processed foods are sugary drinks, snacks or snacks, cereals and sweets as main categories (Stott, 2018). According to the National Institute of Statistics and Geography (INEGI), fried snacks generate a market with a total value of \$ 3,232 million in the country, and a production of 22,558 tons. In this area, french fries, pork rinds, etc. are concentrated. Taxes on junk food are not an obstacle to the consumption of fried potatoes in Mexico because, according to Kantar Worldpanel, in 2017, 90% of Mexican households acquired french fries and bought them approximately 13 times a year (High Level, 2018).

Sonora is a national leader in potato production, because it is the main input for frying / snack making. Likewise, Sonora makes the assortment of the national internal market and in the same way the state market (SAGARHPA, 2018).

Food safety refers to the existence of hazards associated with food at the time of consumption, and can occur at any point in the food chain, adequate control through it is essential. Thus, food safety is ensured through the combination of efforts of all parties involved in the food chain (ISO 22000, 2018).

Ensuring and guaranteeing food safety is a necessity that is carried out worldwide. In order to meet this expectation, it is necessary to design, implement, maintain and certify the management of the productive processes of food processing along the entire production chain. The certification of certain standards demonstrates safety management within the company, allowing it to have control of the processes, manage suppliers, provide responses to buyers and guarantees to final consumers (IRAM, 2017).

Food establishments must ensure that all facilities, machinery, utensils and other equipment are properly cleaned and disinfected so that they are not a source of food contamination. Therefore, it is convenient to have a sanitization program (cleaning and disinfection) that clearly specifies the area or equipment to perform the work, the way in which it should be performed, the frequency, the products and utensils needed, the safety material and those responsible for each activity, in order to allow the removal of dirt and to control the bacterial population properly; also that the facilities and equipment are prepared for the next production cycle (Delgado and Díaz, 2006).

The company under study serves the snack market; The production manager mentions that its objective is to transform the inputs into a finished product that meet the safety and sanitation requirements for its consumption. Within the plant is the production area, seasoning, packaging, quality, laboratory, maintenance offices, administrative area, warehouse of raw material and finished product (Production Manager, 2019).

The production area has three lines: extruded, flour and toast. In the extrudate line, the product goes through extrusion, baking, seasoning and packing processes, in the flour line, the product goes through frying, cooling, seasoning and packing processes, and finally, in the toast line, the product goes through molding, frying, cooling, seasoning and packaging processes.

The inputs are: water, electricity, equipment, instruments and tools, oil, flour, pasta, dyes, flavorings, salt, corn, specifications of quantities for mixing, production order, packing material and cleaning material. The products are a great variety of snacks, mainly fried foods, tortillas or toasts, being seasoned with different flavorings, which gives them spicy and salty flavors. Also, the product is packaged individually and in their respective boxes.

The person in charge of safety in the company, mentions that there is no Master Sanitation Program (PMS), where the cleaning of process equipment, areas, buildings and facilities with their frequency, and personnel is documented. involved, as well as chemicals, safety equipment, tools and equipment for cleaning. It is essential to comply with this program, because it is part of the Prerequisite Program (PPR) that must be implemented in the Food Safety Management System (SGIA) according to ISO 22000: 2018 (Gión, 2019). Table 1 shows the types of pathogens or contaminants that may exist in the food production process, including their description.

Pollutant	Description
Biological	They constitute bacteria, parasites, fungi, viruses, and prions, causing food poisoning.
Physical	Any foreign material present in a food that comes from processing operations or external contamination. (Presence of metals, rings, remains of packaging material, plastics, glass, metals).
Chemical	Agents that may be present naturally in food; they may be products resulting from animal or plant metabolism or they may also be due to accidental contamination (herbicides, pesticides, cleaning products).

Table 1 Biological, physical and chemical contaminants
Source: Félix (2016)

The purpose of having a PMS lies in the growing concern of consumers for foods free of physical, chemical or biological pollutants that may cause harm to health, however, there are no demands or complaints of the clients.

Therefore, the company seeks to reduce these risks, ensuring the safety of its products, through this program, so that it is more practical to take care of cleaning and disinfection aspects throughout the plant, and that, at the same time, it is complying with the requirements of the SGIA. It is important to mention that the PMS has certain requirements which must be met as: cleaning and disinfection; general requirements; cleaning and disinfection agents and tools; cleaning and disinfection programs; onsite cleaning systems; and monitoring of sanitation effectiveness (Girón, 2019).

Problem Statement

Safety is the responsibility of the food industry because customers want to be sure that the products they consume are safe. Having a PMS in the company is extremely necessary because it indicates the specific tasks related to cleaning and disinfection that must be performed in plants that handle food to obtain a safe product, suitable for human consumption. The PMS will be carried out in order to comply with the requirements of the SGIA determined by the ISO 22000: 2018 standard. As described above, it is established that there is a need for a PMS in the plant, because it is part of the SGIA established by ISO 22000: 2018 and it is lacking.

Objective

Prepare a Sanitation Master Program in the processes of the company under study, through the requirements established in ISO 22000: 2018, to access a possible food safety certification.

Literature review

A management system is a tool that allows you to optimize resources, reduce costs and improve productivity by evidencing data in real time that will allow decisions to correct failures and prevent the occurrence of expenses (FAO & WHO, 2016), cited in (Layme & Párraga, 2019). The adequate structuring of the food hygiene health management systems is a complex system that integrates aspects such as: public policies, capacity to comply with international guidelines, epidemiological monitoring and surveillance systems, and timely and preventive management in the face of emerging risks (Tafur, 2009; Moussiaux et al., 2017), cited in (Rojas & Barrera, 2019).

ISO 22000 is an ISO series standard focused on food, which defines and specifies the requirements to develop and implement a Food Safety Management System (SGIA), in order to achieve international harmonization that allows an improvement in food security during the course of the entire supply chain (AVR, 2016). This standard also integrates into the SGIA, the principles of the Hazard Analysis and Critical Control Point (HACCP) system and the application stages developed by the Codex Alimentarius Commission.

Through auditable requirements, it combines the HACCP plan with Prerequisite Programs (PPR) or its equivalent term Good Manufacturing Practices (BPM), they are considered a set of guidelines established to ensure a clean and safe working environment that, at the same time, avoid food contamination at the different stages of its production, industrialization and commercialization (ISO 22000, 2018b). The ISO 22000 (2018) standard states that, the adoption of a SGIA is a strategic decision for an organization in order to improve its overall performance in food safety.

The presence of resilient systems focused on health food management is related to robust and efficient structures, aimed at ensuring products for consumers (Qekwana, McCrindle, Oguttu, & Grace, 2017). In this sense, the systems that support food safety become a strength for the economies, and national and international markets by guaranteeing food that is fit for consumption (Kotsanopoulos & Arvanitoyannis, 2017; McDermott & Wyatt, 2017), cited in (Rojas & Barrera, 2019).

The Codex Alimentarius Commission was created by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) in order to implement its joint program on food standards (FAO, 2018). It is a collection of food standards and related texts accepted internationally and presented in a uniform manner. The purpose of these food standards and related texts is to protect the health of the consumer and ensure the application of fair practices in the food trade. The purpose of its publication is to guide and encourage the development and establishment of definitions and requirements applicable to food to favor its harmonization and, thus, facilitate international trade (ANUAA, 2018).

At the international level, the role of the Codex Alimentarius Commission as a coordinator of food standards and as a technical reference of the World Trade Organization (WTO) has been strengthened, incorporating and developing safety criteria strengthening international trade Martín (2003), cited in (Navarro & Zúñiga, 2019).

A PMS includes the cleaning of the equipment, tools, containers, facilities, and identifies the area or equipment to be cleaned, the period of time between each cleaning and the person responsible for performing the task. To create a PMS, cleaning frequencies must be defined as tasks. When they first develop, the appropriate frequencies may not be known. In these cases, an estimate must be made, which can then be adjusted more or less frequently using the results of the environmental monitoring and integrated pest management programs to validate the frequencies (Food Partners, 2017).

The importance of this program in food establishments is highlighted as it prevents their contamination by surfaces that contact them directly. Likewise, it is indicated in these works that to guarantee good hygienic / sanitary behavior in food establishments it is essential that material conditions exist to facilitate cleaning and disinfection activities (Guzmán and Arteaga, 2017).

Methodology

The object of study was the entire plant; The support materials were: a) ISO 22000: 2018 SGIA Standard. This rule specifies the PPRs to comply with the SGIA, which was used as a guide for the procedure; b) ISO / TS 22002: 2009 Standard Technical Specification of PPRs for cleaning and disinfection; It was used as support to develop the PMS; c) ISO / TR 10013: 2001: Guidelines for the documentation of the Quality Management System (QMS). This standard was used as a guide to obtain the steps for the development and maintenance of the necessary documentation to ensure a QMS; d) Format for writing the PMS, granted by the Document Control area of the company under study; and e) NOM-251-SSA1-2009 hygiene practices for the food, beverage or food supplement process, used as a reference when performing the Standardized Sanitation Operating Procedures (SOPs).

Below is the procedure required to fulfill the objective, developing the PMS in accordance with ISO 22000: 2018.

1. Identify the main process. In order to know the production process, a tour of the plant was carried out by throwing a descriptive argument through a SIPOC.

2. Identify sanitation processes. The surfaces and equipment to be sanitized were identified by means of a route, where the production lines are described, including the equipment, the number of operators, responsible personnel and flowcharts for the equipment.

3 Determine percentage of compliance with the SGIA. A checklist was designed based on the ISO 22000: 2018 standard, which was used to conduct an audit of the SGIA, in order to review the requirements of the standard and obtain the current compliance percentage. With this information it was determined which requirements are related to the PMS and a graphic representation of the results was elaborated to visualize the sections that present major deficiencies.

4. Determine SOPs. Sanitation processes were written in documents that describe (through instructions or steps) the sequence of operations that should be followed in the process. ISO / TR 10013: 2001 was taken as a reference and the purpose, scope, definitions, those responsible, the description of the procedure, the required formats, references and annexes were established. Also, NOM-251-SSA1-2009 was considered when capturing the procedures, considering criteria established by the standard.

5. Identify type of sanitation and frequency of cleaning of areas. Through the route previously made, the production lines that the plant has, and through a talk with the general manager and quality analyst, the names of the products (not mentioned), as well as the limitations or allergens (will not be mentioned) with which each product has. All this was reflected in a cleaning matrix, which indicates the type of cleaning that should be performed on the equipment, depending on the product that started and ended in production. Since each product has certain types of limitations and some of them could be allergenic, therefore the type of cleaning would depend on this.

To achieve this, it was necessary to use conditional formulas in an xls format. The frequency of cleaning of all the most general areas of the company under study was determined, as well as that of the equipment in the process, including these, and the ideal duration of the activity. All with information provided by cleaning managers and sanitation operators. These data were tabulated and classified according to the corresponding area.

6. Develop support material for training. In relation to the sanitation processes for the company's employees, especially for the 45 operators and three production supervisors, support material was developed with the purpose of training them in the identification of risks and dangers that may cause damage to their health or that affect the safety of the product and how to prevent them, the pollutants that may occur, the proper use of cleaning utensils and safety equipment for personnel performing sanitation tasks.

7. Prepare Master Sanitation Program. The PMS document was written, so that the company's general activities were included in terms of sanitizing them, indicating their frequency, cleaning method and those responsible for carrying it out. In addition, ISO / TR 10013 was taken as a reference to establish the purpose, scope, definitions, those responsible, the description of the procedure, the required formats, references and annex. In the description section, the tables were added with the frequency corresponding to each equipment, surface or utensil, the SOPs, the cleaning matrix and the training plan.

Results

Below is what you get when developing the procedure.

1. Identification of the main process. With the information collected from the route of the production process that includes the four production lines that are managed in the plant, a description is made of it:

Suppliers: the suppliers of the processes are, warehouse of raw material that is where it is maintained and management who provides information.

Inputs: As inputs to the process, there is a raw material which is flour, flavoring, coloring, oil, water, salt and peanuts. In addition, the recipe of each product as it indicates specific quantities and finally, a production plan.

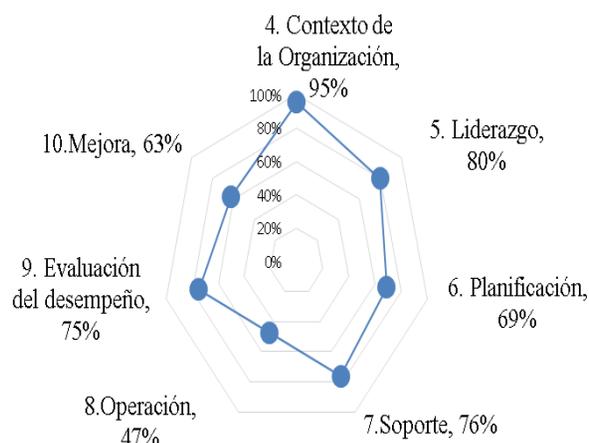
Process: Where the 4 existing production lines in the plant are observed, which are Toasted, Mix, Extruded and Flour, indicating the process through which each product that is made in each line passes.

Output: In which is packed product that is the one that is addressed directly to the customer. Product for reprocessing, that there could be some defect in the wrapper, however, the product did meet the standard, so it is packed again. Non-compliant product, which did not meet the standard. Merma, which is a product that is discarded. Production registration and non-compliant product registration, files with information obtained from what was explained above.

Customers: Warehouse of finished product, where the product is stored in boxes for distribution. Waste deposit, dedicated to locate the product to be discarded. Production supervisor and production manager who will obtain the records mentioned above.

2. Identification of sanitation processes. The processes have production lines which are tortilla, mix, flour and extruded with the areas of process, seasoning and packaging, with the cleaning procedure that must be followed for the proper sanitization of the equipment. In total, 13 diagrams resulted, of which two (Kneader and Dough Feeder) belong specifically to the tortilla line, (Bands, fryer, oven, seasoning cylinder) can belong to two or more lines and were embodied in a single diagram because they have The same procedure. The remaining ones (floors, Hawaiian curtains and walls) correspond to the sanitation department. Due to their space and size, the flowcharts and the layout of the process are not shown.

3. Determination of the percentage of compliance with the SGIA. The result of the audit in the SGIA was 61%. The percentage of compliance with each clause can be seen in Graph 1.



Graphic 1 Percentage of compliance with each clause of ISO 22000: 2018

Having obtained the previous results, it was determined that clause 8 presents a greater opportunity for improvement, due to the lower percentage of compliance, see Graphic 2.



Graphic 2 Percentage of compliance with clause 8 of ISO 22000: 2018

As can be seen, the SGIA has opportunities for improvement, especially in clause 8, however, the company is in the process of meeting requirement 8.5 and its derivatives when implementing the HACCP plan, but for this it is necessary to meet requirement 8.2 to comply with the PPR established in the standard and then attend to its derivatives once the PMS is implemented.

4. Determination of SOPs. Each SOPs is a format with a series of tables (for space and size will not be displayed) which are composed of: name; purpose; scope; definitions; responsibilities; description; required forms; references; change history, annexes; frequency; and flow chart.

