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RINOE Journal-Industrial Organization

Definition of the Journal

Scientific Objectives

Support the international scientific community in its written production Science, Technology and Innovation in the Field of Social Sciences, in Subdisciplines of Market structure, Firm strategy, and Market performance: Production, Pricing, and Market structure, Size distribution of Firms, Monopoly, Monopolization strategies, Oligopoly and Other imperfect markets, Transactional relationships, Contracts and reputation, Information and Product quality, Industrial Organization and Macroeconomics, Macroeconomic industrial structure; Firm objectives, Organization, and Behavior: business objectives of the Firm, Firm organization and Market structure, Vertical Integration, Organization of Production, Firm Size and Performance; Nonprofit organizations and Public Enterprise: Nonprofit institutions, Public enterprises, Boundaries of public and private enterprise, Privatization, Contracting Out; Antitrust policy: Monopolization, Horizontal anticompetitive practices, Vertical restraints, Resale PRICE maintenance, Quantity Discounts, Legal Monopolies and Regulation or Deregulation, Antitrust policy and public enterprise, Nonprofit Institutions, and Professional Organizations; Regulation and industrial policy, Economics of regulation, Industrial policy, Sectoral planning methods; Industry studies: manufacturing, Metals and Metal products, Cement, Glass, Ceramics, Automobiles, Other transportation equipment, Microelectronics, Computers, Communications equipment, Other Machinery, Business equipment, Armaments, Chemicals, Rubber, Drugs, Biotechnology, Food, Beverages, Cosmetics, Tobacco, Other Consumer Nondurables, Appliances, Other consumer durables; Industry studies: Primary products and construction, Mining, Extraction, and Refining: Hydrocarbon fuels, Other nonrenewable resources, Forest products, Construction; Industry studies: Services, Retail and wholesale trade, Warehousing, Entertainment, Media, Sports, Gambling, Recreation, Tourism, Personal and professional services, Real estate services, Information and internet services, Computer software; Industry studies: Transportation and utilities, Transportation, Railroads and Other surface transportation, Air transportation, Electric utilities, Gas Utilities, Pipelines, Water utilities, Telecommunications, Utilities, Government policy.

Market structure, business strategy and market funtioning, Objectives, organization and behavior of the company, Non-profit organizations and public enterprises, Politics of defense of the competition, Regulation and industrial politics, Sectorial studies: Manufactures, Sectorial studies: Primary products and construction, Sectorial studies: Services, Sectorial studies: Transport and basic supplies.

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RINOE Journal-Industrial Organization is a Journal edited by RINOE® in its Holding with repository in Peru, is a scientific publication arbitrated and indexed with semester periods. It supports a wide range of contents that are evaluated by academic peers by the Double-Blind method, around subjects related to the theory and practice of Market structure, Firm strategy, and Market performance: Production, Pricing, and Market structure, Size distribution of Firms, Monopoly, Monopolization strategies, Oligopoly and Other imperfect markets, Transactional relationships, Contracts and reputation, Information and Product quality, Industrial Organization and Macroeconomics, Macroeconomic industrial structure; Firm objectives, Organization, and Behavior: business objectives of the Firm, Firm organization and Market structure, Vertical Integration, Organization of Production, Firm Size and Performance; Nonprofit organizations and Public Enterprise: Nonprofit institutions, Public enterprises, Boundaries of public and private enterprise, Privatization, Contracting Out; Antitrust policy: Monopolization, Horizontal anticompetitive practices, Vertical restraints, Resale PRICE maintenance, Quantity Discounts, Legal Monopolies and Regulation or Deregulation, Antitrust policy and public enterprise, Nonprofit Institutions, and Professional Organizations; Regulation and industrial policy, Economics of regulation, Industrial policy, Sectoral planning methods; Industry studies: manufacturing, Metals and Metal products, Cement, Glass, Ceramics, Automobiles, Other transportation equipment, Microelectronics, Computers, Communications equipment, Other Machinery, Business equipment, Armaments, Chemicals, Rubber, Drugs, Biotechnology, Food, Beverages, Cosmetics, Tobacco, Other Consumer Nondurables, Appliances, Other consumer durables; Industry studies: Primary products and construction, Mining, Extraction, and Refining: Hydrocarbon fuels, Other nonrenewable resources, Forest products, Construction; Industry studies: Services, Retail and wholesale trade, Warehousing, Entertainment, Media, Sports, Gambling, Recreation, Tourism, Personal and professional services, Real estate services, Information and internet services, Computer software; Industry studies: Transportation and utilities, Transportation, Railroads and Other surface transportation, Air transportation, Electric utilities, Gas Utilities, Pipelines, Water utilities, Telecommunications, Utilities, Government policy with diverse approaches and perspectives, That contribute to the diffusion of the development of Science Technology and Innovation that allow the arguments related to the decision making and influence in the formulation of international policies in the Field of Social Sciences. The editorial horizon of RINOE® extends beyond the academy and integrates other segments of research and analysis outside the scope, as long as they meet the requirements of rigorous argumentative and scientific, as well as addressing issues of general and current interest of the International Scientific Society.

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The works must be unpublished and refer to topics of Market structure, Firm strategy, and Market performance: Production, Pricing, and Market structure, Size distribution of Firms, Monopoly, Monopolization strategies, Oligopoly and Other imperfect markets, Transactional relationships, Contracts and reputation, Information and Product quality, Industrial Organization and Macroeconomics, Macroeconomic industrial structure; Firm objectives, Organization, and Behavior: business objectives of the Firm, Firm organization and Market structure, Vertical Integration, Organization of Production, Firm Size and Performance; Nonprofit organizations and Public Enterprise: Nonprofit institutions, Public enterprises, Boundaries of public and private enterprise, Privatization, Contracting Out; Antitrust policy: Monopolization, Horizontal anticompetitive practices, Vertical restraints, Resale PRICE maintenance, Quantity Discounts, Legal Monopolies and Regulation or Deregulation, Antitrust policy and public enterprise, Nonprofit Institutions, and Professional Organizations.

Regulation and industrial policy, Economics of regulation, Industrial policy, Sectoral planning methods; Industry studies: manufacturing, Metals and Metal products, Cement, Glass, Ceramics, Automobiles, Other transportation equipment, Microelectronics, Computers, Communications equipment, Other Machinery, Business equipment, Armaments, Chemicals, Rubber, Drugs, Biotechnology, Food, Beverages, Cosmetics, Tobacco, Other Consumer Nondurables, Appliances, Other consumer durables; Industry studies: Primary products and construction, Mining, Extraction, and Refining: Hydrocarbon fuels, Other nonrenewable resources, Forest products, Construction; Industry studies: Services, Retail and wholesale trade, Warehousing, Entertainment, Media, Sports, Gambling, Recreation, Tourism, Personal and professional services, Real estate services, Information and internet services, Computer software; Industry studies: Transportation and utilities, Transportation, Railroads and Other surface transportation, Air transportation, Electric utilities, Gas Utilities, Pipelines, Water utilities, Telecommunications, Utilities, Government policy and other topics related to Social Sciences.

Presentation of Content

In the first article we present, *Reengineering and Innovation to facilitate the transition from industry 3.0 to 4.0*, by OROZCO-MAGALLANES, Rubén Ulises, PEÑA-MONTES DE OCA, Adriana Isela, MACÍAS-BRAMBILA, Rubén Hassem and LÓPEZ-LAGUNA, Ana Bertha, with adscription in the Universidad Tecnológica de Jalisco, as following article we present, *Operational Excellence and its impact on hazardous waste management in the automotive industry*, by SOTO-LEYVA, Yasmin, BONES-MARTÍNEZ, Rosalía and SANTOS-OSORIO, Arturo, with adscription in the Instituto Tecnológico Superior de Huauchinango, as following article we present, *Parameters of Quality in the Production of Piloncillo in Sabanas Huatusco, Veracruz*, by JIMENEZ-HERNÁNDEZ, Magdalena, GARCÍA-CASTILLO, Luz Ariana, MARTÍNEZAGUILAR, María and LÓPEZ-SERRANO, Moises, with adscription in the Instituto Tecnológico Superior de Huatusco, as last article we present, *Support in the Control of the Maintenance Record of the Installations of the System for the Prevention of Corrosion*, by CRUZ, Vianey, WONG, Juan, RUIZ, Cinthia and LEMA, David, with adscription in the Universidad Politécnica de Altamira.

Content

Article **Journal-Industrial Organization**
December 2021 Vol.5 No.9 1-7

Reengineering and Innovation to facilitate the transition from industry 3.0 to 4.0

Reingeniería e Innovación para facilitar la transición de industria 3.0 a 4.0

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Abstract

Disruptive innovation project regarding technologies available in the transformation industry, in order to face the challenges of globalized competition, respond to a production logic with characteristics of the so-called smart factory and thus close the technological gap to the use contemporary and innovative industrial automation systems through cyber physical elements for the constitution of a digital twin. Among the significant tasks, the review and analysis of the integration means for Industry 4.0 was developed through the use of techniques and tools of rapid methodologies for the design and management of engineering projects, as well as the diagnosis and design proposal of solution in improvements. Therefore, it is a functional approach to the estimated interpretation of international standards when developing the application of a standard process control solution with the capacity to be reworked and composed in such a way that a hybrid productive architecture is generated.

Industry 4.0, Evolution Industry 3.0, Industrial Project Methodology

Resumen

Proyecto de innovación disruptiva en lo concerniente a tecnologías disponibles en la industria de la transformación, con la finalidad de hacer frente a los desafíos de la competencia globalizada, responder a una lógica productiva con características de la denominada fabrica inteligente y así cerrar la brecha tecnológica al utilizar sistemas contemporáneos y novedosos de automatización industrial a través de elementos ciber físicos para la constitución de un gemelo digital. Entre las tareas significativas se desarrolló la revisión y análisis de los medios de integración para industria 4.0 a través del uso de técnicas y herramientas de metodologías rápidas para el diseño y gestión de proyectos de ingeniería, así como también de la propuesta de diagnóstico y diseño de solución en mejoras. Por tanto, es una aproximación funcional a la interpretación estimada de los estándares internacionales al desarrollar la aplicación de una solución de control de procesos estándares con capacidad de ser retrabajados y compuestos de forma tal que se genera una arquitectura productiva hibrida

Industria 4.0, Evolución Industria 3.0, Metodología de proyectos industriales

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Introduction

The schematization of industrial revolutions in history carried out by Ana María Reyes Fabela and Rene Pedroza Flores (1) generates a panorama of understanding of key moments and characteristics.

Movement	Temporality	Characteristics
Agricultural revolution	-2500 BC	Using animal energy, simple technology
First Industrial Revolution	Century XVIII	Mechanical power, steam engine
Second Industrial Revolution	XIX century	Chain manufacturing, fast production lines
Third Industrial Revolution	Twentieth century	Flexible manufacturing, electronic automation
Fourth Industrial Revolution	Started in 2010	Smart factories, connected industry, Industry 4.0

Table 1 Industrial revolutions in history
Source: Reyes Fabela and Pedrosa Flores (2018)

Technological use is an indicator of vital importance to increase productivity, this in any of the tasks carried out as a species, in such a way an example can be cited in which two average people move from point "A" to point " B ", one on foot and the other by bicycle, it can be assumed that the person on a bicycle travels in less time and with less effort than the other, in such a way that by having the necessary technology the activities are facilitated and generate added value. The term industry 4.0 was coined in Germany in 2011, but conceptually they reveal a competence to jointly develop a comprehensive technological solution (Deutschland.de, 2014).