Each team and areas had a PCOS developed, which are: a) kneader; b) conveyor belts; c) mass feeder; d) seasoning cylinder; e) fryer; f) humidifier; g) extruders; h) oven; and i) packing machine. In addition to areas such as: a) floor cleaning; b) cleaning of Hawaiian curtains; c) toast line cleaning; and d) mix line cleaning; The above is carried out as a procedure for the sanitization of each equipment which was established in documents that indicate the specific tasks related to the cleaning that must be performed on the equipment to obtain an innocuous product..

5. Identification of type of sanitation and frequency of cleaning of areas. In the cleaning matrix, see Table 2, the production lines and the products that are produced corresponding to their line or if they are only packaging products without modification are shown. It is noted that this includes the type of run (if it ends or starts) and the limitations. This works with respect to the product that starts and ends and this depends on the allergen or limiting material it contains. Based on this and with the help of conditionals, it is possible to determine the type of cleaning, whether it is deep or dry.

Table 2 Matrix of Cleaning in production lines

In the cleaning tables of areas each area of the company is indicated in general, establishing the frequency of cleaning of the same, being these: exteriors, offices, parking lots, toilets, warehouses, production offices, engineering and similarly, of the process teams, including the duration of each activity (per space will not be shown).

6. Development of support material for training. In order that the managers can use this material to train and adapt the personnel involved for the responsible execution of the tasks specified in the PMS, this material was prepared considering the following: a) identification of risks in the handling of chemical substances; b) cross contamination: color coding; c) safety hazard identification: biological, physical and chemical contaminants; d) safety equipment: Personal Protective Equipment; e) risk prevention; f) hazards: Good Manufacturing Practices; and g) recommendations.

7. Preparation of Master Sanitation Program. All previously made products (process description, equipment tables and frequency of cleaning areas, cleaning matrix of production lines, support material for training) were taken and placed in their corresponding section making use of ISO T / R 10013, and the document control format established by the company and the section procedures are described in each of the tabulations of the frequency of cleaning of areas and equipment, followed by the cleaning matrix and the training support material (because it is a large document, the PMS is not shown).

Conclusions

It is concluded that the objective of the project was met, when carrying out a Sanitation Master Program at the proposed level for a possible certification, because the requirements of ISO 22000: 2018 were reviewed, and clause 8. Special attention was given to PMS. of products that comprise it, as well as frequency tables for cleaning areas, cleaning matrix in production lines, training plan, process lay-out and SOPs, which are extremely necessary for those responsible for the activities of sanitation execute their activities properly.

It is important to mention that it was possible to know the current compliance status of the company in terms of ISO 22000: 2018, since knowing it, it can take relevant actions and address the critical points or areas of opportunity and thus raise the percentage of compliance.

The importance of complying with this program is essential for food business, since it provides the necessary documentation of the guidelines and procedures that must be carried out to carry out the cleaning and disinfection activities of equipment, areas, facilities, etc., where the product is handled, so that it is safe and of the highest quality.

Recommendations

During the development of the project it was observed that the cleaning procedures were not performed as they should. This was due to the lack of the necessary documentation to facilitate this task to the operator. That is why it is recommended that those responsible for carrying out the activities have access to these documents and thus avoid any type of failure. It is also recommended to train those responsible for carrying out sanitation activities monthly.

Finally, it is worth mentioning that it is very important that the company meets the requirements of the ISO 22000: 2018 standard, making use of its most recent version and that it applies continuous improvement throughout the SGIA to be in possibilities at the moment of wanting to access a possible certification.

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Implementation of the lean ergonomics approach to process performance improvement**Implementación del enfoque lean ergonomics para la mejora de desempeño de procesos**

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Abstract

Actually market is subject to constant change which forces organizations to innovate with new strategies that provide greater productivity to maintain a competitive advantage, one of the flexible tools used are Lean systems. However, in most of the improvements registered in these systems, the non-ergonomic elements have not been considered as waste, which have high costs for companies. This document presents an approach to integrating Lean systems with Ergonomics, the main tools used were Value Stream Mapping, SIPOC, Kaizen, REBA Method and NIOSH. As a result, a risk identification was obtained in 86% of the 26 activities of three processes analyzed, mainly by postures, manual lifting of loads and repetitiveness, with the improvements developed, the 25 controlled risks were reduced high to medium or low and obtained an average reduction of 32% in the cycle time of operations, making each process more efficient.

Lean Manufacturing, Ergonomics. Improvement of processes

Resumen

Los constantes cambios en el mercado obligan a las organizaciones a innovar con nuevas estrategias que brinden mayor productividad para mantener una ventaja competitiva, una de las herramientas ampliamente utilizadas son los sistemas Lean. Sin embargo, en la mayoría de las mejoras registradas en estos sistemas no se han considerado los elementos disergonómicos como un desperdicio, los cuales generan altos costos para las empresas. En este documento se presenta un enfoque de integración de los sistemas Lean con la Ergonomía, las principales herramientas utilizadas fueron Value Stream Mapping, SIPOC, Kaizen, Método REBA y NIOSH. Como resultado se obtuvo una identificación de riesgos en el 86% de las 26 actividades de tres procesos analizados, principalmente por posturas, levantamiento manual de cargas y repetitividad, con las mejoras desarrolladas se lograron reducir los 25 riesgos considerados altos a medio o bajos y se obtuvo una reducción promedio del 32% en el tiempo de ciclo de las operaciones, haciendo más eficiente cada proceso.

Manufactura Esbelta, Ergonomía, Mejora de Procesos

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Introduction

The model on the integration of ergonomics and lean manufacturing systems based on the various tools has been presented in various organizations, (Srinivasa and Malay, 2016). While current perspectives consider lean manufacturing as a socio-technical system according to Cullinane, Bosak, Flood, and Demerouti, (2014), with a focus beyond workshop skills to reflect a broader management philosophy that incorporates tools and Human resource practices. Monroe, Fick, & Joshi, (2012), adds that a cost-saving analysis can be performed to demonstrate the impact that ergonomic elements can have on a project specifically increasing productivity and quality can be traced and quantified as a tracking metric.

A common tool to analyze and improve production processes is the Value Stream Mapping (VSM), it is a lean tool that aims to reduce waste. Integrating ergonomics into VSM allows simultaneous consideration of the production system's performance and physical risk factors for the development of skeletal muscle disorders in the manufacturing industry, (Jarebrant, et al., 2015). Lean Ergonomics improves the factors of the work environment in a "Value Stream Mapping" tool of lean manufacturing by identifying risks in the workstation where it evaluates each work activity of the process, (Kasper, 2017).

Prins (2004) explains that through the use of lean strategies with ergonomic principles, safety and job satisfaction tools, both workers and the general process can benefit. Mulyati, Suharno and Muharom, (2015) indicate that the combination of lean thinking and ergonomics are the result of a system where not only the worker is as efficient, but also safe and comfortable while trying to produce the best possible product. Cirjaliu & Draghici, (2016) mention that the differences between Lean theory and the needs of employees for feedback and participation directly with the company, helps reduce stress in lean manufacturing through misunderstanding, collaboration internal between employees and managers. In 2015 Dos Santos, Vieira, and Balbinotti developed an investigation within an automobile vehicle production factory, where Lean Manufacturing tools were implemented adding ergonomic evaluation and working conditions.

In this case, the reduction between the periods from 2013 to 2015 was analyzed until the month of March, a reduction of 23% was obtained compared to the performance in the company. In the work presented by Mulyati, Suharno and Muharom (2015), they applied the lean ergonomics philosophy in a cookie plant in the Yogyakarta region, Indonesia, where ergonomic waste was identified; the most important was the movement that must be resolved immediately with improvements in the vertical and horizontal design.

The great growth in manufacturing has created a lot of economic, environmental and social problems around the world generating the rapid elimination of local waste, (Kumar, 2014). Companies are looking for solutions to increase flexibility and reduce delivery time, the global market is forcing companies to find new ways to reduce costs while maintaining or increasing their quality level. However, Márquez, (2012) mentions that ergonomic principles continue to be second. Solís and Madriz, (2009) complement that many of the risk factors such as strength, repetition and inappropriate postures are the result of an inefficient and poor design of work environments and bad practices in them.

Kim (2017) mentions that when Lean tools are implemented effectively, a culture of worker participation and empowerment is created and a positive work environment is established in which changes in the workplace are expected and accepted. Certainly, the improvement in the work environment achieved by the slender manufacturing is desirable, because through the organization and description of the activities to be carried out, there is a greater control of movements and flow of materials / people in the work stations, which eventually reduces workers' exposure to unplanned injuries and accidents, (Peralta et al, 2017).

According to Yang, Hong, and Modi, (2011), lean manufacturing is complemented by other tools that help balance lines, supply flow of parts and products, identify the process value chain, without neglecting safety and ergonomics. Morse in 2014 concludes that the need for rapid employee participation to adapt and meet demands, the right combination of security, and satisfaction to avoid conflicts.

Methodology

Subjects of study

The present study is carried out in a pork processing company, specifically in the area of processing within the processes of Smoked Sausage, Sausage Mixing and Sausage, Brine. It is a company dedicated to processing and marketing pork and its derivatives nationally and internationally, has a capacity of 500 tons of monthly production, has 165 people, the main customers are national.

Process

Preparation of the Current VSM: at this stage the operations are analyzed through the Value Stream Mapping VSM tool to know the current situation of the processes, where the following elements should be considered:

Process Diagram Elaboration. Analyze the supply chain in detail for each process using the SIPOC Diagram.

Ergonomic Risk Identification. Identify risks in each of the process operations using the BRIEF / BEST Method, determining their risk condition.

Ergonomic Risk Assessment. Evaluate workstation activities using ergonomic methods according to the results of the risk identification in order to define redesign options that reduce risk and obtain acceptable levels of exposure for the worker.

Development of the future VSM. At this stage, ergonomic improvements will be integrated into a future VSM to compare the previous efficiency with the current one in the operations of the processes and the assessment of the ergonomic risks found, it should be considered:

Design of Improvement Proposals. Establish improvement actions using Lean tools to reduce waste that occurs during processes, considering ergonomic conditions and factors. Ergonomic Risk Assessment. Evaluate the activities in the work stations with the implementation of improvements to verify changes as interaction between the human being and the elements used in the operations of the process.

Design of a control plan. As a last stage, a control plan for the assurance of continuous improvement should be developed, establishing a matrix of priorities and responsibilities, structuring the design, selection and control methods to reduce process variation.

Materials

- Nordic Questionnaire
- BRIEF / BEST questionnaire
- Photographic camera
- Fields of evaluation methods
- Ergo Soft Pro 4.0 software
- Microsoft Visio Professional 2016

Results

The SIPOC tool was used to visualize the study area in detail and learn about the operations involved in each process, see tables 1-3. Adding elements such as activities to be carried out, the person in charge of said activity, who provides it, specifying the entrance of the process, its exit and the client, resulting in the analysis of the current situation of each operation during its process and identify the personnel that works , which benefits the next stage of this study, facilitating its identification and risk assessment.

Sipoc "Smoked Embutido Process"						
Exercise	Responsible	Provider	Entry	Process	Exit	Client
Take product to the sausage area	Massage Operator	Massage	Raw Material (product)	The necessary amount of product is provided	Necessary product in the area	Sausage
Prepare machine	Inlay Operator	Cleaning	Clean machine parts	The correct parts are placed on the machine	Armed machine	Sausage
Load tova	Sausage operator	Massage	Raw material in the area	With the help of a bucket the operator made the product to the hopper until it was filled	Loaded hopper	Sausage
Prepare molds	Sausage operator	Cleaning	Molds with cover	The molds are unpacked and placed on the worktable	Ready molds on the work table	Sausage
Prepare stoking	Sausage operator	Warehouse	Stokin and Liquid Smoke	The stokin is bathed and squeezed in liquid smoke	Smoked stoking	Sausage
Embed and weigh	Sausage operator	Warehouse	Stokin and scale	The product is stuffed in smoked stoking	Product stuffed in stokin with the correct weight	Molding
Mold and cover	Sausage operator	Cleaning	Molds with cover	The product embedded in the mold is placed and accommodated	Sausage product molded	Cage
Place in cage	Sausage operator	Cleaning	Cage	Product is put molded in the cage	Cage-molded product	Cooking Room

Table 1 SIPOC of the Smoked Sausage process

Sipoc "Chorizo Mixing and Sausage Process"						
Activity	Responsible	Provider	Entry	Process	Exit	Client
Take product to the area	Grinding operator	Grinding	Raw material (product)	The necessary amount of product is provided	Product in the production area	Mixer
Load	Grinding operator	Grinding	Raw material in the area	The meat is loaded by an elevator	Meat in process make mixed	Mixer
Ingredient Preparation	Mixer operators	Cooling room	Soy, coloring, marinade	Preparation of mp in tubs to be loaded	Ingredients preparation	Mixer
Mix	Mixer operators	Warehouse	Ingredients	Turn on mixing machine	The mixture of soy, marinade, coloring	Mixer
to download	Mixer operators	Warehouse	Tubs, packs	A tub or packs is placed under the mixer	Mixed product	Mixer
Inlay	Sausage operator	Mixer	Packets	Place product in packs	Inlaid and labeled product	Stuffer
Monitor	Employee	Stuffer	Weighing machine	Product weighing is done	But allowed	Packing

Table 2 SIPOC of the Chorizo Mixing and Sausage process

SIPOC "Salmuera Process"						
Exercise	Responsible	Provider	Input	Process	Exit	Cliente
Agitator Filling	Brine operator	Ingredient Warehouse Office	Production program	Program Analyzed	Program analyzed	Operator de salmuera
Go for ingredients	Responsible	Provider	Water	Water supply on agitator	Water in agitator	Brine area
Place ingredients in table	Brine operator	Ingredient Warehouse Office	Plastic soap with ingredients	Transport ingredients to table	Ingredients placed on table	Brine operator
Empty ingredients	Brine operator	Water store	Ingredients on table	Add ingredients in shaker	Ingredients inside stirrer	Brine operator
Shake	Brine operator	Ingredient Store	Energized Agitator	Stir mixture of ingredients with water	Stirred mixture	Brine operator
Download	Brine operator	Brine operator	Stirred mixture	Download	Brine	Injection area

Table 3 SIPOC of the Brine process

Risk identification was carried out using the BRIEF / BEST method. The Brief / Best method was of great support in this study to identify the ergonomic risks that exist in each activity of the process and the part of the human body that is exposed to an injury and / or occupational disease, in addition in this survey they are considered physical pressures such as vibrations, low temperatures, problems with gloves etc. With the application of this method the identification of risks of each operation was obtained by process, where the anatomical regions of the human body exposed to suffer an injury or disease is: neck, back and hands.

Table 4 shows that in the Smoked Sausage process an ergonomic evaluation is required in all its operations except number 1, in Mixing and Chorizo sausage in most of its activities with the exception of operation 1 and 12 because it is under the level of risk, and for the last in the brine process in all but the initial activity.