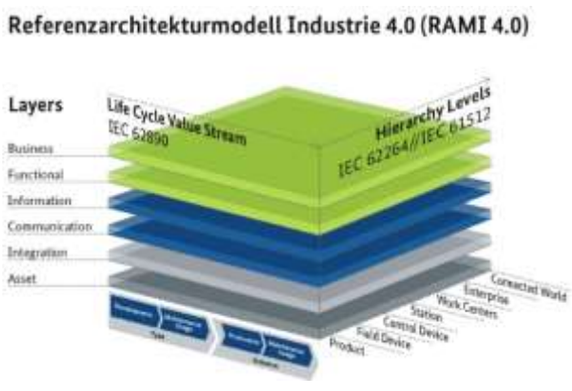

Figure 1 Industry 4.0 architecture reference model
Source: ZVEI (2015)

The functional guidelines of Industry 4.0 by having a vertical axis in which the layers of representation of Information Technology are immersed; In other words, the digital image of the Business, the Functionality, the Information, the Communication, the Integration and the Assets, proposed in this way due to the complexity of their use in an IT solution, allows to identify and separate the parts of predecessor technology to facilitate migration (ZVEI, 2015). According to Siemens (2021), Industry 4.0 "It is about the union between the real and virtual world in factories, that is, the application of information technologies to production processes.

The facilities are autonomous and the production chain self-managed, which allows a more flexible configuration that provides quick and efficient responses to market demand. Likewise, all the information derived from the manufacturing process is available in real time in all the areas that make up the company. "

In Mexico, little has been invested in the migration of productive technologies, and there are few cases of success. It is automotive-type companies that have carried out some work. (El Financiero, 2019).

Currently there is a technical deficiency in the intercommunication of technologies that manufacturers and suppliers supply to the industry separately, there are both hardware and software elements, but they are not properly connected and intercommunicated with each other, such as approval, as well as use of the OPC communication protocol in its different variables.

The companies that have been organized to include analysis technologies and improvements in production processes such as HMI / SCADA manage to allocate the data obtained through field elements to automate, with which they arrive at a result of a large number of information about its processes, but a very vague reason in the analytical and intelligent processing of that information, deficient for purposes of supporting executive decisions in the company.

The diagnosis of Mexican companies in relation to the concept of Industry 4.0 through an exercise on forms and information management, refers to the following figures:

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Organization	Total	%
Automation	7	78
Brewery	6	67
Inlay	6	67
Gas	4	44
Messenger service	5	56
Metalworking	4	44
Mining	6	67
Transportation	9	100

Table 2 Level of competence in processes and digitization
Source: Díaz-Martínez, Cruz Méndez and Ruiz-Domínguez (2018)

The industrial sector is considered an engine of innovation, growth, social stability, by responding to customer demands; with products of the highest quality, personalized and with shorter production times (Díaz-Martínez, Cruz Méndez and Ruiz-Domínguez, 2018); to achieve business growth and develop sustainable competitive advantages (Porter and Kramer, 2011; Barney, Ketchen and Wright, 2011; Marvek, Davis and Sproul, 2016).

The objective of this work is to develop an analysis and transformation methodology, using devices with shapes and designs similar to those of Industry 3.0, through IOLink or OPC UA communication that are integrated and allow predictive tasks mediating analysis of variables, in a timely manner. facilitate the structuring of a strategic plant operation and maintenance plan

The importance of this research is based on the fact that there are no studies on methodologies that support the migration of industry processes 3.0 to 4.0, through the integration of a team of experts, mediating the correct adjustment between the environment and the capacities of the organizations; It starts from the cloud through control technology, IoT Gateway to sensors and actuators, which improves customer-centric decision-making, thereby boosting business innovation, by generating competitive advantages in MSMEs with significance in the economic development of the country.

Work continues with the conceptual framework, as well as a review of the literature and related empirical studies. Followed by the section that describes the methodology used, while the analysis and results are presented in a later section, to finally present and discuss the conclusions, limitations and implications for future research.

Methodology

In order to evolve from Industry 3.0 to 4.0, technology exists in a vast variety of separate field elements that, in the first instance, are not related to each other in a practical way, which makes it difficult to choose tangible and intangible equipment, supplies, and tools. an application process integrated into an automated production line or chain.

For Michael Rüßmann, Markus Lorenz, Philipp Gerbert, Manuela Waldner, Jan Justus, Pascal Engel, and Michael Harnisch, the semantic composition in approach to the RAMI 4.0 model as a nuclear source in a multisystemic way of industrial technologies and solutions is graphically described in its approximate shape as follows:

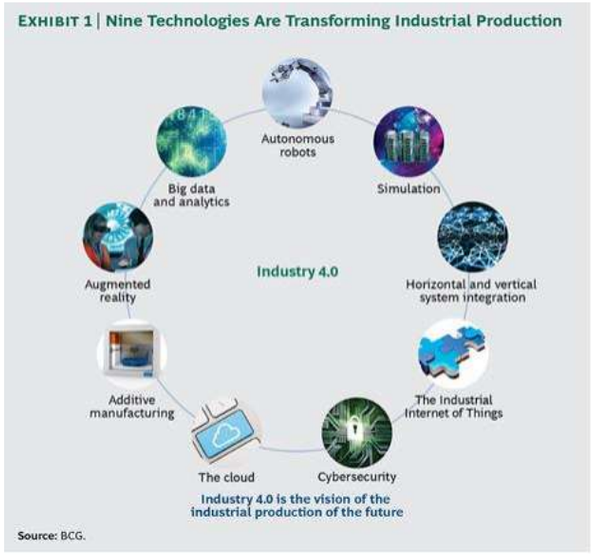

Figure 2 The nine technologies that are transforming industrial production
Source: Rüßmann (2015)

Lean manufacturing "This phase involves the development of smart factories that are capable of using various digital technologies in production processes, in order to efficiently develop their products and meet market needs ... the so-called fourth industrial revolution consists of a complete digitization of a factory's supply chains by means of tools such as: data processing and analysis, software systems, sensors and process automation, through which the prediction of market factors is facilitated, as well as production planning and control, thus adding an important value to the entire chain. " (Lean manufacturing 10, n.d.)

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RAMI 4.0 Semantic Composition	General information features	ZVEI Standards Category - Norm
Robotic Autonomy	Programming in Codesys, Festo PLC, IFM Sensors, Danphoss Inverter, Inlet Hopper Granulator, Final Chill Roll.	Safety equipment IEC 61511, IEC62061, ISO 13849, IEC 62453 Configuration, IEC 62714 Engineering, ISO / PAS 17506, IEC 61131, IEC 62264 Hierarchy Levels
Simulation	Visual Studio, SQL or Oracle, Blender	Digital Factory IEC TR 62794, IEC TS 62832, IEC 62890 Life Cycle, Monitoring Conditions (CM) VDMA 24582, IEC 61131 Engineering, IEC 61987-X, IEC 61360, IEC 62264 Hierarchy Levels
Vertical and horizontal information systems	Configuration of the field element communication system with user visualization services	Configuration IEC 61804, IEC 62453, Life Cycle IEC 62890, CM, VDMA 24582, Hierarchy Levels IEC 62264
IoT	OPC UA, iOlink, Ethernet internet connection protocol with industrial data upload and download.	Communications layer - IEC 61784, IEC 62541 OPC UA, Engineering IEC 62714, IEC 62424, DIN SPEC 16592
Cybersecurity	Microtik or Check-Point for brute force, Social engineering prevention course,	Computer security IEC 62443, ISO IEC 27000, Security equipment IEC 62061 and 61511, Hierarchy Levels IEC 62264
Cloud	Microsoft Azure, Customer-tailored plant design application, Visual Studio C #, PHP Maker	Life Cycle IEC 62890, CM, VDMA 24582, Information Layer eCl @ ss (ISO 13584-42 / IEC 61360) Hierarchy Levels IEC 61512 and 62264, Semantics RIF / SRWL, UWL, RDF (S), SPARQL
Additive Manufacturing	ERP design by Oracle or SQL by means of a Supply Chain Equation	Configuration IEC 61804, IEC 62453, Energy Efficiency ISO 20140-5
Augmented reality	Oculus, Unity, Blender, Database connectivity (SQL Oracle), Systems: training and maintenance.	Life Cycle IEC 62890, Monitoring Conditions (CM) VDMA 24582,
Analytics in Big Data	Statistical Queries, Production Metrics, R, R +, SQL Oracle	IEC 62890 Life Cycle, VDMA 24582 Monitoring Conditions, IEC 62714, 61360 and 61987-X Engineering, eCl @ ss Information Layer (ISO 13584-42 / IEC 61360), IEC 62264 Hierarchy Levels
Robotic Autonomy	Programming in Codesys, Festo PLC, IFM Sensors, Danphoss Inverter, Inlet Hopper Granulator, Final Chill Roll.	Safety equipment IEC 61511, IEC62061, ISO 13849, IEC 62453 Configuration, IEC 62714 Engineering, ISO / PAS 17506, IEC 61131, IEC 62264 Hierarchy Levels

Table 3 Information extracted from the EDT dictionary according to the migration project
Source: i40-semantic-Interoperability (2017)

Engineering FEED or FEL (Front-End Engineering Design - Front End Loading) consisting of elaborating the basic parameters of the process, determining the arrangement and sizing of equipment and ideal models, designing and specifying the systems in their constitution in this case of hardware for production and processing of industrial control and sales channel software for them, as well as the necessary equipment to achieve the assurance of productive technologies, thus establishing the specification of their benefits and work performance in an ideal industrial environment (Davon and Jablokow, 2015)

For the programming of the device, users must use the Codesys software package version V3pbF, which allows the editing of code by structured text as well as by the simplified introduction of data, list of instructions, ladder diagram, function block diagrams, diagram of sequential function blocks, simplified fieldbus configuration, elements for connection via IOLink protocol, loading of controllers or various sensor libraries with preloaded internet of things characteristics, management of search for errors in programming, standard of 10/100 Mbit / s communication via Ethernet, Modbus TCP client server, easy IP protocol as well as TCP / IP and connectivity service via OPC, function library for autonomous function according to IEC 61131-3 standard (CODESYS, 2019) . Regulations related to RAMI 4.0, in which the general and specific characteristics of a development in Industry 4.0 are cataloged, to give light to the technology migration methodology.

The control system of a device that allows adjustments of a signal in a closed link, is achieved by permuting the same signal, by managing the action of a proportional, integral and derivative signal.

Proportional control action, precise minimization of the error in the system, before a prominent error the control action is of the same category in order to generate a tendency to decrease the error, the response speed of the system is increased, the Steady-state system error increases system instability.

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Derivative control action, the derivative of the error is understood as the speed of the error, when the measurable variable moves at a high speed towards the reference point, the controller must recognize the speed of the system in order to decrease its speed in anticipation of the approach. in the reference to avoid startles, the stability of the controlled system increases, the system error rate is minimally decreased, the steady-state error remains the same, this control action serves to stabilize the response outside the upper or lower ranges.

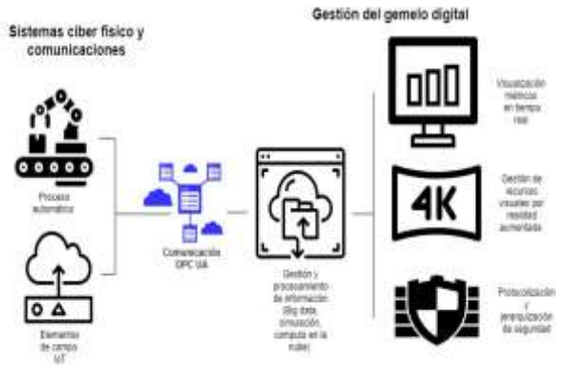

Figure 3 aphic model of elements worked for the development of the migration methodology

Integral control action, calculates the integral of the error signal, which can be observed as the sum or accumulation of the error signal that over time the integration is greater, which allows the reduction of error in the system, Steady-state system error is decreased, system instability increases, system speed is minimally increased.

To specify the function in a real product, it is necessary to program a function whose equation allows closed-loop control work.

$$c(t) = Kp \cdot e(t) + Ki \cdot \int e(t)dt + Kd \cdot \frac{\delta e(t)}{\delta t} \quad (1)$$

Where:

$c(t) = control\ signal$
$e\ (t) = \ error\ signal$
$Kp, Ki, Kd \ = \ PID\ controller\ parameters$

In real control systems there are certain limitations that reduce the ability to control the error to reach the desired response since, no matter how much the proportional action increases, the actuator field element would be overloaded with events to control the variable in error, therefore If it depends on the response speed, they have limits that cannot be overcome even for the current control.

After carrying out the PID control system and communication system according to the OPC UA protocol, the indicator display system is modeled, using the software development kit that Visual Basic introduces.

Through Microsoft Azure, it is configured as a PC stored on the internet, which in turn stores a relational and incremental database with which information from field elements such as sensors and actuators is managed. The variable display system adheres to the design as executable and portable on a web platform.

The team with programmable characteristics develops the functions of network manager of the solution by integrating the various equipment with appropriate IoT work characteristics, as well as the respective structured cabling network with industrial category. (Mikrotik-Mexico, 2017)

Results

A value proposition and key differentiators in a company that integrates innovative technologies requires the acquisition of licenses for its own developments, for an exercise of innovation and / or undertakings in accordance with the new market needs, in that of analysis, as well as information management productive of a portfolio of clients with a close relationship and enough communication allows a contractual technical solution, as well as executable.

The management of an evolutionary migration methodology from industry 3.0 to 4.0 is supported in a versatile way through the tools of project development techniques by agile methodologies. The acquisition, storage, visualization and management of information by protocols of automatic characteristics significantly reduce the time of managerial decision due to the utilities or applications that displace the preparation of reports by a version of indicators that can be modeled in real time and ubiquity.

The Industry 4.0 solution is obviously a sum of technological elements of various kinds, which makes it a complex multisystemic plot, based on the robust OPC UA communication protocol between composition applications, it must favor self-diagnosis in order to avoid failures hard on the system.

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For integration work according to RAMI 4.0 standards for Big Data Analysis solutions, Vertical or Horizontal Integration Systems, Cloud Computing, Cybersecurity, Robotic Autonomy, Industrial IoT, Simulation and Augmented Reality. There is a sufficient and at the same time growing catalog to achieve quality work in Industry 4.0.

Among the most anticipated products due to their ability to interact is the integration of augmented reality elements as they favor divergence in what is commonly known as industrial professional life, and contextualize the user of the productive hardware in a significant change in the performance of job functions

Acknowledgement

FESTO Mexico staff for providing the guidance and instruction of this great opportunity for growth in discoveries, to achieve this feat..

Conclusions

Due to the magnitude of technological integration that includes industry 4.0, mainly from the growth of the internet and utilities based on the solution of various problems from computer science, which has promoted immediate effects both in the productive organization, and impacting in global market competition.

The development of a methodology, the conceptual support of a series of protocols, processes and measures to be executed for the migration from Industry 3.0 to 4.0, whose progress metric transcended in the integration of a group of experts, as well as in the strategic execution of a multisystemic project, this evolution dissolves modern technological approaches and creates expectations for new reaches in the transformation industry based on the normative standards of RAMI 4.0.

The optimization of performance in organizations is explained through the ability of the company to constantly renew itself, by managing to identify and exploit new opportunities, in response to customer demands and continuous improvement, now through the simulation of the behavior of productive teams through virtual reality, as well as augmented reality for the rapid diagnosis of failures in productive systems.

On the other hand, through the web services of the system database, shared conditioning resources for the calculation of machine decision intelligence and the distribution of important information, based on weekly, monthly, annual histories with followers of significant events. and specific reports.

From this exploratory exercise, lines of research and development of complementary, auxiliary, peripheral, or related technologies that will help in the emergence of business models or rapid undertakings are perceived.

The present study is not without limitations, the complete coverage of all the articles that deal with the topic of Transition from industry 3.0 to 4.0 could not have been achieved, given the chosen search procedure. Therefore, there could have been works that having been directed to automated systems, a different language was used. Consequently, the factors derived from the analysis need to be treated with caution.

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Operational Excellence and its impact on hazardous waste management in the automotive industry

La excelencia operativa y su impacto en la gestión de residuos peligrosos en la industria del automóvil

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Abstract

Currently the composition of the products is more complex, therefore, also their residues, being a concern for governments and productive organizations. The automotive industry at the national level is the productive sector that occupies the third place in generation of hazardous waste, therefore, the objective of this application is focused on implementing an effective strategy to reduce the negative impact of this waste, the selected strategy is Known as OPEX (Operational Excellence), it is in charge of managing hazardous waste to reduce expired material; The case analyzed was applied in the temporary storage of hazardous waste, obtaining beneficial results, exposed in the increase in the registration of expired material at a percentage rate of 40% and a decrease of 17.21% in the powder paint residue, the methodology used mainly It is operational excellence complemented by lean manufacturing tools focused on the creation of effective operational flows, to deliver the maximum value, aligned to the mission, vision and corporate procedures, as well as to the client's requirements, for this the DEMING circle is applied and other techniques for the reduction of expired materials, hazardous waste and legally established actions.

Automotive, Warehouse, Waste, OPEX

Resumen

Actualmente la composición de los productos es más compleja, por lo tanto, también sus residuos, siendo una preocupación para los gobiernos y organizaciones productivas. La industria automotriz a nivel nacional es el sector productivo que ocupa el tercer lugar en generación de residuos peligrosos, por lo tanto, el objetivo de esta aplicación se enfoca en implementar una estrategia efectiva para reducir el impacto negativo de estos residuos, la estrategia seleccionada es Conocida como OPEX (Excelencia Operacional), se encarga de gestionar los residuos peligrosos para reducir el material caducado; El caso analizado se aplicó en el almacenamiento temporal de residuos peligrosos, obteniendo resultados benéficos, expuestos en el incremento en el registro de material caducado en un porcentaje del 40% y una disminución del 17. 21% en el residuo de pintura en polvo, la metodología utilizada principalmente Es la excelencia operativa complementada con herramientas de manufactura esbelta enfocada a la creación de flujos operativos efectivos, para entregar el máximo valor, alineados a la misión, visión y procedimientos corporativos, así como a los requerimientos del cliente, para ello se aplica el círculo DEMING y otras técnicas para la reducción de materiales caducos, residuos peligrosos y acciones legalmente establecidas.

Automoción, Almacén, Residuos, OPEX

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Introduction

Solid waste management, particularly hazardous waste, is a matter of concern in almost all countries, as the world has become more productive to sustain society's demand, in turn, products are more complex and have decreased. noticeably its life cycle. This results in an increase in the volumes of waste generated with the presence of hazardous materials, leading to the concentration of waste in a given area, putting even more pressure on the ecosystem (Morejón, 2003). The general law of ecological balance and protection of the environment defines as dangerous all waste, in any physical state, which, due to its corrosive, toxic, poisonous, reactive, explosive, flammable, biological, infectious or irritant characteristics, represents a danger to ecological balance or the environment;

According to this definition, practically any substance could be considered dangerous; however, the factors of greatest importance to society are infectiousness and toxicity. The generation of hazardous waste and waste of special handling worldwide is worrying, in the magnitude in which these put health at risk, considering that the more developed a country is, the greater amount of hazardous waste it will generate, such is the case of The United States of America, which originates an average of 37,000,000 tons of hazardous waste worldwide (American Assembly, 1982), followed by Germany and China; while, in Latin America, Mexico occupies the first place generating 2, 000,000 million tons of hazardous waste annually (Mercader, 2002).

"In Mexico, more than 90% of the hazardous waste produced per year is improperly managed, demonstrating that hazardous waste is abnormally available in the environment, polluting rivers, streams, deserts, among others," which has led to face an important study challenge in hazardous waste management (SEMARNAP, 1996).

This project refers to the topic "Operational Excellence (OPEX) and its impact on hazardous waste management" within an Automotive Manufacturing plant located in Mexican territory.

The company maintains a one-time interest, by generating a clear commitment to become a leading global green organization, working to create a society based on low-carbon recycling through the application of a wide range of advanced technologies supported by the continuous actions of its employees and its high environmental commitment, for this reason it has taken actions such as the reduction of hazardous waste. To achieve this, the methodology proposed by Dr. Luis Amendola was used, applying the following phases (Cuatrecasas, 2011):

Phase 1: Develop the strategy, in this phase the main problem was identified and quantified by separating the quantities of expired waste corresponding to each area, the costs for waste were calculated.

Phase 2: Plan the strategy, in this stage the organization was aligned, seeking to generate commitment with senior management, showing the main problem to all the departments involved, establishing collaborative teams, as well as actions that support in the reduction of generation of expired waste.

Phase 3: Application of tools, for this stage methodological tools were used, such as brainstorming, Ishikawa diagram, Pareto diagram, which helped in the adequate planning of improvement actions, carrying out each one of them chronologically.

The corresponding results of the OPEX application are visualized through the monitoring and evaluation of the different indicators, which are represented by the benefits obtained in the entry records of expired material to the warehouse area and the reduction of the main waste, concluding that The operational tool implemented brought with it economic and environmental benefits (reduction of waste generation) that arose from the improvement actions and the strategies developed.