Process	Operations	Risk value	Risk level
Smoked Sausage	1	>9	Low
	3, 4, 5	10 - 29	Medium
	2, 7, 6	<30	High
Sausage Mix and Sausage	3, 12	>9	Low
	1, 2, 5, 6, 7, 8, 9, 10, 11	10 - 29	Medium
	4	<30	High
Brine	1	>9	Low
	2, 3, 5	10 - 29	Medium
	4, 6	<30	High

Table 4 Risk Identification BRIEF / BEST Method of the Processed are

According to the results of the risk identification, the ergonomic methods to be used were determined, in the processes of Smoked Sausage and Brine, its main activities of suffering any injury is according to the Brief / Brest is due to improper postures and manual handling of loads, evaluating with REBA and NIOSH Method, for the process of Mixing and Sausage Sausage also identified risks by manual handling of load but with displacement and repetitive movements for them the MAC method and erg / IBV will be used respectively. To carry out this stage, a video was taken of the entire cycle of each process to determine the positions to be evaluated.

Risk assessment process Smoked Sausage. This process has 6 operations: Activities 1, 2, 4, 5 and 6 were high-risk identification due to inappropriate postures, so an ergonomic evaluation was carried out with the REBA Method. The positions are shown in Annex 1.

Reba Method "Smoked Embutid Process"												
Position	Operation	Trunk	Neck	Legs	Right arm	Left arm	Forearm Der.	Left forearm	Right wrist	Left wrist	Final score	Acceptable
1	1. Prepare Machine	2	7	3	3	5	5	5	1	1	3	Green
1	two.	6	3	3	3	5	5	5	3	1	5	Green
2	Load	8	1	7	3	2	1	1	7	1	10	Red
3	Hopper	8	7	2	8	8	1	1	1	1	10	Red
1	4. Prepare Stokin	4	7	3	5	5	5	5	1	1	5	Green
2		4	1	3	5	5	5	5	1	1	7	Yellow
3		4	1	3	7	5	5	5	1	7	1	6
1	5. Stuff and weigh	4	7	3	2	2	5	5	1	1	6	Yellow
2		4	1	5	5	3	5	5	1	1	9	Red
3		4	7	3	5	5	5	5	1	1	9	Red
1	6. Mold and Cover	8	1	5	7	2	5	1	1	1	9	Red
2		6	7	5	5	3	5	1	1	10	9	Red
3		8	7	5	7	3	5	5	1	1	9	Red

Table 5 Ergonomic evaluation of the Smoked Sausage process with REBA Method

The results of the evaluation using the NIOSH Method are the following: in the operation of preparing molds, an index of 0.66 was obtained for the origin, which indicates that the level of risk is low, however, for the destination, the horizontal position exceeds the centimeters allowed by the method, so for the purposes of the calculation the maximum amount allowed by the method was taken as a reference.

Therefore, it is obtained that there is a high risk, from the ergonomic point of view this task must be modified. For the activity to accommodate in a cage, an index of 0.97 for the origin and of 1.38 for the destination was obtained, which means that there is low risk for the origin and a moderate risk for the destination when carrying out the activity, however, the operators they may suffer injuries if they continue to do so in the same way, so it is convenient that tasks of this type must be redesigned or assigned to selected workers under control, see Table 6.

Niosh Method		H	V	D	A	F	C	O	F	A	Inds	Acceptabl	
		M	M	M	M	M	M	M	M	T	s	e	
Prepare Molds	Weight: 5.2 Kg	Origin	0.7	0.9	0.9	1	0.8	1	1	1	1	0.51	Green
	Frequency: 3	Destination	0.4	0.9	0.9	0.7	0.5	1	1	1	1	1.26	Yellow
Accommodate in cage	Weight: 10.5 Kg	Origin	0.7	1	0.9	1	0.7	1	1	1	1	0.97	Green
	Frequency: 4	Destination	0.8	0.8	0.9	0.9	0.7	1	1	1	1	1.15	Yellow

Table 6 Ergonomic evaluation of the Smoked Sausage process with NIOSH Method

Chorizo Mix and Sausage process risk assessment. This is one of the processes with more operations for the manufacture of its products has 12 activities which were applied different ergonomic methods such as the REBA Method to evaluate postures, ERGO / IVB repetitive movements, and the MAC Method for manual handling of loads with movement, taking as reference the following parts of the human body: neck, legs, forearm, wrist, trunk and other factors such as grip and load weight, in the Annex 2 the postures are shown, the postures evaluated with the REBA method are shown.

Table 7 shows the results according to the REBA Method for this process were in operations 1, 4, 9, 10 and 11 high risk, immediate action is recommended, operations 2, 5, 6, 7 and 12 is risk It is necessary to take preventive measures, activities 3, 6 and 8 are of negligible low risk and do not require analysis or preventive action.

During the identification of risks of operations with repetitive movements, such as the Embedding and Monitoring activity, this analysis was carried out using the ERGO / IVB Repetitiveness Method, generating immediate action results because they are high risk, causing the Be exposed to injuries in the future or suffer from a work-related illness. The following graph represents the color of red is the score that is 4 very high, see table 8

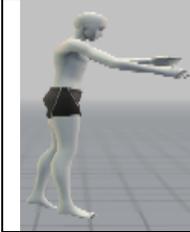
Position	Operation	Método REBA "Proceso Salmuera"										Final score	Acceptable
		Trunk	Neck	Legs	Right arm	Left arm	Right forearm	Left forearm	Right wrist	Left wrist	Final score		
1	1. Tank Filling	1	1	1	5	4	2	1	3	2	6	Yellow	
1	2. Go for ingredients	3	3	2	4	4	2	2	2	2	12	Red	
1	3. Place ingredients on Table	4	3	2	2	2	2	2	3	3	11	Red	
1	4. Empty ingredients in Shiree	3	3	1	2	2	2	2	2	2	9	Yellow	
1	5. Shake	5	3	3	3	3	2	2	3	3	11	Red	
1	6. Download	2	2	1	1	1	2	2	1	1	3	Green	
1	7. Washing	3	2	1	5	5	2	2	3	3	9	Red	

Table 7 Ergonomic evaluation of the Sausage Mixing and Sausage process with REBA Method

ERGO / IBV Method	Inlay		Monitoring	
	Punctuation	Acceptable	Punctuation	Acceptable
Factors	100		100	
Exposition (%)	100		100	
Arms repetitiveness	57		57	
Repetitive Hands	50		50	
CP Neck Risk	IV	Red	IV	Red
MP Neck Risk	IV	Red	IV	Red
LP Neck Risk	IV	Red	IV	Red
Hand Risk	IV	Red	IV	Red

Table 8 Ergonomic evaluation with the ERGO / IVB Method of the Sausage Mixing and Sausage process

Manual handling of loads was assessed using the MAC Method, obtaining a 14-point record, which according to the conditions represents a high risk and immediate actions during activities 1, 2, 3, 6, 7 and 10 see table 9.



MAC method		
Factors	Punctuation	Acceptable
Load weight and frequency	4	Yellow
Distance from hands to lumbar region	6	Red
Asymmetric load	0	Green
Postural restrictions	1	Green
Hand-object coupling	0	Green
Surface (floors)	2	Red
Other environmental factors	1	Yellow
Transfer distance	0	Green
Obstacles	0	Green

Table 9 Ergonomic evaluation with the MAC Method of the Sausage Mixing and Sausage process

Risk evaluation process Brine. The ergonomic risks of the 7 activities of the brine process were evaluated, in order to raise awareness of the level of risk, taking into account the positions and handling of operator loads, see Annex 3. With the application of the REBA Method they obtained the following results: with a level of Medium risk, only operation 1 what needs to be taken, High risk activities 2, 3, 4, 5, and 7 being urgent corrective action to improve the positions of the operator, and Low risk only operation 6, see table 10.

REBA METHOD "CHORIZO MIX AND EMBUTIDO"												
Position	Operation	Trunk	Neck	Legs	Right arm	Left arm	Right forearm	Left forearm	Right wrist	Left wrist	Final score	Acceptable
1	1. Load Soy	4	3	1	4	4	1	1	3	3	10	Red
1	2. Load Coloring	3	2	1	3	1	1	1	2	1	5	Yellow
1	3. Mix Soy with Dye	2	2	1	1	3	1	1	1	1	3	Green
1	4. Load Meat	4	2	2	2	1	1	1	1	1	8	Red
2	4. Load Meat	4	3	1	2	2	1	2	1	1	9	Red
1	5. Preparation of Adobo	3	2	1	4	4	1	1	3	3	7	Yellow
1	6. Load Adobo	3	3	1	4	3	1	1	3	2	7	Yellow
1	7. Load Butter	3	2	1	3	2	1	2	1	1	5	Yellow
2	7. Load Butter	4	2	1	3	2	1	1	1	1	6	Yellow
1	8. Mix Meat	2	2	1	2	3	2	2	1	1	3	Green
1	9. Download	5	2	1	2	4	2	2	2	3	9	Red
2	9. Download	4	3	1	4	3	2	1	2	1	9	Red
1	10. Weigh Mix	4	2	2	2	2	2	1	1	1	8	Red
1	11. Embed	4	2	1	3	4	2	1	2	1	8	Red
1	12. Monitor	3	2	1	3	3	1	1	1	1	5	Yellow

Table 10 Ergonomic evaluation with the REBA Method of the Brine process

For the evaluation of cargo handling, the NIOSH method was used; 3 activities were identified where the operator performs load lifting tasks, where all operations have a high risk; Immediate action is required. (see table 11).

Niosh Method		HM	VM	DM	AM	FM	CM	OM	PM	AT	Index	Acceptable
Go for ingredients	Weight: 25 Kg Frequency: 5	0.83	0.85	0.88	1	0.8	0.95	0.6	1	1	3.52	Yellow
Place ingredients on table	Weight: 8 Kg Frequency: 9	0.44	0.93	1	1	0.91	0.95	0.6	1	1	3.23	Red
Empty ingredients in shaker	Weight: 17 Kg Frequency: 1	0.83	0.94	1	0.86	0.91	0.95	0.6	1	1	1.96	Yellow
		0.4	0.93	0.95	1	0.88	0.95	0.6	1	1	3.89	Red
		0.6	0.82	0.95	0.71	0.88	0.95	0.6	1	1	4.11	Red

Table 11 Ergonomic evaluation with the NIOSH Method of the Brine process

Value flow map of the Processed Area

The VSM represents the current situation processed area divided into the processes of Smoked Sausage, Mix and Sausage Sausage, and Brine; which indicates the way in which the process flows, operating times, requirements, inventories, pieces per batch and the flow of customer and supplier information. It also shows the result of the ergonomic evaluation for each process and operation indicating the level of risk of each posture evaluated and method used, using a circle and boxes of red, yellow and green.

The manufacturing times of the processes are the following in Smoked Sausage of 147.37 min for the production of 1 lot corresponding to 137 pcs of the stubborn product, the Chorizo Mixing and Sausage process is 277 min per batch in pieces are 2450 of the product ranch sausage, and finally in brine for each batch 300 liters is produced to supply the processes of the processed area, see figure 1.

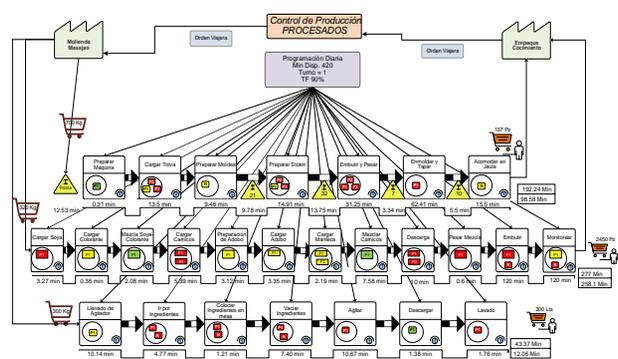


Figure 1 Current VSM with Ergonomic Evaluation of the Processed Area
Source: Self Made

Improvement proposals design

The correct positions that operators must perform to reduce or eliminate the risk during their activities were established, for this purpose they propose to use some Lean tools to eliminate the waste generated in the process such as unnecessary movements.

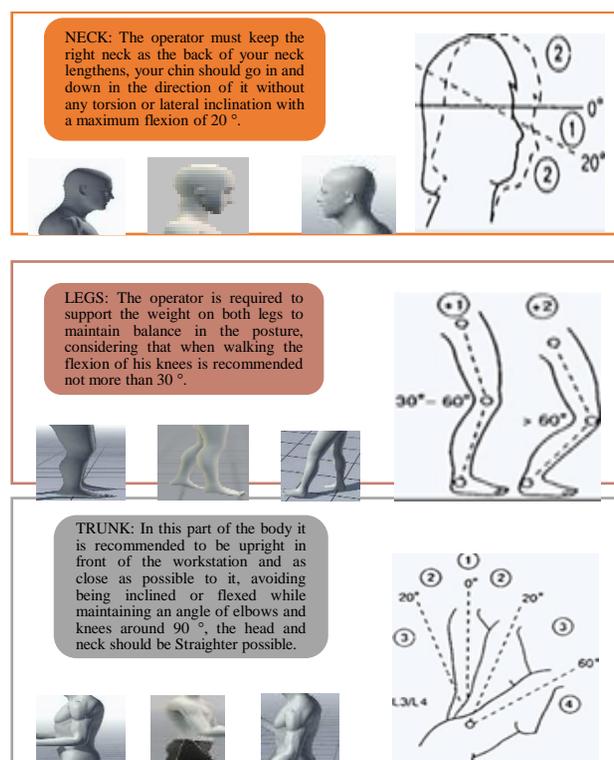


Figure 2 Proposals for positions Evaluated with the REBA Group a Method

In group A, the anatomical region of the trunk predominates with a high score and with a greater risk factor than the other parts of the body, it is necessary for the operator to adopt neutral positions, the position of the spine must retain its natural curvatures and avoid turning and sudden changes in position, in addition to having working conditions according to their physical dimensions and ability to increase their productivity avoiding any work-related injury or illness.

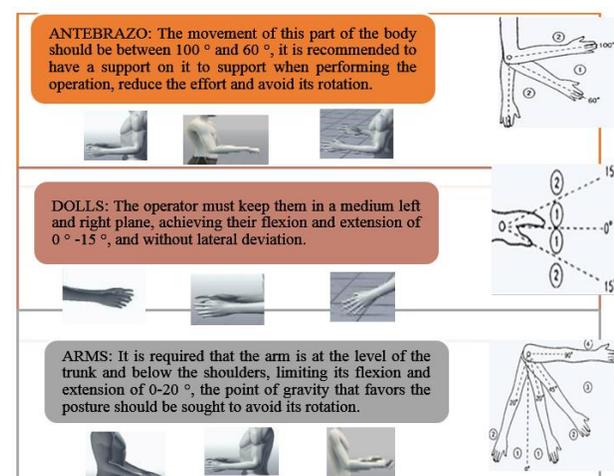


Figure 3 Proposals of positions Evaluated with the REBA Group B Method

In group B the arms are mainly exposed to be damaged, so it is recommended that the tool to be used is close to the operator's body and better yet have some auxiliary element that helps to counteract the weight of the tool.

Design of Proposals for improvement in Cargo Handling Postures. In the processes of Smoked Sausage and Brine, the NIOSH method was used because the manipulation of the weight is manual (see figure 4), while for MACL Sausage Mixing and Sausage the MAC Method was used due to the fact that there is movement when loading the weight during its operations, to improve the position of the worker, the design proposals must be applied in the equipment that transports the material, in this way the operator automatically changes his posture.

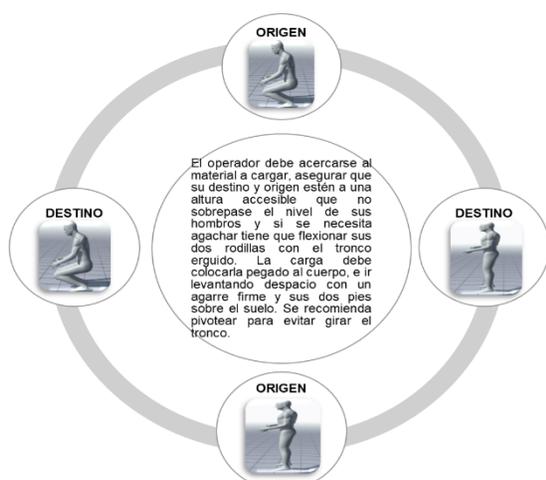


Figure 4 Proposals of positions Evaluated with the NIOSH Method

In the Smoked Sausage process it is proposed: Establish a Poka Yoke that helps to standardize the distance to which the materials used during the process should be.

A worktable with adjustable height, such as the one you already have, but a range that the operator can move it to a higher level because the current one can only decrease its height and it is at a very low level to the person who is in the work station. For the Filling in Hopper it is proposed to use the same mechanism of other processes for the filling of hoppers by means of a vertical elevator

Chorizo Mixing and Sausage Process proposes the following: A supermarket at the beginning of the process and after preparation of marinade with the purpose of eliminating some operations and reducing its time, is to keep the materials in containers, and in turn place kanban of withdrawal that indicates to the warehouse area and supplies the process of the raw material that is needed. Acquiring a stainless-steel shovel with the measures of 500-700 grams, 10 x 10 x 70 cm will be used for the Unloading activity, thus reducing the operation time and eliminating the operator's risk posture.

To improve the Embedding operation where risk factors due to repetitive movements were found, it is recommended that the equipment be put into automatic mode and in this way the operator can engage in another activity and eliminate his risky posture. Another proposal is to handle the loads with a utility cart to reduce the times and improve the evaluation of the MAC Method and the risk to the operator for moving the material.

Brine Process is proposed:

Install an intercom, in the brine area since before the discharge is performed, the operator has to communicate with the operator of the injection area through an intercom that is installed in a neighboring area to the brine called the area of weighing ingredients. Where the operator has to leave to that place traveling a distance of 15 meters. Performing this improvement will reduce the time interval between agitation and discharge activities where a dead time of 6.04 minutes is averaged.

Improvement Analysis of the Smoked Sausage Process. The efficiency of the process operations was calculated obtaining a time reduction of 76.42 minutes, which in percentage represents 39.7 for a batch of 137 pieces, see table 12.

	Efficiency	
	Min	Pieces
Current	192.24	137
Improved	115.82	137
Saving	76.42	
	39.7%	

Table 12 Efficiency Improvement in the Smoked Sausage Process.

The VSM Futuro also included proposals that are part of the process, such as a supermarket and Kanban with the purpose of supplying raw material in a timely manner and requested, two Kaizen were represented representing the proposed Poka Yokes in order to expedite the process and reduce time in operations, see figure 5.

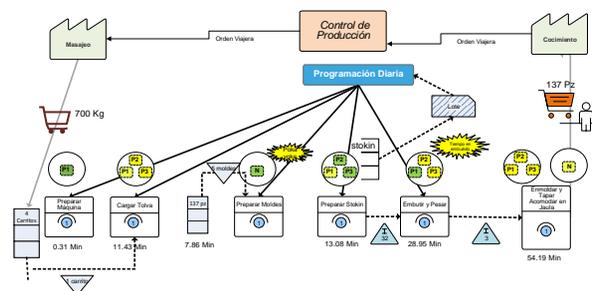


Figure 5 VSM Future of the Smoked Sausage Process

Analysis of Improvements in the Sausage Mixing and Sausage Process. The efficiency in the mixing and sausage of sausage was calculated in which a batch of 600 kg usually produces 2450 pieces in a time of 277 minutes, with the implementation of improvements and corrections of postures the production time of a batch at 179 minutes saving 98 minutes, see table 13.

Mixing and Sausage Efficiency			
	Min	Pieces	Lot
Current	277	2450	600 kg
Improved	179	2450	600 kg
Saving	98	35.37%	

Table 13 Efficiency Improvement in the Chorizo Mix and Sausage Process
Source: Self Made

As can be seen in the VSM Future, activities 1, 2, 6 and 7 were grouped in a single operation to what was called loading ingredients, using the tools Lean the supermarket and KanBan helps the operator manage the materials of a more efficient way since supplies will be supplied 2 times. Therefore, a single step was effectively achieved, leaving as a result loading ingredients activity 1, 3 minutes the cycle time and activity 4 of 5 minutes the cycle time, see figure 6.

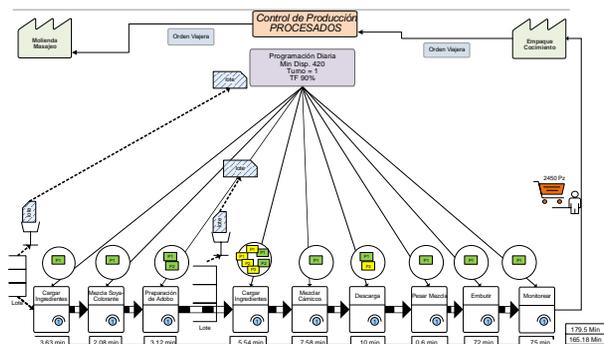


Figure 6 VSM Future of the Chorizo Mixing and Sausage Process

Analysis of Brine Process Improvements. The improvement of efficiency in the brine process considering that each batch has 300Kg of which 300lts of brine leave and normally during one shift 8 lots are processed in 347 min, with the implemented improvements of inferfon and postural correction in the operators its improvement is improved manufacturing time up to 21.6%, see table 14.

Brine Efficiency			
	Min	Pieces	Lot
Current	347	2400 lts	8
Improved	272	2400 lts	8
Saving	75	21.6%	

Table 14 Efficiency Improvement in the Brine Process
Source: Self Made

Ergonomic evaluation was performed again in the brine process, instructing the operator of the positions that must be adopted as can be seen in figure 7. A considerable reduction in ergonomic risks was achieved. The risk was lowered to a low level, in the same way in the evaluation through NIOSH it was lowered in the high risk levels to a low risk level.

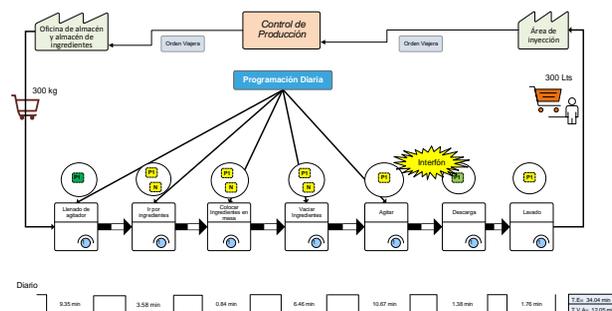


Figure 7 VSM Future of the Brine Process

Design of a Control Plan

This tool helps the process to monitor each of the proposals made during its operations, determining the critical variables, as a result of the risks that exist are suffering from occupational diseases and injuries, the person responsible for each improvement and monitoring is designated as a method of control was proposed to make a checklist specifying the positions of the operator and the time it takes to perform it.

Proposal Benefit Cost

The cost of selling 1Kg of Tozinet is \$ 87.00 pesos of which 61% are costs and 39% profit, for each piece you earn \$ 33.39 pesos. The application of improvements in this process has a cost of \$ 80,371.00 pesos, but your investment would be recovered no later than 30 days considering that for each lot there are 54 more pieces earning \$ 1,803.06 pesos and normally 3 lots are produced daily, in 30 days \$ 162,275.4 pesos.

The daily production for the sausage mixing and sausage process is 2,450 pieces in 179 minutes, saving 100 minutes, which can be made up to 3 lots in the working day, multiplying the 3 lots by 2450 pieces by the price of the product in its presentation of 250gr is \$ 16.00 pesos, the company obtains \$ 55, 272.00 pesos in profit for 3 lots, for 1 lot it gets \$ 18,424.00, considering that 53% of the sale price is cost and 47% profit, see table 15.

	Proposal	Cost
Smoked Sausage Process	Fiberglass Tape	\$371.00
	Vertical Bucket Elevator	\$80,000.00
Chorizo Mix and Sausage Process	Supermarket	\$10,500.00
	Rotor change to equipment	\$8,000.00
	Stainless steel shovel	\$400.00
Brine Process	2 Interphone	\$1,798.00

Table 15 Cost of proposals

To complement this study, an investigation was carried out to determine the expense that can be presented to an organization if the human factor is injured by any anomaly in its working life, see table 16.

González, (2015) mentions what cost is generated at a company for a disability to its worker is \$ 209.00 pesos considering that it is increasing over the years, while Banda, (2016) comments that the average cost for an accident at work is 200 thousand pesos, this will depend on the degree of physical damage that the worker is caused, on the other hand a carelessness can cause until death that according to (Álvarez, 2016) the obligation of the employer towards the family of the deceased is to pay compensation of 5,000 days of minimum wage, corresponding to 350,500 pesos, which are borne by the IMSS if the employee was insured, as established in Federal Labor Law in its article 502.

Cost	
Inability	\$209.00
Accident	\$200,000.00
Death	\$350,000.00

Table 16 Cost of risks

Acknowledgments

The work team thanks all the participants for their interest and collaboration during the data collection. Thanks also to the university (Instituto Tecnológico de Sonora) for its support and facilities for the development of the project, this publication was funded by PFCE2019.

Conclusions

Based on the study and results of the Lean Ergonomics project applied to the different processes, the objective of increasing efficiency is achieved through Lean tools and ergonomic evaluations, improving on average 32% the operating times of each process, in turn It decreases and / or eliminates the level of risk of each activity to be carried out, allowing the operator to work in appropriate conditions and do his job in a safe way. Implementing the improvements has a cost, however, not attending to the needs of the process and the human factor generates accidents, diseases that lead to days of disability and even death, causing a higher cost for the organization and damage to the operator. Recent studies (Bertolini et al., 2013; Montero, 2016; Vinodh & Joy, 2012) co-report that Lean Manufacturing is a system that focuses on the reconfiguration of manufacturing systems, tries to offer the highest possible value to customers with The least use of resources of all kinds, has its origin in the Toyota production system and consists of a method to systematically reduce waste.

In addition (Alpenberg and Scarbrought, 2016; Arezez et al, 2014; Dotoli, 2015) mention that this approach has become very popular among manufacturers, services and large commercial areas. Today, it is the best-known method for industrial improvement and acts at work through a set of group activities that pursue the benefit of the organization.

It is very important to follow up on the improvements and proposals made, as well as adopt the Lean culture in all the processes of the company. It is also highly recommended that the operator carry out the proposals for improvement on the postures that must be corrected since they have a high frequency of realization, in order to avoid injuries, fatigue, and disorders that may arise from performing their activities with erroneous positions. , and thereby prevent the detonation of skeletal muscle disorders.

The key factors that can be supported are cost, quality, delivery, safety and morale, through simplified thinking that will help reduce costs, require less labor, increase product development, it will achieve better quality and generate huge profits, (Thurston and Ulmer, 2016).

It is recommended and important that employees be trained about the Lean Ergonomics philosophy so that they understand it, know how to carry it out and integrate it as part of the process.

According to Arce, Romero, & Leon, (2017) Lean tools and practices have provided companies with significant help to meet the waste challenge, therefore, it has been possible to promote productivity and other key performance indicators. There are several cases of (Abuthakeer et al., 2010; Bertolini et al., 2013; Chong et al., 2013; Kumar et al., 2016; Lacerda et al., 2016) where they have reported positive results after implementation, how to shorten delivery times, reduce inventories of work in progress, increase the value-added relationship and among others.

It is necessary to follow up with the established control plan and its proposed frequency, since this tool is new for organizations and its implementation requires changes which are required to be monitoring until the process flows.

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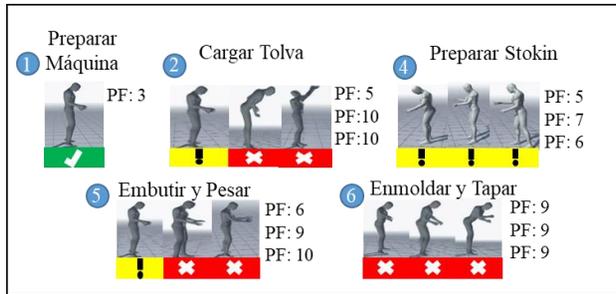
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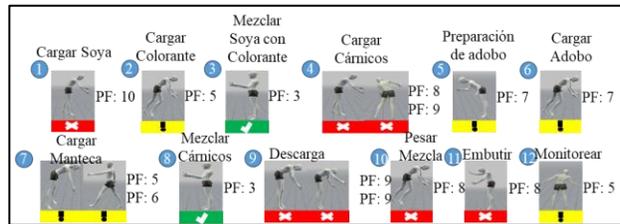
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Annexes



Annexes 1 Ergonomic evaluation positions of the Smoked Sausage process with REBA Method

Source: *Self Made*



Annexes 2 Ergonomic evaluation positions of the Chorizo Mixing and Sausage process with REBA Method

Source: *Self Made*



Annexes 3 Ergonomic evaluation positions of the Brine process with REBA Method

Source: *Self Made*

Intellectual Capital Management Model for Competitiveness in a Beach Hotel: Case Study in the City of Manzanillo, Colima

Modelo de Gestión del Capital Intelectual para la Competitividad en un Hotel de Playa: Estudio de Caso en la Ciudad de Manzanillo, Colima

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Abstract

For decades the economy was based on production and physical assets were the main source of resources. This situation has now changed, with intangible assets now being the main source of value creation and sustainability of competitive advantages in the company. The current definition of intangibles has focused on the strategic area within the Resource-Based Approach, emerging as a complementary structure to the Competitive Advantage approach. Goals: The analysis of intangibles as a scenario of competitiveness in the hotel industry, in particular, such as management, control and identification of unspecified intangibles. Methodology: Starting from the general objective, this research will have a mixed, quantitative and qualitative methodological approach. And through a quantitative research approach of analytical type, it is intended to know the influence of intangible resources on the factors that allow obtaining and sustaining a competitive advantage in the company. The above is based on the "Intellectus Model" (IADE-CIC, 2003) and the "Five Capital Model" (IADE-Caja Madrid, 2004). Contributios: Based on 106 variables analyzed, the multifactorial analysis by reduction of factors allows to determine 11 cross factors that contribute to generate the space of the intangible assets that in the case of the hotel which allows to be more competitive.