Methodology

The methodology for the development of this application is shown below:

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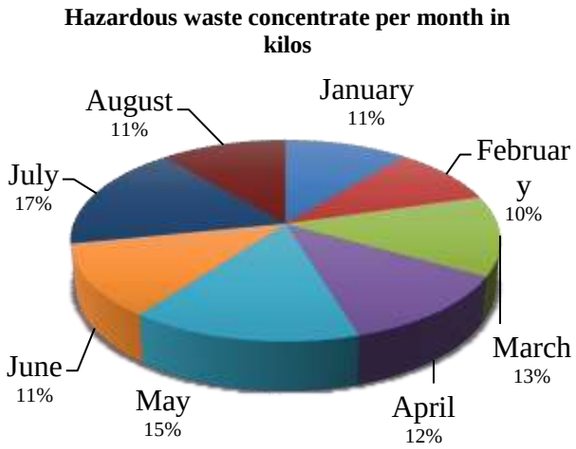
Phase 1 Develop the strategy

With the aim of reducing the arrival of expired material to the temporary hazardous waste area for proper management, through the application of operational excellence OPEX., In the first instance, we proceeded to know the problem that existed at that time, for which the analyzed the incidents in the entry and registration of material temporarily available in the warehouse. In the same way, the real weight per month in kg of the main waste was quantified (Graph 1.1 Concentrate of hazardous waste per month in kilos).



Graph 1.1 Concentrate of hazardous waste per month in kilos
Source of consultation: Own Elaboration

With the information obtained, expired materials were specifically identified from January to August 2020 (Table 1.1 Total hazardous waste concentration).

Hazardous waste	Kg.	%
Impregnated Plastic Voids	1394	6
Impregnated Metal Voids	3169	13
Solid Varnish	4404	18
Liquid Varnish	1643	7
Powder paint	7120	30
Silica	3210	13
Spent Oil	2809	12
Welding Slag	97	0.4
Lamps	60	0.2
Acetone	21	0.1
Silicon	127	0.5
Hexane	3	.01
Per butyl	13	0.1

Table 1.1 Total hazardous waste concentration
Source of consultation: Own Elaboration

As it is observed that the material with the greatest quantity in the warehouse area is powder paint (Table 1.1 Total concentration of hazardous waste), this observation leads to the analysis of the generating cause of said storage, concluding that the source of origin of the accumulation of the material was the production area (Figure 1.1 Main generating areas of hazardous material in the operating flow).

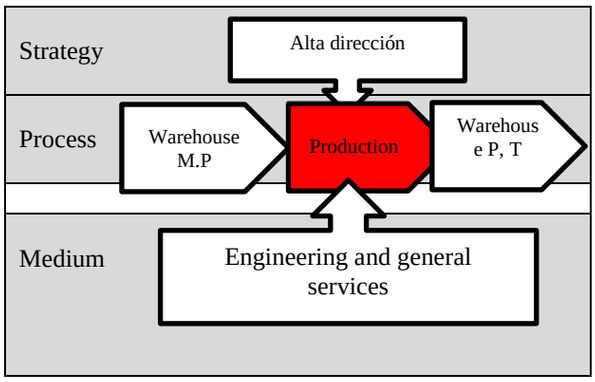


Figure 1.1 Main generating areas of hazardous material in the operating flow
Source of consultation: Own Elaboration

Subsequently, the total arrivals to the temporary hazardous waste area were reviewed, it was observed that of 42 reports only 10 were registered in the log, this is equivalent to 24%, the rest were re-entered the production process adopting different analyzes and uses of the production line. Therefore, the manager held a meeting requesting the assistance of senior management where he pointed out the importance of taking immediate actions that provide solutions, to avoid the accumulation of waste since it was observed that from January to August approximately 7, 210 kg of powder paint with an average cost of $ 231.31 per kilogram, this is equivalent to a monetary loss of $ 102,932.95 in an analysis period of 8 months, considering a monthly average of 902 kg.

Phase 2 Plan the strategy

For the development of the phase, the following stages were followed (Figure 1.2 Stages to plan the strategy):

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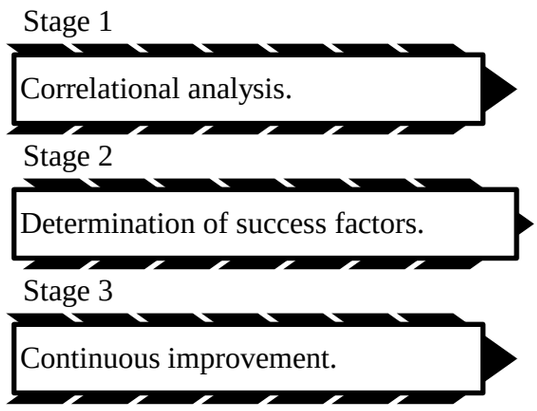


Figure 1.2 Stages to plan the strategy
Source of consultation: Own Elaboration

Stage 1) Correlational analysis: the relationship between the different categorical variables was determined, this process began with the investigation of the records at the highest incident points, identifying the months of March, May and July 2020, being the month of July where there was a higher generation of expired material with a total of 17% (Graph 1.1 Concentrate of hazardous waste per month in kilos); Next, the work system applied in the arrival and departure of the material was analyzed, considering that this time interval is designated to investigate the origin and make the decision of disposal or final disposal. Subsequently, the solution ideas were contextualized to plan the optimal strategy.

Stage 2) The planning of the strategy was carried out through a critical analysis in which the main stakeholders participated, as well as the areas affected by the described problem, including the following departments: Production, planning, purchase of materials, raw material warehouse, temporary storage of hazardous waste, shipments to final disposal of hazardous waste. The strategy to follow began with a sequence of meetings with senior management, where various topics were discussed, concluding with the following ideas:

1. The situation of excessive generation of hazardous waste.
2. The importance in the supply chain, the direct impact on the product.
3. Costs related to expired material.

Subsequently, according to the problem, the Critical Success Factors (CRF) were defined (Figure 1.3 Critical success factors)

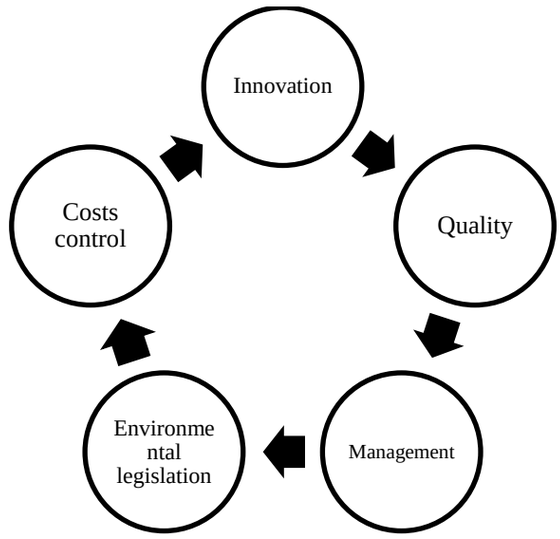


Figure 1.3 Critical success factors
Source of consultation: Own Elaboration

Stage 3) For continuous improvement, a work team was created, with the participation of the following areas: Senior management, environment, production and warehouse. The high-performance team analyzed various issues, including the following: Total amount of hazardous waste to date, amount of expired material from warehouse, amount of expired material that arrives at the hazardous waste warehouse, amount of powder paint that entered the hazardous waste warehouse.

Phase 3 Application of tolos

To properly plan the operations, various tools were used. In the first instance, brainstorming was applied, followed by this technique, an Ishikawa diagram was implemented, where the possible causes that originated the expired material were observed in a general way; By using the 6 M, an effective solution to the problem was identified and proposed. Taking into account the two work tools mentioned above, a registry was created to generate follow-up to the value chain. Subsequently, a Pareto diagram was made that allowed assigning an order of priorities showing the trivial problems of the non-trivial ones, within this tool it was taken into account that the distribution of the effects as their possible causes is not a linear process, considering that the 20% of the total causes originate 80% of the effects and internal rebounds of the predicted behavior.

With the intention of mitigating the problem, the main and/or priority activities in the short, medium and long term were determined, the planning is described below:

Short-term: Completion and submission of a registration of complete substances that they contain, expiration date, need for thermal control and control range. The activities required for short-term compliance were established as significant actions, these activities seek to audit the warehouse area through the following operations: 1) Analysis of the system's functionality, 2) Review of real usage and update of boms, 3) Training of operators, leading group and leading team in the efficiency of consumption of chemical materials (Table 1.2 Significant actions in the short term); With the information obtained from the registry, the calendar of material delivery times was analyzed, as well as possible local suppliers were identified, a format for monitoring and control of expired material was created upon arrival of the temporary storage of hazardous waste and a costing registry for hazardous waste (Dávila, Ponce and Yandum, 2019).

Activity	Responsable	Beginning	Finished
Meeting with interested parties.	Dept. Environmental.	16 sept.	18 sept.
Complete table of substances.	Dept. Store	30 sept.	4 oct.
Check usage and update boms.	Production Department.	16 sept.	8 nov.
Analysis of lines with the highest generation of waste.	Dept. Environmental.	21 oct.	8 nov.
Create significant waste cost records.	Dept. Environmental.	28 oct.	8 nov.
Create monitoring and control formats for expired material.	Dept. Environmental.	4 nov.	15 nov.
Create OPEX procedure.	Dept. Environmental	28 oct.	15 nov.
Audit performance.	Dept. Environmental	29 oct.	13 nov.
Operator training.	Dept. Environmental	21 oct.	20 nov.

Table 1.2 Significant actions in the short term
Source of consultation: Own Elaboration

Medium-term: The lines with the highest generation of hazardous waste were analyzed to develop the OPEX technique, seeking to generate a re-consumption strategy or some other alternative use for expired products (Navarro, 2003).

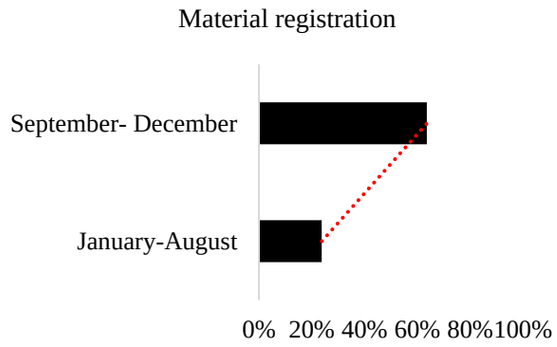
Long-term: The activities planned within this period of time contemplate that each time a new substance arrives, the registry will be updated and shared with the area involved. If there is expired material, a situation will be sent to the interested persons to decide which alternative to proceed.

Results

As a result of the application of the methodological part corresponding to Phase 1 and 2 described in the development of the project, different indicators were obtained which are presented below:

1. Documentary analysis.
2. Proposal for improvement.
3. Development of documentary proposal.

For the correct improvement in the management of hazardous waste, the historical data were compared with the current ones (Graph 1.2 Waste register).



Graph 1.2 Waste register
Source of consultation: Own Elaboration

The information observed in the previous graph (Graph 1.2 Waste register) shows that in the January-August period only 24% of hazardous waste was reported, later with the implementation of the project the registration index increased, in a percentage status of 64 % obtaining a profit of 40%; however, this is only part of the rendering of the application that is suggested to be followed up in a timely manner.