Intangibles, Competitiveness, Processes

Resumen

Durante décadas la economía estuvo basada en la producción y los activos físicos constituyeron la principal fuente generadora de recursos. Esta situación ha cambiado actualmente, siendo ahora los activos intangibles la fuente principal de creación de valor y sustentabilidad de ventajas competitivas en la empresa. La definición actual de los intangibles se ha centrado en el ámbito estratégico dentro del Enfoque Basado en los Recursos, surgiendo como estructura complementaria al enfoque de la Ventaja Competitiva. Objetivos: El análisis de intangibles como un escenario de competitividad en la industria hotelera, caso en particular, como son gestión, control e identificación de intangibles no determinados. Metodología: Partiendo del objetivo general, la presente investigación tendrá un enfoque metodológico mixto, cuantitativo y cualitativo. Y a través de un enfoque de investigación cuantitativo de tipo analítico, se pretende conocer la influencia de los recursos intangible sobre los factores que permiten obtener y sostener una ventaja competitiva en la empresa. Lo anterior tomado como base el "Modelo Intellectus" (IADE-CIC, 2003) y el "Modelo de los Cinco Capitales" (IADE-Caja Madrid, 2004). Contribución: De las 106 variables analizadas el análisis multifactorial por reducción de factores permite determinar 31 items cruzados que contribuyen a generar el espacio de los activos intangibles que para el caso del hotel lo que permite ser más competitivo.

Intangibles, Competitividad, Procesos

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Introduction

For decades the economy was based on production and physical assets were the main source of resources. This situation has now changed, with intangible assets now being the main source of value creation and sustainability of competitive advantages in the company.

Nowadays companies face a new era of the economy based on knowledge and learning, which has been called the knowledge society (Lane, 1966; Well, 1998; Gallardo, 2001). This paradigm shift is observed today, so that the passage of tangible resources has ceded its present role in the value chain to intangibles making knowledge management necessary. As Bueno (1998) and Raich (2000) point out, this transition created the need to manage the company as a whole and generated new concepts, such as knowledge management, intellectual capital and even human capital, however, it is not yet has developed a method to measure intellectual capital or human capital in monetary terms.

The current definition of intangibles has focused on the strategic scope within the Resource-Based Approach, emerging as a complementary structure to the Competitive Advantage approach, which raises the construction of an advantageous and sustainable competitive position in the long term, through a position in the product market (Porter, 1985). However, the Resource-Based Approach assumes a refreshing vision of strategic conception, since it considers the importance of internal factors (resources and capabilities) as the foundation of the organizational strategy, therefore, of the competitive position.

The first contributions in this approach were those of Grant (1991), Barney (1991) and Peteraf (1993). Although there are other important contributions such as those of Wernerfelt (1984), Aaker (1989), Dierickx and Cool (1989), Amit and Shoemaker (1993) among others. In the Spanish sphere are those of Fernández (1993) and Fernández and Suarez (1996).

With this new strategic approach and a changing and globalized environment where knowledge and information become important, intangible assets are instituted as those strategic resources that meet the necessary characteristics to generate sustainable competitive advantage through characteristics such as heterogeneity, value relevance, shortage, imperfect mobility, durability, inimitability and imperfect substitutability (Grant, 1991; Barney, 1991; Peteraf, 1993). Therefore, the efficient management of intangibles has become the main source of the competitive advantage of companies.

However, despite the importance of the intangible Gallardo and Pérez (2003), they state that there is a great difficulty, referring to their valuation, since accounting does not accurately reflect the true value of the company, that is, part of the Intangible source value is not reflected in the financial statements. Years ago, factors such as labor, land and capital were identified as drivers of performance obtained by companies, now the vision has changed radically, passing the aforementioned elements to the background and reaching factors of intangible nature.

Cañibano, García-Ayuso and Sánchez (1999) explain that efficient strategic management must rely on quantitative and qualitative information on intangible assets, being essential to design and implement an information system that considers the existence and relevance of such intangibles. Intangible assets differ from financial and physical resources in the sense that their value depends on how well they serve the organization. Although, this prevents an independent valuation of intangible assets, so a completely different approach is required to assess their value.

One of the main aspects in the framework of business management is to know the effect of intangibles on the performance of the company. Those companies that manage to transfer their strategy to measurement systems will be able to effectively execute their strategy, since they will be able to communicate their objectives and goals. This communication makes managers and employees focus on critical inducers, allowing them to align and link investments, initiatives and actions with the achievement of strategic objectives (Cañibano, García-Ayuso and Sánchez, 1999).

The main purpose of this work is to develop an intellectual capital management model for the generation of sustainable competitive advantage through a case study in a beach hotel in the city of Manzanillo Colima.

Emergence of knowledge-based society

In pre-industrial society, the labor force was overwhelmingly employed in extractive industries, such as mining, fishing, forestry, agriculture, etc. It worked with a brute muscular force, using traditional methods and with greater dependence on natural elements. Therefore, productivity was low and the economy was subject to tangible events and price fluctuations in raw materials. These societies were agrarian and structured with traditional forms of routine and authority.

Already in the industrial era the world becomes technical and rationalized. The machine predominates and electrical energy replaces muscular strength, providing the necessary boost for productivity, that is, doing more with less. In this era new transformations arise with respect to the elementary force in a company: the human element. The knowledge of the trade is divided into its most basic components and the craftsman is replaced by new elements: the engineer, who becomes responsible for the layout and flow of work and the semi-specialized worker, who becomes the human gear between the machines (Bell, 1976).

Thus, a world of coordination, planning and programming is born, where the human element, inputs and markets are assembled for the production and distribution of goods. The components of the goods are produced jointly in the precise time and the adequate proportion to accelerate the flow of said goods. In this way a necessary distinction is introduced between the role and the person, which is formalized in a company organization chart. The criterion of the technique is efficiency and the way of life is modeled on the economy, focusing on how to extract the greatest amount of energy from a unit provided by nature, such as coal, oil, gas, etc., using the best machines and getting competitive prices.

A new stage arises in the industrial era, the post-industrial, based on services. Now what counts is not brute force or energy, but information.

The key piece in the company is the trained and trained professional to provide the types of specialization. The industrial society was characterized by the amount of goods that indicated the standard of living, now the post-industrial society is characterized by the quality of life provided by services and amenities, such as health, education, entertainment and the arts.

According to Bell (1976), it was in the second half of the twentieth century that there has been an extension of the specialization of functions from the economic to the intellectual field. It is at this time when the knowledge society is born. Basically the proposal of the idea of a society dedicated to knowledge was made by Robert Lane (1966) who presents an approximation to that definition, mentioning that it is the one in which, to a greater degree than in other societies, its members:

1. They investigate the basis of their beliefs about man, nature and society.
2. They are guided, possibly unconsciously, by objective verification standards and with respect to higher education follow scientific rules of verification and deduction in research.
3. They devote considerable amounts of resources to research, thus counting on a broad pool of knowledge.
4. They accumulate, organize and interpret knowledge in a constant effort to achieve consequences of immediate utility.
5. They use this knowledge to guide and perhaps modify the values and goals, as well as to advance them.

Since then, a set of ideas, concepts and expressions that model its true content and its real reach in the scientific community have emerged and becoming widely disseminated, among other expressions those of human capital, intellectual capital, intangible assets, learning process, organization smart, organizational learning, explicit knowledge, tacit knowledge, knowledge economy and knowledge management (Well, 1998).

The knowledge society has been characterized by the constant emergence of new knowledge, by the permanent development of intellectual faculties, all this being specified, in an unusual acceleration of the expiration of dominant paradigms, of the obsolescence of the methods of analysis.

Bueno (1998) argues that currently in society theoretical knowledge and tacit knowledge are becoming important over any other kind of knowledge, taking more relevance those that require a certain mental model and processes based on creation, ideas, and abstraction and innovation. In particular, tacit knowledge is what enables the generation and sustainability of the competitive business advantage in the current economy (Nonaka and Takeouchi, 1995).

Transformation of information into knowledge

Within the creation of the knowledge society, the transformation of the data or information to what we know today as Knowledge, a process that leads to the formation of the concept of Distinctive Basic Competence (Well, 1998: 215).

The evolution that knowledge has had consists of three stages:

1. The data process. Use of technologies that transform this data into information.
2. Learning process. At this stage the information is converted into knowledge, through the learning process, that is, how to learn to learn to learn new knowledge.
3. Distinctive competence. At this stage, knowledge is transformed into distinctive competence, that is, knowing how to do better than others, thanks to a certain process of mental creation.

This process seeks to produce and disseminate knowledge, disseminate human talent or intelligence, both individual and organizational throughout the structure of the company. Thanks to this process, the company has an immense flow of knowledge that can be released, provided it is able to properly manage the flows of such knowledge that circulate through it. Management that aims to generate new knowledge that allows it to not only create competitive advantage or distinctive competence, but also make it more durable. The knowledge society depends largely on the ability of the company to learn, how knowledge and innovative talent are incorporated both in people and in the company.

Taking reference to Bueno (1998) classifies knowledge as:

- a) Knowledge gained: is the knowledge coming from outside the company and that is acquired through contracts, both perfect and imperfect. This knowledge is explicit for the company.
- b) Knowledge created: it is the knowledge that is born inside the company and that can both focus on explicit knowledge and tacit knowledge.
- c) Explicit knowledge: is the knowledge that can be transmitted or shared between people or within the organization with relative ease.
- d) Tacit knowledge: it is the knowledge that presents certain difficulty and complexity to be transmitted or communicated interpersonally.

Following the previous author, it is explained that both explicit and tacit knowledge can act as an origin in the creation of new knowledge. Explicit knowledge is basically composed of technical knowledge, some skills or abilities and few attitudes, which allows it to be easily transmitted through current information and communication technologies. While tacit knowledge is closer to talent, art or a certain mental model, aspects that are difficult to convey interpersonally, basically composed of attitudes, capacities and certain abstract, complex and sophisticated knowledge.

Of the concrete combinations that arise from this knowledge, you have to:

- 1 The generation of explicit knowledge from explicit knowledge is done through processes or systems.
- 2 Based on explicit knowledge, you can create tacit knowledge or know-how in the company, this takes the name of tacit knowledge in people. This type of knowledge involves internalizing certain patterns or patterns of action and carrying out specific learning processes.
- 3 If tacit knowledge is transformed into explicit knowledge, that is, if they are externalized, we would be talking about concepts such as business strategy.

If tacit knowledge generates new tacit knowledge, it will have been possible to socialize and share among all members of the organization, new values and attitudes, aspects that will make them different and will improve their competitiveness.

To understand the concept we know today of knowledge it is convenient to try to understand its definition, consulting the following authors. Bell (1976: 206) defines it as “a set of organized expositions of ideas, presenting a reasoned trial or an experimental result, which is transmitted to others through some means of communication in a systematic way”.

Nonaka and Takeuchi (1995) mention that knowledge is a justified certainty, that is, an individual justifies the truthfulness of his certainties based on observations of the world around him; These observations depend on a point of view, personal sensitivity and individual experience. Therefore, when an individual creates knowledge, it makes sense of a new situation with the justified certainties that he has firmly adopted.

After knowing the transformation that the information has had in knowledge and its conceptualization, it is necessary to highlight the challenge that companies face with respect to the efficient use of the knowledge of their workers and the way in which they can be used in the construction of sustainable competitive advantages.

In the opinion of Gallardo and Pérez (2003), they are living in a society in which theoretical and tacit knowledge are gaining enormous importance over any other kind of knowledge. And it is this type of knowledge that motivates the generation and sustainability of competitive business advantages. Gallardo and Calamonte del Río (2002) indicate the need to have a human potential capable of competing in the market, capable of achieving competitive or distinctive advantages, which uncheck the company from the rest of the sector, since it is a verifiable fact that training of employees is a transcendent element for the supervision and expansion of the company in the current era.

In general, the possible changes will be manifested in the line of knowledge management.

This means giving greater importance to intangible resources over tangibles, a circumstance that was not previously occurring.

If in today's society the new challenge is the construction of the knowledge economy paradigm, in the company that challenge is translated by the way in which this knowledge will be managed. This undoubtedly represents an arduous, complex and emerging task. It is said that it will be arduous, because it must try to release accumulated mental energy in the organization, enclosed in the minds of the people who compose it. It is complex, since knowing how to convert this intellect into a business asset, into organizational knowledge, which can be accessed by all people in the company, so that it can be used in the creation of new knowledge. Emerging, because it is born with its own principles.

Therefore, Knowledge Management is a strategy to be considered by companies whose objective will be to create greater value for the shareholder and those involved in the development of the organization such as: customers, employees, suppliers, creditors. This strategy will be undertaken, first, by capturing individual talent as an organizational and secondly, developing it further and trying to retain it within the organization to give its greatest benefits. It is clear that, if the company outsources a strategy to its market, in proportion, it must carry out an internal strategy, which allows it to manage the knowledge flows that circulate and develop within it.

In this sense, Raich (2000) points out that companies should be able to manage in an organization the tangible, intangible, virtual parts and therefore knowledge. Knowledge depends on the ability of people and organizations to learn and how they incorporate knowledge and innovation. Gallardo and Roldán (2003) point out that this has resulted in the processes integrated in the so-called Knowledge Management, referred to as the creation and proper application of knowledge in companies, being necessary to contemplate new strategies that include knowledge as a fundamental element.

Knowledge within the company can be located at different levels: in its workers and managers, in its suppliers, in relations with other companies, in its customers, etc.

To identify this knowledge, it is convenient to use the different groups named under the concept of Intellectual Capital and that are not fully captured in the balance sheet (Sánchez, Chaminade and Escobar, 1999). Some authors affirm that the organization's resources are essential when they allow the company to develop strategies that achieve and sustain a competitive advantage. One of those resources is knowledge, a competitive resource that the company has (Nonaka and Takeouchi, 1995; Grant, 1996).

The value of employee knowledge depends directly on its potential to contribute to the achievement and maintenance of the competitive advantage of the company. Some research in this regard (Huselid, 1995; Pennings, Lee and Van Witteloostujin, 1998), present attributes of human resources, including training, experience, skills and in particular, the characteristics of managers, influencing the results of the company. Ordonez (2005) mentions that even using such knowledge and considered as an important factor in the current competitive environment, it is not enough to use the knowledge base of employees.

Although the company's resources and capabilities have added value in the past, changes in consumer demands, in the structure of industry or in technology, can make them less valuable in the future (Barney, 1995 : 51)

The resource-based approach

During the 1980s, the intensity and increasing dynamism of competitiveness through product markets has had profound implications for the evolution of strategic thinking in companies. The external environment in companies has focused attention on resources and capabilities as the main source of sustainable competitive advantage and the main parameter for the formulation of strategies (Ordonez, 2003).

However, the resources themselves do not reveal the competitive advantage, but that this would be determined by the way in which they are exploited as a whole, therefore, the role played by the capabilities or competencies in the company must also be considered. (Cruz, 2002).

In the 1990s the analysis of the strategies focused on the industrial structure, that is, it was considered that the differences in business results were a consequence of the sector in which the company developed its activity, so there was a greater homogeneity between companies that belonged to the same sector (Porter, 1980, 1985).

On the other hand, Rumelt (1991) demonstrated the existence of greater profitability differences between companies that belonged to the same industry than between companies from different sectors and Cool and Schendel (1988) in a study conducted in the pharmaceutical industry, concluded that there were differences Significant profitability among companies that belonged to the same strategic group.

These verifiable events led to a rethinking of the determinants of income in the company and since then it has been considered as a fundamental basis for the sustainability of a competitive advantage the role of the company's resources and capabilities (Cruz, 2002). So Grant (1991) has come to affirm that a resource-based perspective is the fundamental basis for business strategy and favorable economic results.

Part of the antecedents of the Theory of Resources and Capabilities are found in the Theory of the Growth of the Company (Penrose, 1962) and in the works on Strategic Management (Andrews, 1987) where the strategy is defined as the adjustment between what the company can do (strengths and weaknesses) and what the environment allows (opportunities and threats).

On the other hand, the theory of the growth of the company (Penrose, 1962) considers the company as an administrative organization with a set of productive, human and material resources. Its approach allows us to visualize that resources are never by themselves, the inputs in productive processes, without the services that resources can provide. The services are the result of experience and knowledge accumulated within the company, and therefore, specific.

Nelson and Winter (1996), through their Theory of Evolutionary Change, argue that the company can be seen as a repository of knowledge, that is, that it has a specific or specific range of knowledge that it will use in its production process. This range of knowledge, generally with its own characteristics, distinguishes one company from the other, even with the same activities and geographical place of establishment. This knowledge is stored or stored in the company, allowing you to build your own behavior model that can be predictable and regular, becoming what could be called the genes of the organization.

Now, from the approach of the Economic Theory, some explanations have been made to understand the existence of lasting differences between the results of the company (Teece, Pisano, and Shuen, 1997). This theory has been an essential part for the construction of an analysis model of the interrelationships between the strategy and the strategic resources of the company, studying among other aspects the way in which the organizational resources are applied and combined, making the competitive advantage be sustainable, the nature of income generated by resources and the origins of heterogeneity (Ordóñez, 2003).

However, the most relevant antecedent on the perspective of the resource-based company is Wernerfelt's (1984) research, since then there have been many empirical and theoretical investigations that analyze the competitiveness of the resource-based approach and capabilities, to mention a few are: Dierickx and Cool (1989), Grant (1991), Barney (1991), Connor (1991), Schoemaker (1992), Mahoney and Pandian (1992), Hall (1992, 1993), Amit and Schoemaker (1993) and Peteraf (1993).

The company as a set of resources and capabilities

From the perspective of the Theory of Resources and Capacities, the company is defined as “an organized and unique set of heterogeneous resources and capacities that are generated, developed and improved over time” (Cruz, 2002: 6). As Barney (1991) states that there is a great diversity of companies, even in the same sector, so that heterogeneity is a source of sustainable competitive advantage, which allows explaining the differences in profitability between them.

Peteraf (1993) mentions that the heterogeneity within the theory of resources and capacities is made up of the differences between the results obtained from companies of the same industry, originated by the different levels of efficiency achieved by the heterogeneous resources. The company that possesses a combination of resources and capabilities superior to other companies, will obtain superior results.

Barney (1991) states that an important postulate of the theory of resources and capabilities is that these are heterogeneous among the same companies, that is, the resources that feed the productive process within an industry are distributed in a heterogeneous or diverse way among the companies that integrate it. This characteristic of resources within the same industry is argued by this theory, given the scarcity of superior resources. That is, if the resources were homogeneous, all companies could develop the same strategies and therefore could not achieve differentiation through these resources, not achieving a competitive advantage.

Wernerfelt (1984) points out that the Theory of Resources and Capabilities explains how and why companies achieve a sustainable competitive advantage and are able to maintain it. Its main focus is to consider the company as a set of unique resources of diverse nature, moving away from the traditional economic perspective of analyzing strategies based on their activities in the market.

As stated in previous paragraphs, resources and capabilities have significant relevance in achieving economic benefits of the company. Therefore, it is necessary to consider the definitions and classification of “resources” in order to contextualize this theory.

For Wernerfelt (1984), resources are all those tangible and intangible assets that are linked to the company in a semi-permanent manner, as is the case with brands, own technological knowledge, qualified personnel, commercial suppliers, machinery, capital, etc. which also constitute strengths or weaknesses in the company. The traditional approach of Porter (1981) considers as resources only the strengths that the company can use to formulate and implement its strategies.

Barney (1991) mentions in a general way that resources are all assets, organizational processes, attributes, information and knowledge controlled by a company, thus allowing the implementation of strategies that improve their efficiency and effectiveness.

Amit and Schoemaker (1993) agree with Cuervo (1993) when pointing out that resources are a “stock” or inventory of available factors that the company owns or controls. Cuervo (1993) adds that these factors (resources) are diverse in nature and include both physical, technological, human and organizational factors.

Regarding the classification of resources Barney (1991) states that they can be grouped into three categories:

- 1 Physical capital resources: this category includes equipment and technology, the company's infrastructure, geographic location and the degree of accessibility to raw materials.
- 2 Human capital resources: groups everything related to the workers and managers of the company, such as experience, labor relations, etc.
- 3 Organizational resources: groups the organizational structure of the company, the planning, control and coordination systems, as well as the informal relations between different groups of the company.

And according to their degree of mobility in the market, they are classified as: marketable resources and non-marketable resources. For his part, Grant (2004) distinguishes between tangible, intangible and human resources. Although this classification is currently accepted only as tangible and intangible resources. Tangible resources include all the physical resources of the company such as: the location of the plant, the infrastructure, the machinery, the building, etc. Financial resources are also included such as: internal financial funds and borrowing capacity.

Intangible resources include those based on information and knowledge such as: human, technological, organizational and commercial culture (patents, trademarks, copyrights, contracts, trade secrets, reputation, business relationships with suppliers and distributors, etc...)

For Cuervo (1993: 68), capacities are “knowledge and skills that arise from the collective learning of the organization, as a result of the combination of resources and the creation of organizational routines that are developed by information exchange based on the human capital of the company”.

Unlike resources, capacities are complex patterns of coordination between people and these with other resources. Grant (1991) states that one capacity arises from an organizational routine or several in interaction. This is that, through certain routines, the company has a memory that allows it to undertake complex activities that involve the solution of technical and organizational problems.

Once the theory of resources and capabilities is contextualized, it is necessary to delimit the concepts of competitive advantage and how it is linked. The following section describes the characteristics, elements and management of this.

The competitive advantage from the perspective of the resource-based approach

This section begins by contextualizing the competitive advantage. Hill and Gareth (2005) explain that a Competitive Advantage arises when a company generates a higher profitability than the companies in its industry have on average. While a Sustained Competitive Advantage exists only when it is able to maintain said performance above the average of the companies in its industry, for several years.

Within the nature of resources Aaker (1989) states that the way to achieve a sustainable competitive advantage lies in a process of asset management (tangible and intangible) and skills, with the following steps:

- 1 Identify those assets and skills that have strategic relevance,
- 2 Select those that will be relevant for future market needs,
- 3 Implement programs that allow to develop, extend and protect these assets and abilities.

Having, identifying and exploiting strategic resources in order to develop a strategy that allows competition, based on these resources, causes the company to be interested in identifying, knowing and analyzing the resources and capabilities it possesses, discovering which ones can be considered superior or distinctive (Ordonez, 2003). These resources manage to have the capacity to carry out activities in a superior way to their competitors, obtaining therefore better benefits (Barney, 1991).

Ordonez (2003) states that the study and analysis of strategic resources and capabilities can be carried out from three perspectives:

1. Focused on the organizational knowledge generated by coordinating some specific individual capacities and resources, thus constituting the achievement of a sustainable competitive advantage. This perspective assumes a dynamic and evolutionary nature of resources (Reed and DeFillippi, 1990; Grant, 1991; Amit and Schoemaker, 1993).
2. The strategic basis for the development of a sustainable competitive advantage lies in the resources accumulated internally. This perspective considers resources as a stock (Dierickx and Cool, 1989: 1506).
3. This perspective is considered intermediate from the previous ones and indicates that differential or distinctive competitiveness is the cause of the success of a company's strategy, paying greater attention to organizational resources and capabilities..

Also Hall (1992) proposes as sources of competitive advantage four types of capacity differentials: functional, positional, cultural and regulatory.

The functional and cultural differential is based on skills and abilities, that is, it refers to doing while the positional and regulatory differential are related to the assets owned by the company, this refers to having.

According to the previous approaches, the company must be able to develop new skills on which it can base its strategies. In this way, their dynamism and multiplicity will make imitation by competitors difficult and will increase the company's adaptability to external factors and will ensure long-term competitiveness (Mascarenhas, Baveja, Jamil, 1998).

However, not all authors agree to call strategic resources the drivers of competitive advantage, so what for Wernerfelt (1984) is critical resources, for Barney (1991) they are strategic factors and strategic assets for Amit and Schoemaker (1993) or inputs capable of generating sustainable income for Conner (1991).

Strategic assets are those resources and capabilities that explicitly determine a competitive advantage in the company. It is important to identify the characteristics of these resources and capacities, allowing to know why and what these strategic assets are (Cruz, 2002).

However, the above, Barney (1991); Grant (1991); Schoemaker (1992); Amit and Schoemaker (1993) and Peteraf (1993) agree by stating some of the requirements that resources must have to be strategic:

- a. Valuable: they must contribute significantly to the achievement of competitive advantage.
- b. Scarce and lasting: not being possessed by current or potential competition, otherwise they would cease to be valuable.
- c. Difficult to imitate, non-substitutable and non-marketable: this will allow to maintain a long-term competitive advantage.

As a result of the combination of the above characteristics, the income generated by these strategic assets must be appropriable by the company, so that they must be resources over which the company exercises its ownership and control (Cruz, 2002).

In addition to the requirements mentioned above, in order for the competitive advantage to be sustainable, strategic resources must meet other conditions.

Peteraf (1993: 180) presents a model in which four basic conditions are established so that the strategic resources of the company generate a competitive advantage: heterogeneity, imperfect mobility, ex ante limits to competition and ex post limits to competition. None of them acts independently, but are directly related to each other and heterogeneity is an essential condition of competitive advantage, that is, without which it could not be achieved or obtained.

According to the previous author, the detail of each condition is as follows:

- 1 Heterogeneity. This condition assumes that the differences between the results achieved by companies of the same industry originate from the different levels of efficiency achieved by the heterogeneous resources of the companies. Those companies that possess a combination of resources and capabilities superior to other companies will also obtain superior results. This condition is based on the scarcity of superior resources by companies, that is, some companies have valuable and scarce resources that are not available or available to rival companies (Barney, 1991). In addition, these superior resources must also be durable, otherwise they will allow for a temporary or short-term competitive advantage (Amit and Schoemaker, 1993).
- 2 Imperfect mobility. This condition admits that these resources cannot be marketed in the market due to their particular characteristics or idiosyncrasy, becoming obsolete or lacking use outside the company where they were originally generated. On the contrary, imperfect immobility admits that these resources can be commercialized, although their value within the company that uses them is greater than the value they would have in another company. This means that these resources are adapted to the specific needs of the company.

- 3 Ex ante limits to competition. These limits that are established before the competition allow a company to enjoy a privileged position with respect to a resource, even before rival companies compete for that resource. The control exercised over a scarce and valuable resource can be translated into economic benefits only if competitors have failed to recognize in advance the value of that resource or are unable to exploit it in such a profitable way because they lack the necessary complementary resources (Grant, 1991).
- 4 Ex post limits to competition. In order to obtain a competitive advantage and maintain it for a long time, the company must establish ex post limits to the competition, which delay, lead or prevent these established ones from imitating or overcoming the competitive position of the most profitable companies. These are barriers that are established to avoid the imitation of the competitive advantage of a company, whose overcoming involves for the imitators a high cost that could completely reduce the income potentially obtained in said attempt (Fernández, Montes and Vázquez, 1997).

Therefore, obtaining a competitive advantage is due to the possession of strategic assets and the distinctive competencies that allow these resources to be used effectively (Cruz, 2002).

In order for the competitive advantage to be sustainable it is necessary that two requirements be presented: heterogeneity and imperfect mobility that at the same time explain the differences in the economic results of the companies, but are not the only requirements, these must also be difficult to imitate and replace so that the competitive advantage can be sustained for a long time (Lippman and Rumelt, 1982; Barney, 1986a and 1986b; Dierickx and Cool, 1989).

Another necessary condition for the competitive advantage to be lasting is that ex post limits to competition must be established. These conditions are called isolation barriers, entry barriers or barriers to strategic groups (Caves and Porter, 1977).

These mechanisms act as obstacles to the possible imitation of resources, causing the scope of competitive advantage to competitors in the industry to have a high cost that dissipates the potential income that would be obtained in the attempt.

Methodology

The main purpose of the research is to develop an intellectual capital management model for the generation of sustainable competitive advantage through a case study in a beach hotel in the city of Manzanillo Colima.

And as secondary objectives the following were raised:

1. Characterize and delimit the particular attributes of heterogeneity, imperfect mobility, ex ante and ex post limits to competition, of those strategic intangible resources, which directly contribute to the formulation and implementation of the competitive advantage.
2. Develop and propose a strategic intangible management model that, through the application of statistical techniques, allows to know its correlation with the generation of sustainable competitive advantage and the generation of economic benefits.

Therefore, to verify the influence of the selected intangibles as strategic in the generation and sustainability of the competitive advantage of the company and the processes and instruments for its management, the following hypothesis is proposed:

H1 Intangibles considered strategic have positive correlation for the generation and sustainability of the competitive advantage of the company.

The variables to be explained in this research and according to Barney (1991); Grant (1991) and Peteraf (1993) would be: heterogeneity, imperfect mobility, ex-competition limits and ex-post competition limits, that is, they are: valuable; scarce and lasting; difficult to imitate, non-substitutable and non-marketable.

Starting from the general objective, a mixed, quantitative and qualitative methodological approach was applied in the present study. And through a quantitative research approach of analytical type, it is intended to know the influence of intangible resources on the factors that allow obtaining and sustaining a competitive advantage in the company.

In the analysis of intangibles, the difficulty is evident due to the lack of information, therefore, qualitative research techniques are the most appropriate. The case study is constituted as a technique of analysis of the processes of measurement and management of intangibles in companies, as well as validation of the criteria for their dissemination Sánchez et al. (1999). In accordance with the above, the methodology for the analysis of the management, control and identification of intangibles proposed in this investigation are the Case Study (Garrigós and Camisón, 2001).

Sánchez et al. (1999) argue that in research related to intangible issues, the use of methodologies with subjective analysis is appropriate, considering the following aspects:

- A. The analysis of intangibles is a relatively new topic in companies. This implies the absence of historical data on some variables of interest, hence the objective analysis techniques are not the most appropriate.
- B. The knowledge society (mentioned in previous sections) has the characteristic of being changeable, so it is not advisable to use historical data to predict or know future scenarios. In techniques with objective data, scenarios with past conditions are constructed, which is unlikely to be repeated in scenarios within the knowledge society.
- C. In most cases the information obtained on intangibles is of a qualitative type, therefore the use of techniques based on quantitative data is not the most appropriate.

D. On several occasions there are no indicators available to measure the variables related to certain intangibles. This implies considering the experience, information and the vision of "experts" or "key informants" of the companies of great importance for the construction of new indicators.

In a first approach to the objective of the investigation, the independent variables were analyzed through the Case Study.