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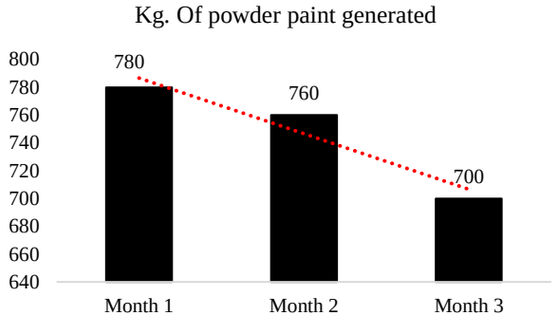
With this result it is deduced that in the future each hazardous waste will be reported in time and form by the areas immersed in the process, this will bring about the improvement in the process of use and disposal of the materials, as well as the control of the levels production, and the benefit to the environment (Guerra, 2007). Regarding the monitoring of production levels by adjusting the order controls (input of raw material), the surplus material will be greatly reduced avoiding the generation of waste (Gutiérrez, 2010), which cause monetary losses and negative impacts. to the environment that is exposed by the presence of expired material.

Another benefit that is noted within the results of the OPEX application is that oriented to the environment, which brings with it the monitoring of the correct management of hazardous waste, the punctual record of expiration dates of substances and materials, the establishment of controls of production for the review, analysis and improvement of real usage, the analysis of hazardous waste generation lines and the creation of an action procedure for environmental aspects (Mejía, 2011).

The results obtained with Phase 3, which is identified by the implementation of the previously selected tools, brought with it the reduction of the main expired product (powder paint), which represented 29.5% of the registered hazardous material (Graph 1.3 Register of kg of powder paint generated).



Graph 1.3 Register of kg of powder paint generated
Source of consultation: Own Elaboration

As previously described, the monthly average of generated material was established at 902 kg per month (January-August 2020), with the implementation of OPEX in its initial phase (month 1), a record of 780 kg is observed, obtaining a benefit of 13.5 %, with respect to month 2 it reaches 15.74% and to end in month 3 the percentage benefit amounts to 22.4%.

In such a way that the average benefit is 17.21%; (Graph 1.3 Register of kg of powder paint generated). Now, in monetary terms, the monthly savings achieved is $ 46,724.62.

Thanks

To the Higher Technological Institute of Huauchinango and the Industrial Engineering Division for the facilities granted for the preparation of the presented chapter.

Conclusions

The development of the Operational Excellence project (OPEX), satisfactorily responded to the objective, in the same way it served to identify areas of opportunity which, in turn, will allow the organization to become a leading ecological company worldwide, working to create a society based on recycling with a low carbon emission, through the application of a wide range of advanced technologies supported by the continuous actions of its employees and their high environmental commitment, which in relation to the powder paint residue already It was achieved in the short and medium, the only thing missing is the long term, which will be achieved when the strategy is applied to all the products handled by the warehouse.

In the same way, the contribution that was made is considered of utmost importance in the procedures of action of the main problems, which guides us to the common objective of a company, continuous improvement.

Returning to the relationship of the main objective that manifests the implementation of an effective strategy to reduce the negative impact of hazardous waste, it is stated that the generation of the main waste (powder paint) was reduced by an average of 17.21%. It is important to mention that a complete situational analysis was carried out, which allowed carrying out the project, in the same way, strategies were formulated for the delivery of results and it was possible to evaluate the impact of the project on waste management through economic indicators (loss initial = $ 102,932.95., final loss = $ 46,724.62).

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Parameters of Quality in the Production of Piloncillo in Sabanas Huatusco, Veracruz

Parametros de Calidad en la Producción de Piloncillo en Sabanas Huatusco, Veracruz

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Abstract

The development of panela or brown sugar in Mexico takes place in small factories or mills commonly called rural agribusinesses. The process is usually handmade, it does not have quality control measures such as good manufacturing practices (GMP) and measurement of physicochemical parameters that can be monitored by the producers to ensure the quality and safety of the product. The importance to evaluate these parameters to contribute to a continuous improvement process to obtain a competitive product in the market. The aim of this study was to determine the quality parameters in each stage of preparation of brown sugar and the final product, by characterizing, monitoring, control and physicochemical analysis of different samples obtained during the process. The results obtained on physicochemical parameters such as humidity, PH, Color Icumsa, ° Brix, Pol, Purity, in the stages of milling or cane juice extraction, concentration of juice or cane syrup and final product, show that they are affected by the degree of maturity and variety of cane used, and the time exposed to high temperature, meladura (cane honey) concentration and adequate filtration process and clarification.

B.rown sugar, Piloncillo, Physicochemical parameters

Resumen

La elaboración de panela o azúcar morena en México se realiza en pequeñas fábricas o ingenios comúnmente llamados agroindustriales rurales. El proceso es generalmente artesanal, no se cuenta con medidas de control de calidad como buenas prácticas de manufactura (BPM) y medición de parámetros fisicoquímicos que puedan ser monitoreados por los productores para garantizar la calidad e inocuidad del producto. La importancia de evaluar estos parámetros para contribuir a un proceso de mejora continua para obtener un producto competitivo en el mercado. El objetivo de este estudio fue determinar los parámetros de calidad en cada etapa de preparación del azúcar moreno y del producto final, mediante la caracterización, seguimiento, control y análisis fisicoquímico de diferentes muestras obtenidas durante el proceso. Los resultados obtenidos sobre parámetros fisicoquímicos como humedad, PH, Color Icumsa, ° Brix, Pol, Pureza, en las etapas de molienda o extracción de jugo de caña, concentración de jugo o jarabe de caña y producto final, muestran que son afectados por el grado de madurez y variedad de caña utilizada, así como el tiempo de exposición a alta temperatura, concentración de meladura y adecuado proceso de filtración y clarificación.

Azúcar B.rown, Piloncillo, Parámetros fisicoquímicos

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Introduction

The main uses of sugarcane are the production of crystal sugar, piloncillo or panela and obtaining fodder. In Mexico, sugar cane is produced in diverse climates, soils, and cultural conditions.

Sugar in Mexico has a considerable market size, its consumption is widespread in the domestic sphere and it has a significant demand in the industrial sector. Mexico is among the top ten sugar producing and consuming countries in the world. A small part of the sugar cane production is for the production of piloncillo (in the center and north of the country) also known as panela (in the south). , which is obtained from the concentration and free evaporation of the cane juice.

The area planted with sugar cane in Mexico is distributed mainly in the state of Veracruz, where it is cultivated on an annual average, 253 thousand hectares, which represents 36.7% of the national total. It constitutes the main perennial crop in the state and is established in 90 municipalities of the entity where around 380 sugar mills are located in the different municipalities of the central zone of the state, such as: Huatusco, Comapa, Fortín, Sochiapa, Totutla, Zentla, Atzacan and Paso del Macho. However, very low economic yields are obtained due to poor and precarious processing conditions, since traditional and artisanal practices are used. (Chavez, 2011; Cortez, 2013; Leano 2013) since traditional and artisanal practices are used. (Chavez, 2011; Cortez, 2013; Leano 2013) since traditional and artisanal practices are used. (Chavez, 2011; Cortez, 2013; Leano 2013)

Literature review

The cultivation of sugar cane gave rise to an agro-industrial system that occupies a preponderant and transcendent place in the economic and social activity of Mexico. This activity was initiated by the Spanish conquerors and currently a whole productive tradition has been created where cane is grown and processed in 61 mills located in Campeche, Chiapas, Colima, Jalisco, Michoacán, Morelos, Nayarit, Oaxaca, Puebla, Quintana Roo, San Luis Potosí, Sinaloa, Tabasco, Tamaulipas and Veracruz. (http://www.veracruz.gob.mx)

The sugarcane agribusiness is of the utmost importance for the Mexican economy, despite the crisis that has occurred in recent years in our country, sugarcane has been an important source of direct and indirect employment in the different sugarcane regions of the country. .

It is estimated that the production of piloncillo in Mexico participates with 2.3% of the national production of sweeteners from sugar cane, with an average of 115 thousand tons, if taken as a base, almost 5 million tons of sugar produced per year. anus. The Food and Agriculture Organization of the United Nations FAO, (http://teca.fao.org), reports an average of 36 thousand tons of production for the period 1999-2001. The national production of sugarcane is carried out in 683,008 hectares that generate 48,363,316 tons of raw material that supply 58 sugar mills or sugar factories located in 15 sugarcane states with productivity of the grass where 13% of the national population lives. The supply zones cover 227 municipalities, in which more than 12 million people live. Que contribuyen de manera importante al desarrollo industrial del país. (Zafranet, 2008; http://www.siap.gob.mx)

In the sugar mills, the labor force is employed to carry out harvesting, transportation and planting tasks. It also influences the activities of the tertiary sector (services), providing income to the population that forms part of the economy of these agroindustrial regions during the five months of the harvest. The sugar agroindustry in Veracruz is made up of 22 sugar mills that represent 36 percent of the national sugar plant, which are supplied by an industrializable surface of 233 thousand 11 hectares of sugar cane and provide direct and indirect employment to 145 thousand people in the field and 22 thousand in the factory, which generates a total of 167 thousand jobs.

In Veracruz, a population of one million people depends on this economic activity (COVECA, 2008). Piloncillo production is an important source of income in the region of Huatusco-Fortín, Veracruz, because throughout the year it is a significant source of income for families living in this area and represents a major contribution to family spending, with the highest production of piloncillo occurring from January to June.

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The average number of workers per mill is 12 employees for a regional total of 2,550 jobs generated, considering an average of four members per family, together with the 213 families of mill owners, it can be considered that 11,052 inhabitants of the region depend economically on the production of piloncillo. (Córtez 2013)

However, various factors threaten the competitiveness of the sugar industry as an economic activity, such as the low productivity of the fields and industry, as well as international sugar prices. The substitution of sucrose for high fructose corn syrups and synthetic sweeteners, the instability in oil prices, among others.

The diversification strategy must take into account the efficient use of the potential of sugarcane in order to increase added value, based on cutting-edge technologies and the application of biotechnology, as a complement to sugar production. From the sugar cane harvest and processing it is possible to obtain eight products and by-products (sucrose, ethanol, crop residues, bagasse, molasses, filter cake, stillage and boiler ashes). However, the industrial production of sugar cane derivatives and by-products has not shown constant development and in the Mexican sugar industry there has not been a significant change in the pattern of diversification in recent decades. The problem lies in the absence of a national model of diversification, the lack of knowledge and information are factors that constitute the main obstacle for a sugar cane agriculture (agricultural sector), biofactory (industrial sector) with efficient and sustainable production. (Aguilar, 2012)

Processso of production of Piloncillo

The manufacture of piloncillo was observed in three trapiches located in the town of Sabanas, municipality of Huatusco, belonging to the central zone of Veracruz, in which the elaboration procedure is artisanal and is carried out empirically. The average production is 1,300 to 1,500 kg per day; the variety of cane used as raw material corresponds to CP-290 (Canal Point), CP-2086, pata de fierro, 1210 and RD. (Chavez 2011)

Cut

The process begins with the cutting and storage of the cane. The cane producers in the area have as a cultural tradition the cut by thinning. They do not have technical measurement controls to determine at what time of the year the cane should be harvested. The cut is carried out by observation according to the maturity of the sugar cane or due to economic necessity, which forces them to process it ahead of time; regularly the cut is made in the months of October to May. (Chavez 2011)

Herd and Transportation

Once the cane is cut, it is rolled up, raised and transported in cargo trucks to the mill. On some occasions, the cane must be stored in the cutting place before being transported. When it arrives, it is prepared in the raw material reception area; in some cases it is stored for long periods of time. (Chavez 2011)

Msmell

In the mills, the extraction of cane juice is carried out by means of physical compression by a dough or roller mill which is operated by a person (miller), who is in charge of introducing the cane rolls manually. A solid residue called bagasse is also obtained, which still contains a high percentage of moisture and sucrose, which is why it is carried by a person (green bagasse) next to the grinding area where it is stored for drying naturally. Once the bagasse is dry, it is carried by another person (dry bagasse) next to the burner and is used as.