The use of the analysis of the case studies as a research technique is not new, currently the application of this technique and its applications has been booming. In the 20s and 30s in the United States of America it was considered as a method of qualitative analysis and close to participatory observation. However, in the 50s and 80s, interest in the use of this technique decreases to the extent of being considered forgotten (Platt, 1992).

With the publication in 1984 of Yin's book on research with Case Studies, a rebound in interest in the study of this technique begins, with the incorporation of new elements of discussion and novel applications Sánchez et al. (1999). In the literature of organizations Yin (2003) is a point of reference in conducting research using this methodology.

Yin (2003, p. 13) defines Case Studies as "an empirical investigation that studies a contemporary phenomenon within its real context, especially when the boundaries between the phenomenon and the context are not clearly evident" and in which they are used Multiple sources of evidence. In addition, he states that at the time there are issues that begin with "why?" Or "how?", Case studies are the most appropriate research strategy. Some relevant advantages over case studies are pointed out by Kingsley and Bozeman (1997) as a research technique:

- The researcher receives a large amount of information about the phenomenon being analyzed.
- They can be used in any phase of knowledge of the phenomenon to be analyzed, however, it is convenient to apply it when knowledge is scarce or when it is desired to arrive at an explanatory theory of the studied phenomenon.

- It is considered a useful tool for learning a certain phenomenon.
- It is a flexible technique, since it allows the researcher to modify his research procedures throughout the study, as a result of the interaction with who is being investigated.

Atkinson and Shaffir (1998) point out that case studies constitute a type of qualitative empirical research whose main characteristics are:

- They are carried out in the field, that is, within organizations.
- It involves the collection of information, using the interview and observation as the main instrument, although information from archives and other sources can also be obtained.
- It links the researcher with people belonging to the world he studies, that is, with managers and employees of organizations.
- There are no procedures to be applied rigorously.

In order to increase knowledge about the types of case studies, several authors have been consulted. Thus, we have that Yin (2003) considers four types of case studies existing in the literature of organizations:

- A. **Descriptive:** analyze how certain phenomena occur in an organization, within its real context.
- B. **Exploratory:** its main objective is to become familiar with a situation where there is no fully defined theoretical framework.
- C. **Illustrative:** they show the management practices of the most competitive companies.
- D. **Explanatory:** they try to reveal the causes or the reason of a certain organizational phenomenon.

Hernández et al., (2004) mention that defining the type of study is extremely important, since that is where the research strategy depends and classifies research in the social area, into four types of case studies:

- *Explorations* that serve as a basis to visualize the scenarios that the researcher will face and usually precede the other three.
- *Descriptions* base the correlational investigations, which in turn provide important information to initiate explanatory studies.
- *Explanatory* generate a great sense of understanding and are usually highly structured.

Continuing with other authors who classify the case study, we find that Spicer (1992), states that depending on the main objective of the investigation, case studies can be classified into two groups:

- A. Descriptive / exploratory: they mainly try to describe the accounting practices used by companies, and
- B. Informative / explanatory: they seek to explain the reasons for the observed practices.

Based on the approaches of Spicer (1992), Yin (2003), Hernández et al. (2004) The type of study shown in this research is descriptive, because it is aimed at responding to how certain events, physical or social events occur.

Abundant on the characteristics of the descriptive cases Gómez and Gutiérrez (1996) set out three fundamental aspects:

1. They start from a theoretical model to study a phenomenon, where a set of hypotheses are structured.
2. The hypotheses are contrasted in a representative sample, taking into account that the data and indicators obtained reliably measure the theoretical variables raised in the hypotheses.
3. Finally, it is statistically analyzed to what extent each hypothesis has been tested.

The “Intellectus Model” (IADE-CIC, 2003) and the “Five Capitals Model” (IADE-Caja Madrid, 2004) were considered as the basis for the construction of the methodological proposal.

As a starting point for the application of the proposed empirical model, the guidelines for the measurement and dissemination of intangibles proposed by the MERITUM Project (Cañibano et al., 2004) based on the conduct of a set of case studies that were considered let you know in detail how the company is managing its intangibles and subsequently an Exploratory Factor Analysis (AEF) was applied.

The Intellectual Capital Model used as a reference in this research has had some modifications and adjustments that have been possible through the application of a first proposal in hotels in countries such as Spain, Mexico, Dominican Republic and Chile, making it an appropriate model for the hotel sector for the experiences obtained in its first applications.

This model is structured in five components: human capital, organizational capital, technological capital, relational capital and contextual capital. Each of the components is integrated by the following elements:

1. **Human Capital (four elements):** attitudes, training, skills and structure and nature of the workforce.
2. **Organizational Capital (four elements):** organizational culture, organizational structure, organizational learning and organizational processes.
3. **Technological Capital (two elements):** technological endowment oriented to internal operability and technological endowment oriented to commercial functions.
4. **Business Relational Capital (four elements):** customer relationships, supplier relationships, allied relationships and relationships with competitors.
5. **Contextual Capital (four elements):** reputation and corporate image, corporate social responsibility, environmental conservation and location.

From these 18 elements, 89 variables have been defined that explain in an operative way the intangibles that the hotels under study have and finally they are reflected in 106 indicators of intellectual capital.

The information was collected through the survey, applying questionnaires containing questions according to the design of the intellectual capital model described above.

The number of questionnaires applied was decided according to the total number of employees at the operational and managerial level of the hotel studied.

The questions were closed and of an evaluative type, using the "Likert" type scale that was from 1 to 5, allowing to give a value to each of them, where the value of 1 is equal to totally disagree; 2 equals partially disagree; 3 is equal to neutral; 4 is equal to partially agree and 5 is equal to totally agree.

For the selection of the hotel to be studied, a hotel company from the city of Manzanillo was sought that was between small and medium and allowed the application of the survey to its operational and managerial staff and a suitable business profile for the fulfillment of the objective of the investigation and the empirical test of the hypothesis.

According to the directory of hotels in that city, the general manager of several hotels was contacted. There was a hotel that agreed to the application of the surveys, but for the privacy of the data the name is omitted.

The questionnaires were applied during the months of March, April and May 2019 and were applied according to the work shifts and working days of the employees. During the high holiday season for Holy Week, which was during the days of April 15 to 28, no questionnaire was applied.

The total number of questionnaires applied and valid were 36, among operational employees in the areas of: kitchen, restaurant, maintenance of rooms and green areas, reception and reservations. In the managerial level the areas of: human resources, finance and general management were included.

With the data collected in the applied questionnaires, they were captured in an Excel database to be able to apply through the SPSS program, an Exploratory Factor Analysis that would allow us to know the relationship between the variables.

Results

Starting from the main purpose of the research that intends to develop an intellectual capital management model for the generation of sustainable competitive advantage, it was decided to apply the Exploratory Factor Analysis method to reduce the data and find the underlying structure within the wide set of variables. According to Hair et al. (1999), define the factors as homogeneous groups formed with variables that are strongly correlated with each other and independent of the rest.

As described above in the methodological part, in the first stage the theoretical approach of the construct and considering the "Intellectus Model" (IADE-CIC, 2003) and the "Five Capital Model" (IADE-Caja Madrid, 2004), 106 items were considered and once the data reduction was applied through the Exploratory Factor Analysis and considering those elements that had a factor load above .70, 31 items were obtained, as shown in the following table.

Human capital
Attitudes: 4 items
Training: 2 items
Competencies: 3 items
Template structure and nature: 1 items
Total items: 10
Organizational Capital
Organizational culture: 3 items
Organizational structure: 5 items
Organizational learning: 3 items
Organizational processes: 2 items
Total items: 13
Technological Capital
Internal technological endowment: 1 items
Total items: 1
Relational Capital
Relationship with customers: 4 items
Total items: 4
Contextual Capital
Corporate social responsibility: 1 item
Conservation of the environment: 2 items
Total items: 3

Table 1 Final version of the model
Own Elaboration

At the end and in a first approach of the intellectual capital management model, it was reduced to 31 items that explain the model.

Conclusions

In conclusion, the evaluation analysis found that the items of the proposed model show good clarity in relation to the specificity of the concept, when reaching a Global Validity Index above (CVI) of 0.70

For this reason, human capital and organizational capital have a clear weight over the other securities blends, this being a clear reference to start a first model and test it to other organizations

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Analysis of financial management for decision making in medium-sized enterprises in Ciudad Juárez, Chihuahua

Análisis de la gestión financiera para la toma de decisiones en las medianas empresas de Ciudad Juárez, Chihuahua

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Abstract

The objective of this research was to analyze the financial management in medium-sized enterprises in Ciudad Juárez, Chihuahua. For this, a quantitative methodology of descriptive non-experimental transactional design was used. Medium-sized businesses from the commercial and industrial sectors, established in Ciudad Juárez, Chihuahua, were considered as the unit of analysis. 87 businesses were identified with these characteristics. The fieldwork was completed with 31 medium-sized businesses, a questionnaire validated by experts was implemented and applied to the general administrators of each business. The results show that medium-sized businesses have an efficient financial management due to their low level of debt and completion of investment projects, however, these projects are primarily financed by partner contributions and accumulated profits. Thus, to improve the financial management in medium-sized businesses external financing is recommended through bank loans or the stock exchange market, likewise, the financial resources obtained should be allocated mainly for investment projects previously analyzed.

Financial management, Decision making, medium-sized enterprises

Resumen

El objetivo de esta investigación fue analizar la gestión financiera en las medianas empresas en Ciudad Juárez, Chihuahua. Para ello, se utilizó una metodología cuantitativa, de diseño no experimental transeccional descriptivo. Se consideró como unidad de análisis a medianas empresas de los sectores comercial e industrial, establecidas en Ciudad Juárez, Chihuahua. Se identificaron 87 empresas con estas características. El trabajo de campo se realizó con 31 medianas empresas, se utilizó un cuestionario validado por expertos, el cual fue aplicado al administrador general de cada empresa participante. Los resultados obtenidos muestran que las medianas empresas realizan una gestión financiera eficiente ya que su nivel de endeudamiento es bajo y realizan proyectos de inversión, sin embargo, estos proyectos son financiados principalmente por aportaciones de los socios y las utilidades acumuladas. Por lo tanto, para mejorar la gestión financiera en las medianas empresas se recomienda el financiamiento externo a través de préstamos bancarios o del mercado de valores, así mismo, los recursos financieros obtenidos deben destinarse principalmente a proyectos de inversión previamente analizados.

Gestión financiera, Toma de decisiones, medianas empresas

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Introduction

MSMEs represent the highest percentage of companies in Mexico, however, they have a survival of 12 to 24 months, with a profitability of 5 to 6% and a cost of 12% per year to acquire bank capital (BANXICO, 2015).

In the state of Chihuahua there are 124,219 economic units, of which 123,519, that is, more than 99% are MIPYMES, companies with a number of employees below 250. While in Cd. Juárez, Chihuahua there are 41,109 economic units of the which 99% are MSMEs (INEGI, 2019).

According to the National Commission for the Defense of Users of Financial Services (CONDUSEF, 2015), MSMEs present various problems related to poor administration and financial management, which causes these economic units to have a short period of existence. Rodríguez (2016), points out that financial management in MSMEs is characterized by insolvency and low liquidity, as a result of ineffective financial policies or by the ignorance of the owner or manager regarding the proper management of their resources.

Castillo and Ceballos (2014), suggest that MSMEs retain a culture in which they seek to finance themselves through personal loans or banking institutions, however, the products offered by these institutions generate high financing costs and difficulty in obtaining them due to the requirements that companies must meet.

When MSMEs require financing, they can opt for a banking or non-bank one through government institutions, in both cases the presentation of an investment project is necessary, the credit institutions require formality and presentation of the project so that it is feasible to obtain the credit (Castro, 2017).

According to Gonzales and Quizhpe (2012), a company to grow needs financing and increases sales, and to achieve this, it requires investments in accounts receivable, inventories and fixed assets. In the short term, this financing can be derived from additional sales, as well as retained earnings. The above is achieved with efficient short-term financial administration.

Regarding medium-sized companies, their importance in the country is that they contribute 25% to 40% of the Gross Domestic Product (GDP) considering collateral added value (HSBC, 2017). In 2014 they employed 3,029,362 workers, which represents almost 16% of the total population employed in the country (González, 2015).

The medium-sized companies, due to their characteristics in terms of income generation and employed personnel, are forced by their level of operations to have effective internal controls, detailed accounting records and greater fiscal commitments. Therefore, they require effective financial management.

The purpose of financial resources management is to obtain resources (either by capital contributions or credit), their correct management and application, as well as efficient coordination of working capital, investments and results, to make sound decisions (Perdomo, 2008).

An alternative option to obtain financial resources is through the Stock Market, where companies, credit institutions and government agencies offer financial instruments among the investing public, who acquires them through financial intermediaries (BMV, 2019).

According to Nava (2009), the analysis of financial management allows identifying the economic and financial aspects that show the conditions in which a company operates with regard to the level of liquidity, solvency, indebtedness, efficiency, performance and profitability, facilitating the taking of managerial, economic and financial decisions in business activity.

Analyzing the financial management of medium-sized companies will provide best practices that will contribute to improving their performance and encouraging their growth.

Therefore, the objective of this research was to analyze the financial management of medium-sized companies in the commercial and industrial sectors in Ciudad Juárez, Chihuahua.

Methodology

The nature of the research was quantitative, descriptive non-experimental transectional design. The study variable was financial management and the indicators considered for its measurement were: financial performance, financial structure, use of information technologies, financial decision making, long-term financial administration and short-term financial administration.

The investigation was carried out in Ciudad Juárez, Chihuahua in the months of June to September 2018.

The information collection was carried out through the survey method, a questionnaire was administered that was designed considering the existing literature as reference and validated by a group of experts. The questionnaire was divided into two sections, the first one included general data and the second section consisted of 15 dichotomous questions and 10 closed multiple-choice questions that addressed the indicators of the variable financial management. It was considered as a unit of analysis for medium-sized companies in the commercial and industrial sectors, established in Ciudad Juárez, Chihuahua. 87 companies with these characteristics were identified.

For this, the database of the National Institute of Statistics and Geography (INEGI) was taken as a sampling frame. Considering this number of companies, it was proposed to make a census with the intention of including all of them in the study. The field work was carried out with 31 companies that met the characteristics required for this investigation. In each participating company the questionnaire was applied to the general administrator. The information collected was processed and analyzed using the statistical software SPSS version 24.

Results

This section presents the socio-labor indicators, and the results of the indicators of the variable financial management.

Socio-labor indicators

31 medium-sized companies participated in this research, of which 52% belong to the commercial sector and 48% to the industrial sector. The two sectors mentioned are those that group the largest number of medium-sized companies in Ciudad Juárez, Chihuahua.

Table 1 shows the distribution by seniority and sector of the companies participating in the study. The results show that 60% of medium-sized companies in the commercial sector and 63% of those belonging to the industrial sector are between 6 and 15 years old.