Precleaning

At this stage of the process, different methods of pre-cleaning the raw juice are observed, one of them is the use of nursery meshes to manually filter and remove all solid and larger residues. Another of the methods observed is the use of uneven tanks which settle the sludge and large particles of the extracted juice. This separation prevents the precursor substances of the color from being released due to the effect of heat and reduces the amount of solid incrustations in the pans, increasing its useful life and the rate of heat transfer.

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The juice from the pre-cleaner passes to the storage tank where the sludge settles and is extracted through an orifice into black sheet or food-grade stainless steel tanks. (Chavez 2011)

Clarification

LThe next stage is the clarification of the juices, which is carried out in order to eliminate impurities in suspension, colloidal substances and some colored compounds initially through coagulation and later by flocculation, by adding sodium bicarbonate (NaHCO3) and milk of lime (CaO). At this stage is where the work of the operators (Tachero, Pailero and Trapichero) begins. Once the juice is received in the first tank it begins to heat up and based on the experience of the operator, the necessary amount of Bicarbonate is added. sodium (NaHCO3) and the slurry.

Concentration and evaporation

At this stage of the process, the concentration of juice begins, which is carried out with the help of the oven (constantly fed by bagasse) until reaching the necessary temperature according to the experience of the pailero. There are three pans where the juice begins to evaporate until it obtains a viscous consistency (molasses or honey)

In some trapiches they add complements to help give consistency to the molasses, such as the addition of panela, sugar and water. During this stage, high temperatures have been reached, approximately 120 to 128 °C, and a concentration of 65 to 70°Brix, which is why the operator keeps the syrup in constant movement to prevent it from sticking to the bottom of the pan and if this happens, the necessary amount of animal fat (bait) must be added. (Chavez 2011; Mosquera 2007)

Cooling

In one of the mills, the honeydew is emptied manually by two people into a pan, which is activated by rotating blades, allowing it to cool down, leaving it ready for molding. This operation is carried out according to experience because they have not defined the time that must remain in the rotating pan. In other trapiches, the syrup is emptied by means of gravity and through a stainless steel channel it is poured into the mixer.

Once the pailero gives the syrup the correct point according to his experience, the wooden molds which have been previously washed with water to prevent the honeydew that forms the piloncillo from adhering. The filling of the molds is done manually by the operators, (Banker) These are placed on rustic shelves for approximately 15 minutes to solidify and later unmold on cement plates.

Packaging and storage

When the panela has dried and cooled, it is packed in cardboard boxes by one or two operators depending on the production obtained. Once packed, the final product is weighed and then stored in the warehouse. (Chavez 2011)

Iallology

In the present work, a methodology was established in the measurement of the different physicochemical parameters, such as Humidity, PH, Color Icumsa, °Brix, Pol, Purity, etc., that contribute to ensure the quality of the piloncillo produced in the central zone of the state. from Veracruz.

Sampling for analysis

TheThe samples were taken from three mills located in the town of Sabanas, municipality of Huatusco, Veracruz. For their identification, they were called Trapiche 1, 2 and 3. Trapiche 1. Located in Manzana el Cantillo. Trapiche 2. Located in the Manzana Tejerías. Trapiche 3. Located in the Manzana la Esperanza. Samples were obtained in triplicate from different points that are key in the piloncillo production process. The juice samples were taken at the extraction stage (mills), the molasses from the concentration area, and the piloncillo samples from the finished product area.

The juice was placed in clean, dry plastic bottles and refrigerated at 4°C to prevent it from degrading and losing important properties for later analysis. A sample of 4 liters of juice from the concentration stage was taken, which was cooled in a "bath-marie" to be packaged in new plastic bottles. Samples of 1 kg of piloncillo were taken once cooled and unmolded and placed in sterilized plastic bags until completing 3 samples.

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Analysis of physicochemical parameters

The physicochemical analyzes of each sample were carried out according to the methods indicated in the official Mexican standards that are mentioned below:

NMX-F-275(1992) Determination of Brix degrees in juice samples from sugar-producing plant species - solids and specific weight (hydrometric method) - test method.

NMX-F-271(1991) Determination of pol (apparent sucrose) in samples of juices from plant species that produce sugar - normal weight method.

NMX-F-266(2012) Determination of pH in samples of sugar cane juice, molasses and molasses.

NMX-F-235-1991 Determination of pol (apparent sucrose), in samples of syrup, cooked mass, molasses, washed and final molasses.

NMX-F-079(2012) Determination of polarization at 20 ºC

NMX-F-526(2012) Determination of color by absorbance in sugars.

NMX-F-294 (2011) Determination of humidity in samples of crystallized sugars.

Determination of ° Brix in cane juice

Certified Brix Hydrometers were used, with scales from 0 to 10, 10 to 20 and 20 to 30º Brix, and certified Thermometers, with a scale in degrees Celsius.

Determination of Pol in cane juice

For the determination of Pol in cane juice, a digital electronic saccharimeter (Autopol) was used, with a scale in degrees S. 26 g of sample, previously homogenized, were weighed. Subsequently, the sample is placed in the capsule and quantitatively transferred to a 100 ml Kohlrausch flask and calibrated with distilled water, keeping the content at 20 °C Lead subacetate was added to the sample. The sample was placed in a 250 ml beaker, discarding the first 25 ml of the filtrate.

The polarimetric tube was rinsed two or three times with the filtered solution 200 mm, and later it was filled with the remaining solution to take the reading.

Determination of ° Brix in Meladura

A 100 cm^3 test tube was filled with the sample, eliminating the foam, and it was left to stand for 20 minutes until the occluded air bubbles were completely eliminated. The Brix hydrometer was carefully introduced, in such a way that the stem was submerged one centimeter from the position in which it should remain stable, floating freely. The temperature of the sample was taken. The observed reading was corrected for temperature, using for this effect the Table "Corrections for temperature to hydrometer readings °Brix".

Determination of pH in Meladura

150 ml of a homogeneous sample of syrup was poured into a beaker and the pH was measured with a potentiometer with automatic temperature adjustment.

Determination of Pol at 20 ºC in Piloncillo

A 26 g sugar sample was taken in a capsule and transferred to a 100 ml Kohlrausch flask rinsing with distilled water to a volume of approximately 80 ml. The sample was stirred until completely dissolved at a temperature of 20 °C, for which it was placed in a water bath. Subsequently, the sample was made up to a volume of 100 ml with distilled water and stirred until the complete formation of the precipitate, it was filtered and the first 25 ml of the filtrate were discarded. The polarimeter tube was rinsed with the sugar solution to approximately two thirds of its capacity; then it was filled with this solution at 20 °C avoiding the presence of air bubbles. The tube was placed in the polarimeter, three determinations were made at 20 °C and the reading was recorded.

Determination of Color by Absorbance in Sugars (Piloncillo)

A solution was prepared with 50 g of the piloncillo sample and 50 g of distilled water, dissolving and stirring at room temperature.

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The solution was vacuum filtered using a 0.45µm filter membrane; the filtered solution was deaerated for one hour at room temperature in an ultrasonic bath for one minute.

Subsequently, the samples were read in a spectrophotometer at a wavelength of 420 nm.

Moisture determination in crystallized sugar samples (piloncillo).

To determine the surface moisture content in crystallized sugar samples, 10 g of each were placed in capsules previously dried in an oven at 105°C and at constant weight.

Subsequently, the samples placed in the capsules were weighed on an analytical balance and placed in the oven for 3 hours to dry them. They were weighed again to determine weight loss during drying. Weight loss was expressed as a percent of the original mass of the samples.

Results

LThe results obtained in the physicochemical analyzes carried out on the different samples of raw cane juice, molasses and piloncillo, are shown in the following tables.

DETERMINACIONES FISICOQUIMICAS EN JUGO DE CAÑA			
	PARAMETROS		
	GRADOS BRIX	% POL	PUREZA
TRAPICHE 1			
MUESTRA NO. 1	17.64	13.72	77.778
MUESTRA NO. 2	17.75	13.98	78.761
MUESTRA NO. 3	17.98	13.97	77.697
TRAPICHE 2			
MUESTRA NO. 1	18.84	16.47	87.420
MUESTRA NO. 2	18.96	16.44	86.709
MUESTRA NO. 3	18.86	17.14	90.880
TRAPICHE 3			
MUESTRA NO. 1	18.06	15.91	88.095
MUESTRA NO. 2	18.34	15.57	84.896
MUESTRA NO. 3	17.58	16.39	93.231

Table 1 Physicochemical determinations in cane juice

DETERMINACIONES FISICOQUIMICAS EN MELADURA					
	PARAMETROS				
	GRADOS BRIX	% POL	PUREZA	PH	% EVAPORACION
TRAPICHE 1					
MUESTRA NO. 1	73.78	55.81	75.644	5.06	76.09
MUESTRA NO. 2	72.1	54.32	75.340	5.07	75.38
MUESTRA NO. 3	71.1	55.96	78.706	5.09	74.71
TRAPICHE 2					
MUESTRA NO. 1	75.54	55.69	73.723	5.48	75.06
MUESTRA NO. 2	75.24	55.99	74.415	5.51	74.80
MUESTRA NO. 3	75.28	55.17	73.286	5.50	74.95
TRAPICHE 3					
MUESTRA NO. 1	74.6	59.23	79.397	5.40	75.79
MUESTRA NO. 2	74.74	58.69	78.526	5.41	75.46
MUESTRA NO. 3	74.82	58.56	78.268	5.41	76.50

Table 2 Physicochemical determinations in honeydew

DETERMINACIONES FISICOQUIMICAS EN PILONCILLO			
	PARAMETROS		
	% POL	COLOR	HUMEDAD
TRAPICHE 1			
MUESTRA NO. 1	70.96	13834	1.449
MUESTRA NO. 2	71.00	14466	2.231
MUESTRA NO. 3	70.2	14690	2.050
TRAPICHE 2			
MUESTRA NO. 1	67.98	32032	0.637
MUESTRA NO. 2	68.78	37727	0.917
MUESTRA NO. 3	69.07	32165	0.784
TRAPICHE 3			
MUESTRA NO. 1	71.9	12061	1.043
MUESTRA NO. 2	71.22	12759	1.354
MUESTRA NO. 3	71.94	12841	1.189

Table 3 Physicochemical determinations in piloncillo

As can be seen in Table no.1, the values obtained for the cane juice samples from trapiche 1 are lower in the analyzed parameters, Brix degrees, % polarization and degree of purity, compared to the values obtained in the samples from mills 2 and 3, which is due to the variety and quality of cane used (CP cane point, RD and iron leg). In addition to not having the physiological maturity required to make the cut and process it. Thes samples from mill 2 have a higher % of polarity and purity, which can be attributed to the quality and physiological maturity of the sugar cane used, in addition to not exposing the raw material to room temperature for long periods of time in the area of reception. In relation to the pH values obtained in the samples of trapiche 1, they are lower than those observed for the other two trapiches and that according to the reported data it has been determined that the optimal pH of the cane juice to obtain quality panela.