Antiquity (years)	Sector		
	Comercial	Industrial	Total
	%	%	%
0 to 5	13	12	13
6 to 10	53	44	48
11 to 15	7	19	13
16 to 20	0	6	3
21 and more	27	19	23
Total	100%	100%	100%

Table 1 Age and sector of medium-sized companies
Source: Self Made

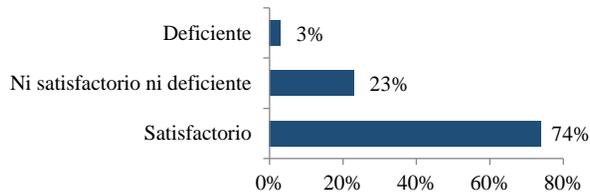
Financial performance

Table 2 shows that 94% of the respondents affirm that in the company a financial management is carried out in which the financial statements are audited, analyzed and made projections that are subsequently reviewed against the results obtained. While 6% state that the above is not fulfilled. It is important to mention that 16% of the participants in the sample indicate that the financial statements are not audited by an internal control area.

Question	Yes	No
	%	
Are the financial statements audited by an internal control area?	84	16
Is an analysis of the financial statements made to know their liquidity, operational efficiency, solvency and profitability?	97	3
Are annual projections of sales, costs and expenses made?	97	3
Are projections reviewed against the actual results of the performance obtained?	97	3
Average	94	6

Table 2 Financial performance
Source: Self Made

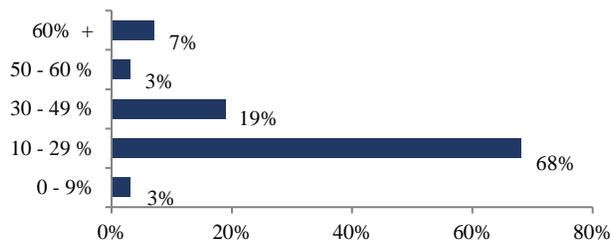
Figure 1 shows that 74% of respondents believe that the financial performance of the company in the last 5 years is satisfactory, while 23% maintain a neutral position and 3% consider that the company has had a poor performance.



Graphic 1 Financial performance of the company in the last 5 years
Source: Self Made

Financial structure

With respect to the financial structure indicator, figure 2 shows that in 90% of the companies participating in this study the assets that come from external financing are in a range of 0 to 49% with respect to the total of their assets. While in 10% of companies the assets acquired with external financing are between a range of 50% and greater than 60%.



Graphic 2 Assets from external financing
Source: Self Made

Use of information technologies

Table 3 shows that 84% of respondents state that the company has software for financial management and 14.5% mention that there is no support software.

Question	Yes	No	ND
	%		
Does the company have any software for financial management?	81	19	0
Does the company have a computer system for inventory management?	87	10	3
Average	84	14.5	1.5

Table 3 Use of information technologies
Source: Self Made

Information management

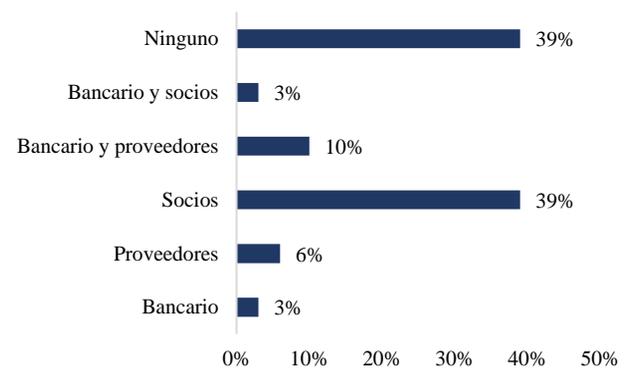
Table 4 shows that 100% of respondents agree that the company uses the information in the financial statements for decision making, and 93% of the participants indicate that the accounting and financial information has been available when it has been required to obtain credits. While 7% evidence the lack of information.

Question	Yes	No
	%	
Is the information in the financial statements used to make investment and / or financing decisions?	100	0
Has accounting and financial information been available to facilitate credit?	93	7

Table 4 Information management
Source: Self Made

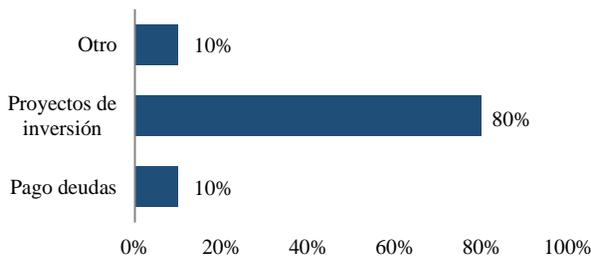
Financial decision making

Figure 3 shows that 39% of the companies participating in this study mention that they do not currently have any type of financing, 39% obtain financing from partners, 10% are financed by banks and suppliers, 6% obtain supplier financing, 3% has bank financing and the remaining 3% obtained financing from banks and partners.



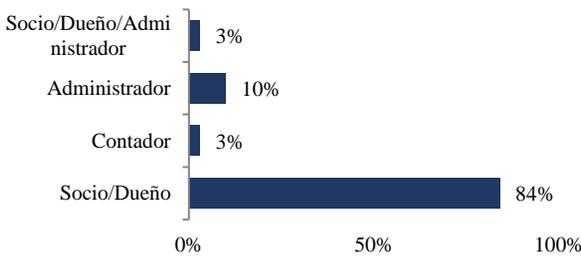
Graphic 3 Current financing
Source: Self Made

The results in graph 4 show that of the total of companies that obtained some type of financing, 80% allocated the resources obtained to investment projects, 10% for the payment of debts and the remaining 10% for various purposes.



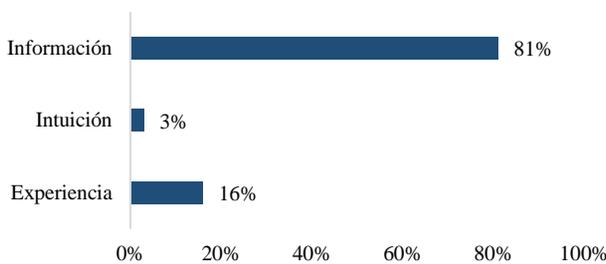
Graphic 4 Use of financing
Source: Self Made

Figure 5 shows that in 84% of the companies surveyed the main partner and / or owner are the ones who make the financial decisions, in 10% it is the administrator, in 3% the main partner, owner and / or administrator and in the remaining 3% the counter.



Graphic 5 Financial decision making
Source: Self Made

Figure 6 shows that 81% of the companies surveyed make financial decisions based on the available information, while 16% is based on experience and the remaining 3% on intuition.



Graphic 6 Approach to financial decision making
Source: Self Made

Long term financial administration

Table 5 shows that 68% of the companies participating in this research claim to have carried out a long-term investment project in the last 5 years, while 32% responded negatively.

On the other hand, 39% of companies indicate that they currently have a long-term investment project and 61% currently do not have an investment project. 89% say they evaluate the financial cost of the various financing options, while 11% mention that they do not perform this evaluation.

Question	Yes No	
	%	
Has the company had long-term investment projects in the last 5 years?	68	32
Does the company currently have a long-term investment project?	39	61
Is the financial cost of the various financing options evaluated?	89	11

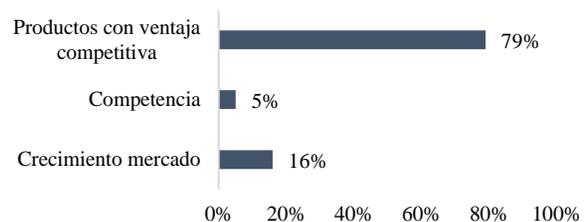
Table 5 Long term investment projects
Source: Self Made

Graph 7 shows that of the total number of companies that currently have a long-term investment project, 46% indicate that resources are invested in research and development, 38% invest resources in expansion, 8% in fixed assets and 8% remaining in various activities.



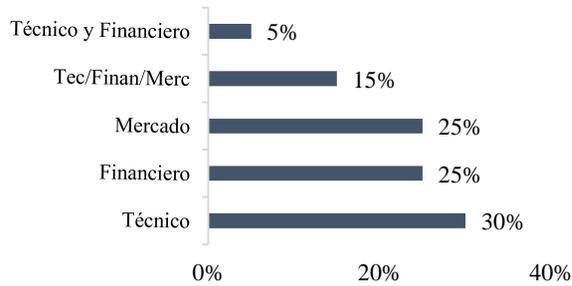
Graphic 7 Investment projects
Source: Self Made

Figure 8 shows that of the total number of companies that have developed a long-term investment project in the last 5 years, 79% have considered the completion of the project taking as reference that the products present a competitive advantage, 16% market growth, while 5% take into account the existence of few competitors in the market.



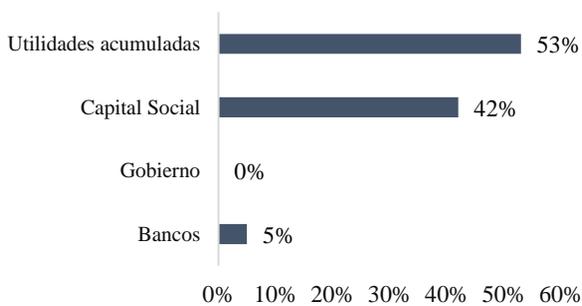
Graphic 8 Factors considered when conducting an investment project
Source: Self Made

According to the results presented in figure 9, of the total number of companies that have developed a long-term investment project, 30% of the companies carry out a technical study, 25% a financial study, 25% a market study, 15% carry out a study considering the technical, financial and market aspects, while 5% carry out a technical and financial study.



Graphic 9 Studies prior to an investment project
Source: Self Made

Figure 10 shows that the main source of financing in 53% of the companies surveyed is the accumulated profits, 42% indicates the share capital and 5% indicates that the bank's main source of financing is.



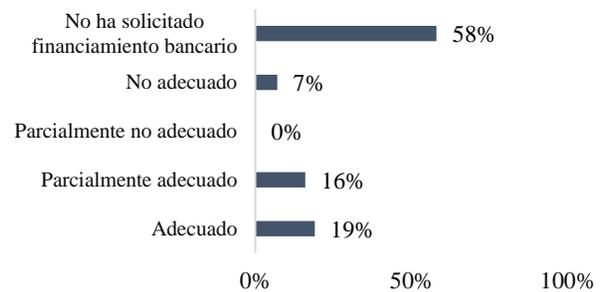
Graphic 10 Main source of financing
Source: Self Made

39% of the companies participating in the sample consider the increase in productivity as a determining factor to request financing, 29% an increase in sales, 16% business opportunities, 3% consider the three previous factors, the 3% increase in productivity and opportunities, and the remaining 10% consider other non-specific factors, as shown in figure 11.



Graphic 11 Factors considered when requesting financing
Source: Self Made

With reference to the process to access a loan in banking institutions in Figure 12, it can be seen that 58% of the companies surveyed mentioned not having requested bank financing, 19% affirm that the process is adequate, 16% mention that it is partially adequate, while 7% consider the process not adequate.



Graphic 12 Loan process in banking institutions
Source: Self Made

Short Term Financial Administration

For the study of the short-term financial management indicator, the administration of cash and accounts receivable was considered. Table 6 shows that 67% of the companies participating in this study state that they perform financial management of cash through bank reconciliations, temporary investments and a minimum balance in their accounts, while 33% responded negatively. However, only 35% of companies make monthly bank reconciliations. Regarding the existence and compliance of credit and collection policies, 77% indicate that they have this type of policy, while 19% have an absence of credit and collection policies.

Question	Yes	No	ND
		%	
Does the company make monthly bank reconciliations?	35	65	0
Does the company make temporary investments of cash surpluses?	81	19	0
Does the company have the policy of maintaining a minimum balance in bank accounts?	84	16	0
Average	67	33	0
¿La empresa tiene políticas de crédito y cobranza por escrito, y se cumplen?	77	19	3

Table 6 Cash and accounts receivable management
Source: Self Made

Conclusions

The results obtained in this research work allow us to conclude that in the medium-sized companies of the industrial and commercial sector in Ciudad Juárez, Chihuahua, effective financial management is carried out, since they have a healthy financial structure, with a minimum of assets financed with liabilities, which indicates that in case of some financial contingency they could overcome it since the financial commitments, in the majority of the companies surveyed are not significant.

Likewise, medium-sized companies use the financial statements as a tool for decision-making since these statements are mostly reviewed by a different entity to the one who prepares them, which gives them a greater degree of reliability.

It is important to consider that 61% of the companies participating in this research are 6 to 15 years old, and 23% are older than 20 years. This can be a factor that positively impacts your financial management.

Another important finding observed in the results is that medium-sized companies have or have had investment projects in the last 5 years, mostly for the acquisition of assets. This indicates that companies are growing or that they have the financial possibilities to renew their fixed assets, however, most of the investment projects are financed by own resources, either, profits from previous years or contributions from shareholders, which implies that companies are not taking advantage of external financing, for example, bank loans or financing through the stock market and therefore, the business risk leans mostly towards shareholders.

Financing through liabilities, with effective financial management has advantages such as the deductibility of interest for tax purposes and a balanced financial structure with respect to the assets of the company, so it is recommended that the sources of financing do not come in large shareholder contributions or accumulated profits. On the other hand, some authors (Rodríguez and Hernández, 2013; Urrutia and Cuevas, 2016) suggest that through the integration of business networks, competitive improvement, efficiency in processes and the social capital of companies are increased.

Under this perspective, it is considered important that medium-sized companies in Ciudad Juárez, Chihuahua, integrate business networks that aim to share best practices, carry out government and private management, as well as provide advice and training to network members, among other activities.

Finally, it is recommended to conduct studies of medium-sized companies with a focus on compliance with the requirements for bank financing, their financial capacity for timely payment of principal and interest on loans requested, as well as analyzing whether medium-sized companies They are open to financing through the stock market, which opens the possibility to obtain resources from a large number of investors at a financial cost potentially lower than the bank, complying with the legal, financial and corporate requirements established by the Law of the Stock Market.

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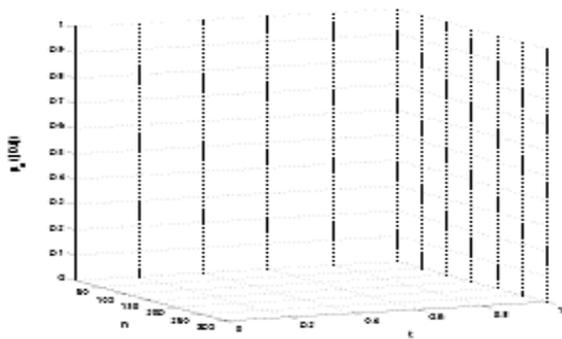
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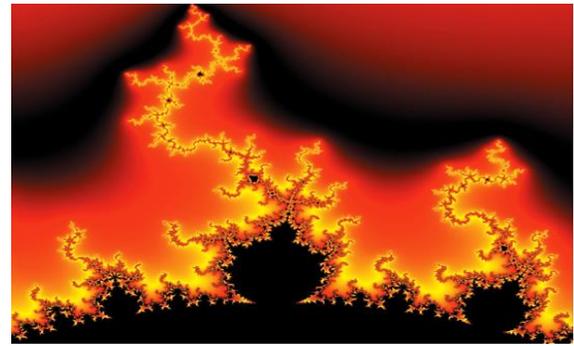


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