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It must be between 5.6 and 5.8, thus avoiding the formation of reducing sugars, favoring clarification, and facilitating decachazada (Mosquera, 2007). Regarding the values of the parameters analyzed in the syrup samples, reported in Table 2, it is observed in the results obtained in the analysis of °Brix in syrup (concentrated juice that was evaporated between 75 to 80% of the water content) in which trapiche 1 has less °Brix compared to trapiche 2 and 3. When comparing the results with the parameter established by the NMX-F-266-SCF-2012 standard where the syrup has a value of 55 to 65 °Brix, it is considered that the syrup used for panela has a higher concentration of sugars, as it is a product in its purest state, obtaining a parameter of 70 to 76 °Brix.

The results in Pol of trapiche 3 are higher compared to trapiche 1 and 2. It is observed that in trapiche 2 there is less purity due to the fact that during the concentration process water and panela (in a deteriorated state) were added, which is also reflected in the % of Polarity with respect to the samples of trapiche 3 and affects the quality of the final product (color). The samples from trapiche 3 were the ones that presented the highest values in terms of % of Polarity and Purity.

In relation to the pH, considering as a reference a parameter already established in a sugar process, it presents values of 5.8 - 6.3, the results obtained are similar, unlike trapiche 1, which presents low pH values, which depends on factors such as temperature and the time used to obtain the concentration and clarification of syrup, stage of the process in which CaO is added (lime milk), as well as the physiological maturity of the raw material.

In other studies, it has been observed that clarifying the juice at a temperature of approximately 60°C favors the clarifier to act efficiently, which allows the speed of movement of the particles present in the juice to be accelerated, facilitating the elimination of impurities. In some cases, the need to make a second addition of fining agent at a temperature between 75 and 85 °C has been reported (Ortega, 2004).

Thes determinations made on piloncillo samples in Table no. 3, show the results of the % of Polarity and it is observed that the values of trapiche 2 are lower with respect to the values of trapiches 1 and 3, due to the concentration of sugars that is influenced by the factors temperature and time in the process of concentration and clarification of the syrup In relation to the values obtained in the color of the piloncillo It is observed that the samples of mill 2 on average correspond to 32,165 IU and differ from the values obtained in mills 1 and 3 which present average values of 14,466 and 12,061 IU respectively. This indicates that the panela from trapiche 2 has a dark color and is considered in the market as a third quality product. The piloncillo from mills 1 and 3 have a light color and are considered top quality. So the color attribute is an important factor that determines its price in the market.

Regarding the humidity values of the different samples, it is observed that the piloncillo of mill 1 presents a humidity of 2,231% and mill 3 of 1,189%, being the piloncillo of mill 3 the one with the highest humidity when compared to mill 2, which It is 0.637%, which is due to the high temperatures and the cooking time at which the honeydew is processed, coupled with the fact that a variable amount of water and stored panela were added in the same process. This parameter is important for the producer because it is one of the most appreciated quality indices in the market.

Conclusions

The results obtained indicate that the physicochemical characteristics of the cane juice, such as: °Brix, Pol and Purity, depend on the maturity and varieties used as raw material in the sugar mills, through which it is possible to determine the yields of the final product. As for the Syrup, the physicochemical characteristics °Brix, Pol, Purity and pH are determined by the process time and the high concentration temperatures. As for the physicochemical characteristics of the Piloncillo such as Color, Humidity and Pol, it depends on an adequate process filtration and clarification. On the other hand, the lack of control and equipment to carry out monitoring in each of the stages of the process in the mills, result in the final product not having the quality and safety standards required to achieve competitive products in the market. piloncillo market.

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LThe results obtained in this work applying analytical techniques to evaluate the quality of piloncillo, molasses and cane juice, will serve as a reference and will help producers consider carrying out the necessary analyzes at each stage of the process. achievesstandardizing the operating conditions and obtaining quality products, In the raw material reception area, it is recommended to reduce the length of stay of the cane in the sugar mill facilities before grinding, since the sun dehydrates the stem, generating acidification of the juices and acceleration of the investment of sucrose into sugars. reducers. This affects the yield for °Brix in juice and Pol in cane, since sucrose (Pol) is usually lower than the expected results.

To improve the extraction of cane juice, it is recommended to calibrate the mills, this will help to obtain better efficiency in grinding and reduce the loss of juice and a lower moisture content in bagasse.

The cane juice obtained from the mill should remain in the storage tank for as short a time as possible to prevent the juices from acidifying and sucrose from degrading, and to avoid using a greater amount of lime for its neutralization.

To guarantee an efficient process of eliminating impurities from the juice, a pre-cleaner must be adapted that guarantees a good separation of impurities, such as the use of meshes of different sizes and uneven sedimentation tanks, since these impurities are precursors of the color in juice and remain in the final product

When juices with low pH are present, food grade lime milk or lime must be added, preparing aqueous solutions in adequate concentrations.

In the evaporation and concentration of the juices, it must be carried out in a short period of time. In this way, the breakdown of reducing sugars is reduced in this stage.

Thus promoting the inversion of sugars due to high temperatures (greater than 100°C), which affects the final product's consistency, humidity, color and polarity.

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Support in the Control of the Maintenance Record of the Installations of the System for the Prevention of Corrosion

Apoyo en el Control de Registro de Mantenimiento de las Instalaciones del Sistema para la Prevención de la Corrosión

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Abstract

The project is to perform support work in monitoring the implementation of the operational reliability model of the facilities. Currently has a maintenance manual, which attached to the established guidelines, determines what activities, describes the area where we must work, that schedule time in which to perform and preset length of each. All this must be followed for proper operation. Moreover, having tracked to maintain a Quality Management System helps to increase the competitiveness of any organization whether public or private at the international level through continuous improvement of productivity. System requirements for quality management have been developed specifically to be applicable to any type of generic product.

Quality, Corrosion, Methodology

Resumen

El proyecto consiste en realizar un trabajo de apoyo en el seguimiento de la aplicación del modelo de fiabilidad operativa de las instalaciones. Actualmente se cuenta con un manual de mantenimiento, el cual apegado a los lineamientos establecidos, determina cuáles son las actividades, describe el área en la que se debe trabajar, el horario en el que se debe realizar y la duración preestablecida de cada una. Todo esto debe seguirse para un correcto funcionamiento. Por otra parte, el tener seguimiento para mantener un Sistema de Gestión de Calidad ayuda a aumentar la competitividad de cualquier organización ya sea pública o privada a nivel internacional a través de la mejora continua de la productividad. Los requisitos del sistema de gestión de la calidad se han desarrollado específicamente para que sean aplicables a cualquier tipo de producto genérico.

Calidad, Corrosión, Metodología

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Introductionn

Referringo to the current situation there is the ISO 9001:2000 Quality Management Manual, which establishes and describes the guidelines of the Quality Management System (QMS) based on the International Standard ISO 9001:2000 Quality Management System – Requirements, and its National equivalent NMX-CC-9001-IMNC-2000. The current certification (QS O57/06 MX), which is the result of the formal and public recognition of the reliability and technical competence of the company, obtained through Conformity assessment specifies the requirements for a quality management system that a company needs to demonstrate for customer satisfaction.

Justification

The interest in carrying out this project is due to the need to create an annual maintenance plan for the Maintenance area that allows controlling and guaranteeing the useful life of the pipelines and thus being able to provide reliability in the process. Therefore, the preparation and scheduling of the maintenance program is essential, since it will provide security to the personnel regarding the work team as well as the work area in which they are going to work.

Yese is going to monitor the Quality Management System, because according to its standards and always adhered to, the company must continue with the guidelines established by the current standard.

Therefore, with the implementation of the maintenance program and with the follow-up of the QMS, costs are minimized, the reliability of the operations is sought, the useful life of the pipelines is intended to be prolonged, and thus to be able to comply with the established process and maintain essential services for the continuity of operations.

Targets General and Specific Objective

Elaborater a maintenance program for corrosion control facilities to prolong the useful life of pipelines through cathodic protection; as well as continue with the Quality Management System.

Objective specific

- Makesr a field investigation on cathodic protection methods to maintain pipelines.
- Analyzer pipeline maintenance information.
- Controlr and update the documentation of the Quality Management System.
- Elaborater weekly work orders in the SAP system (Management of productive systems) for the manual personnel in charge of the operation and maintenance of the Rectifiers of the cathodic protection system.
- Reporte of fuel consumption of the vehicles assigned to the Corrosion area and that are owned by the company, as well as keeping a statistical control of the performance of each one.
- Elaborater Monthly reports of charges for maintenance on the rights of way shared with other subsidiaries.
- Elaborater monthly reports of electrical energy consumption of each of the rectifiers of the cathodic protection system installed and keep a statistical control of both the Kw. /h as $.
- Elaborater AST's (Job Safety Analysis).
- Elaborater closure of AST's (Analysis of Safety at Work)
- Elaborater ACR's (Root Cause Analysis).
- I haver a register of the certificates of the measuring instruments calibrated in the year 2010
- Elaborater a request for decals for the control of the Rectifiers of the Madero Pipeline Sector for access doors of each rectifier.
- Givesr a follow-up to the RELIABILITY practice.

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- Makesr Pipeline risk assessments by the sector by applying the IAP (Risk Management Index) software and updating the information at least every 4 months.

- Structurer a maintenance program for PGPB facilities to prolong the useful life of the pipelines and prevent them from corroding

- Delimitsr the maintenance borders between Operational Managements as well as the frequencies of each activity.

- Informra CFE the exact location of the pipelines by means of plans.

- Evaluater the maintenance program.

Troubleknow how to solve

Pairto follow up on the Quality Management System and develop the Maintenance Plan for corrosion control facilities to extend their useful life. It is important to have reliable records on maintenance management, which allows knowing the efficiency of the activities and evaluating the performance in the maintenance management and execution process.

- To be able to carry out field research on cathodic protection methods, it is necessary to review the files related to this topic.

- It's about having the documents, analyzing why the pipelines are maintained, what it is for, what is cathodic protection, so that the Quality Management System is followed up, etc.

- Yese must keep track of all the records, ensure that it is maintained with the reference standard, report the operation of the system to the superintendent, support the execution of internal quality audits and verify the implementation of corrective and preventive actions.

- To be able to prepare work orders and later pass them to the SAP system, it is necessary to know what is the situation that requires maintenance; since with this the crew is informed what they should do. It must be uploaded to SAP to have control of everything that is done.

- Pairfuel reports follow a pre-established format. These are done at the end of each month. A record of each previous month must be kept and formulas that are already established are used to obtain results on the performance, mileage traveled in the month and total fuel cost of each vehicle.

- Elaborater reports in relation to shared rights of way. These must be done monthly.

- I haver a control of the monthly charges of each rectifier. Each station has its own control. You must have information on the 41 facilities managed by the Pipeline Sector of Ciudad Madero. You must take into account the location, the meter number, the KWH and the total cost involved.

- To follow up on the RELIABILITY practice, it is necessary to keep track of the different areas it covers, such as maintainability, management of releases and major repairs, reliability-focused maintenance, risk-based inspection and work management, planning and programming. "ATPP".

- To be able to carry out Risk Assessments at the time of executing work orders, you must first answer a questionnaire related to working conditions to find out if they are safe, if they have the correct work team; This is divided into 2 areas: prior to leaving the workplace and verification at the workplace.

- To be able to structure the maintenance plan, the pre-established guidelines must be followed and according to the needs that the Pipeline Sector requires.

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– To a correct maintenance planning, the activities that are responsibilities of each management must be delimited. A series of activities must be carried out for each type of management, specify the maintenance orders that must be carried out in each management, the operations, as well as specify how many times a year these operations will be carried out.

– At the time of making the plans to inform CFE of the exact location of the pipelines, you must go to the place where it is located, with the GPS take the exact location and later capture on the plan where you can go to get to said rectifier , define the access paths, as well as name the valve located at the specified point.

– The evaluation of the maintenance program must be carried out monthly, within the first 15 calendar days of the following month. There will be a period of 3 business days for the closing of orders in order not to be considered as breaches.

Scopes

PairWhen preparing the different reports, they will be delivered to me classified in order to issue the one corresponding to each case, for example, the one on the operation of the cathodic protection system of the different gas pipelines, which includes operating parameters of the automatic rectifiers. remote controlled. From these, the consumption of electrical energy is derived, for which a record of Kw/Hr and Cost is issued, which is supported by the billing that the Federal Electricity Commission delivers to PGPB.

De the foregoing consolidates the information for the preparation of the monthly reports of the charges for the maintenance of shared road rights. For the maintenance of the cathodic protection system, it is necessary that the manual personnel in charge of such objective move to each of the facilities where the different Rectifiers that comply with this connection are located, leaving evidence in the work orders that are elaborated in the SAP system.

Limitationss

The information provided by the company will not be updated for reasons of company policies. The work will be carried out from the Madero Pipeline Sector where all the information collected from each of the work areas will be controlled throughout the residency period.

The development of procedures and manuals are determined at the national level, which indicates that they must be followed to the letter. La lack of time to carry out the project limits all activities to be carried out in the duration of the residency. The distances at which each of the Rectifiers that provide cathodic protection are located are far from the facilities of the Madero Pipeline Sector.

Foundationor theoretical

Finisheds relating to quality Quality

Grador in which a set of inherent characteristics meets the requirements.

Satisfactioncustomer no.

Perceivedn of the client on the degree to which their requirements have been fulfilled. Customer satisfaction.

Capacityd

Aptituded of an organization, system, or process to perform a service that meets the requirements for that product.

Finisheds related to System management

Setor of mutually related or interacting elements.

Systemto Quality Management

Systemmanagement skills to direct and control an organization with respect to quality.

Politicsto the quality

Intentionoverall s and orientation of an organization related to quality as formally expressed by top management.

Objectiveor the quality

Somethingor ambitious, or intended, related to quality.

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Assuranceor the quality

Parte of quality management aimed at providing confidence that quality requirements will be met.

Betterto the quality

Parte of quality management aimed at increasing the ability to meet quality requirements.

Finisheds related to the organization Work Environment

Setor conditions under which the work is performed.

I provider

Organizationnot a person who provides a product.

Finisheds related to the process and the product Product

Yesit is defined as “result of a process”.

Processesor

Yesit is defined as "a set of mutually related or interacting activities, which transform inputs into outputs".

Designhey development

Setor process that transforms the requirements into specific characteristics or the specification of a product, process or system.

Procedureor

Formspecific to carry out an activity or a process.

Finisheds related to conformity Non-conformity

Breachor a requirement.

Actionn Preventive

Actionn taken to eliminate the cause of a potential nonconformity or other potentially undesirable situation.

Actionn Corrective

Actionn taken to eliminate the cause of a detected nonconformity or other undesirable situation.

Actionn Predictive

Actionn taken to eliminate the cause of a non-conformity or other undesirable situation that could arise according to the useful life cycle of the machinery or tool related to the natural gas transportation process.

Ducts

Spaceor hole with a rectangular or circular section, generally limited by walls and used to house pipes or to channel air in ventilation systems, allowing inspection, repair and/or maintenance.

Programto maintenance

Lthe most important goal of any maintenance program is the elimination of any malfunction of the machinery. Many times a major breakdown will cause serious peripheral damage to the machine, increasing repair costs. A complete elimination is not possible in practice at this time, but can be approached with systematic attention to maintenance. The second purpose of maintenance is to be able to accurately anticipate and plan your requirements. That means spare parts inventories can be reduced and major overtime work can be eliminated. Thes Repairs to mechanical systems can ideally be planned during scheduled plant shutdowns.

The third purpose is to increase the availability for production of the plant, through the significant reduction of the possibility of some stoppage during the operation of the plant, and to maintain the operational capacity of the system through the reduction of the time of downtime of critical machines. Ideally, the operating conditions of all machines should be known and documented. The ultimate purpose of maintenance is to allow maintenance personnel to work during predictable and reasonable work hours.

ISOR 9001:2000

It is a set of standards on quality and management. ISO 9001:2000 has been prepared by the Technical Committee ISO/TC176 of the ISO International Organization for Standardization and specifies the requirements for a good quality management system that can be used for internal application by organizations, for certification or for contractual purposes.

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RuleMexicans

Thes Official Mexican Standards contain the information, requirements, specifications and methodology, which for their commercialization in the country, must comply with the products or services to whose fields of action they refer. They are, therefore, of national and mandatory application.

Layouyou

The process of locating the right place to install an industrial plant requires the analysis of various factors, and from the economic, social, technological and market points of view, among others.

Systemto

Chartto some production process.

Chartto process flow

It is a graphic representation of the steps that are followed in a whole sequence of activities, within a process or procedure, identifying them through symbols according to their nature; It also includes all the information considered necessary for the analysis, such as distances traveled, quantity considered and time required.

Corrodedn

Corrosion is understood as the interaction of a metal with the environment that surrounds it, producing the consequent deterioration in its physical and chemical properties. The fundamental characteristics of this phenomenon is that it only occurs in the presence of an electrolyte, causing fully identified regions, called anodic and cathodic: an oxidation reaction is an anodic reaction, in which electrons are released going to other cathodic regions. In the anodic region the dissolution of the metal (corrosion) will take place and, consequently, in the cathodic region the immunity of the metal. Corrosion can manifest itself in different ways; either by uniform attack, pitting attack, intragranular attack, galvanic attack, crack attack, selective alloying and/or medium-related fractures.

Cathodic protection implies the reduction of the potential difference between the anodic and cathodic sites to zero, in order to reduce the corrosion current to zero.

To achieve this goal, current is impressed at one end of the electrode towards the structure, polarizing the cathodic sites in the electronegative direction. As the potentials of the cathodic sites are biased towards the potentials of the anodic sites, the corrosion current is reduced. When the potentials of all the cathodic sites reach the potential of the most active anodic sites, corrosion in the structure is eliminated.

Methodologyto Root Cause Analysis.

Andhe Root Cause Analysis (RCA) is a reliability methodology that uses a set of techniques or processes to identify casual failure factors. And that is, the origin of a defined problem, related to personnel, processes, technologies, and the organization, with the aim of identifying profitable activities or actions that eliminate them.

Layouts specific to the Cause Analysis Methodology

Raiz (RCA)

Below are the stages that will be developed during the execution of a Root Cause Analysis Methodology in PEP to identify the actions and/or recommendations that eliminate the causes of the failures and that offer profitability. Below is an example of how to approach a problem with the Root Cause Analysis Methodology.

Compilationny Data Processing.

ANDhe analysis of a problem begins with the collection of data on equipment failures and their respective associated impacts (in safety, environment, production and maintenance costs); in order to prioritize the failures through the use of histograms that allow a treatment of the data. The data to be collected must be captured in the computer tool available at the facility. The minimum data required are:

– Names of the installation and equipment(s) associated with the failure.

– DescriptionNo of failure (Failure mode).

– Dateoh time the error occurred.

– Causes of the fault.

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– Powers executed corrective actions.

– Costor the repair made.

– timeor out of service.

– Productionn deferred.

– Impacts in safety and in the environment.

Its TThe information will be obtained from the review of:

– Manuals of equipment.

– Manuals of operation.

– Conditions operational / trends.

– Planes of maintenance.

– Informationn specific on failures: immediate causes, previous studies, photos, failure analysis, laboratory analysis, among others.

Allor the above can be consulted in the operational context document of the facility.

Analysiss Cause-Effect

ANDhe Root Cause Analysis in PEP must be carried out using the Cause-Effect method. This method is based on the fact that a failure event always has a cause, and that this in turn has another cause, the first becoming the effect of the second. In other words, a cause always becomes the effect of another cause, thus forming a chain of causes and effects, which can continue until reaching the root cause of the problem.

Conclusions

As a conclusion to the monitoring and analysis of each of the parameters reported by the operators and registered in the SAP system during the year 2012, a Maintenance Program was carried out for the gas pipeline in charge of the Ductos Madero Sector for the year 2013. Leaving said open program to changes in the period of work for possible preventive, corrective or predictive actions throughout the year, however, said program must be complied with in order not to put the transportation of Natural Gas at risk.

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General explanation of the subject and explain why it is important.

What is your added value with respect to other techniques?

Clearly focus each of its features

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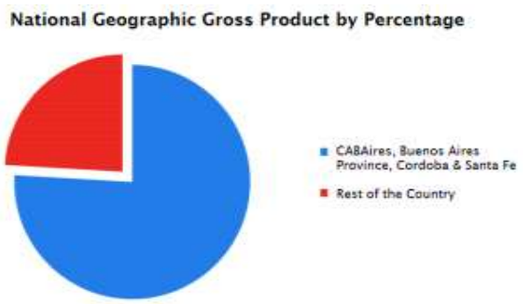

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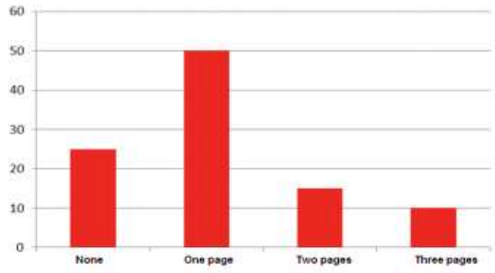

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