Article **ECORFAN Journal-Republic of Colombia**
December, 2024 Vol.9 No.17 14-23

Technology applied in inventory control, case study: Department of measurement, connections and services of the Federal Electricity Commission

Tecnología aplicada en control de inventarios, caso estudio: Departamento de medición, conexiones y servicios de Comisión Federal de Electricidad

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DOI: 10.35429/EJC.2023.17.9.14.23 Received July 18, 2023; Accepted October 30, 2023

Abstract

The use of technology represents making processes more efficient and obtaining better results in their control. For government institutions such as the Federal Electricity Commission, it represents benefits in the optimization of resources and improvements in the services provided to the users of the organization, likewise it implies savings due to the good performance in the use of the materials that uses this department, focused on providing services to users, since costs are lowered. The study has been carried out through a diagnosis to know the real causes of the problem in the area, various instruments have been used to collect information to later process through tools that allow us to know the root cause of the problem. The analysis was carried out through the SWOT matrix to find opportunities for improvement, to end with the strategic proposal as well as the relevant actions, and the importance of having a contingency plan that allows controlling the strategic actions designed.

Technologies, Process efficiencies, User services, Optimization of resources, Improvements in customer service

Resumen

La utilización de la tecnología representa eficientar los procesos y la obtención de mejores resultados en el control de estos. Para instituciones gubernamentales como lo es, Comisión Federal de la Electricidad, beneficios reales como la optimización de los recursos y mejoras en los servicios que se prestan a los usuarios del organismo, así mismo implica ahorros por el buen desempeño en la utilización de los materiales que utiliza este departamento, enfocado a prestación de servicios a usuarios, ya que se abaratan los costos. Es estudio se ha realizado mediante un diagnóstico para conocer las causas reales de la problemática del área, se han utilizado diversos instrumentos para recopilación de la información para posteriormente procesar a través de herramientas que permitan conocer la cusa raíz del problema. El análisis fue llevado a cabo mediate la matriz FODA para encontrar las oportunidades de mejora, para finalizar con la propuesta estratégica, así como las acciones pertinentes, y la importancia de contar con un plan de contingencias que permita controlar las acciones estratégicas diseñadas.

Tecnologías, Eficiencias de procesos, Servicios a usuarios, Optimización de recursos, Mejoras en atención a usuarios

Citation: VALDEZ-GUERRERO, Raquel, BARBOZA-MORALES, Suguey, ROBLES-ARIAS, Isela Margarita and RÍOS-CALDERÓN, Graciela Guadalupe. Technology applied in inventory control, case study: Department of measurement, connections and services of the Federal Electricity Commission. ECORFAN Journal-Republic of Colombia. 2023. 9-17: 14-23

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Introduction

Baja California Sur is a young state, with recent regional development, which implies that the governmental system optimizes the performance of the services it provides and favors the participation of all the actors of the social system, both to entrepreneurs, as well as to raise the quality of life of citizens, by having elements that favor and provide welfare, real and adequate improvements to the needs of the social fabric. Thus, it is important to have accessible services with prices within the reach of the users, as well as quality and quick response in the attention of services provided by the Federal Electricity Commission to the inhabitants of Baja California Sur, which due to its own characteristics of location as well as natural resources, the orography that distinguishes it as a state far from industrial resources, and therefore with high prices for the transportation that implies putting them within the reach of the population, which brings as a consequence that the governmental services are impacted in the same way. From the above derives the importance that the controls of the materials and equipment used are safeguarded and controlled in an efficient way in the search to optimize those resources.

Figure 1 Population and average annual growth rate
www.inegi.org.mx › doc › cpv2020_pres_res_bcsBaja California Sur – INEGI

To supply energy inputs and goods required for the productive and social development of the country in an efficient, sustainable, economic and inclusive manner, through a policy that prioritizes national energy security and sovereignty and strengthens the public electricity service, is the mission that distinguishes the public organization such as the Federal Electricity Commission, which, like any other company, uses the administrative process. The art of knowing how to manage organizations involves the search for productivity with efficiency, (Correa, 2019).

The control process (Karla, 2019) mentions, as the establishment of systems that allow measuring current and past results in relation to the expected, in order to know if they have obtained what was expected, correct, improve and formulate plans, this measurement of results, obtained once the processes and procedures are implemented, is done in order to detect deviations and establish measures or corrective actions necessary, so that the results are related to the designed standard.

The control system in the organizations, applies in all functional areas of the same, this study is located directly in the inventory control of the measurement, connection and services area, whose functions are the attention of services requested to that organization by the users of the system conformed by the Federal Electricity Commission, represents one of the most important activities of the company. It consists of several tasks, but above all to have a warehouse of materials, equipment and products that allow to satisfy the needs of services requested by the local society, in time and form, so it is necessary and indispensable the effective control of the flow of inputs and outputs of these products in that space called warehouse.

Inventory control is one of the keys to keep up to date information on the volume and validity of your stored products, so having a good inventory control management can be a somewhat difficult task to perform, especially if you do not have a system that allows companies to have full visibility of their products, when entering and leaving the warehouse, represents the process that organizations perform to manage and maintain control of the goods they have registered in the warehouse.

There are different strategies and methods to maintain a good performance at the time of inventory control. Having an efficient control system allows total visibility of the products in stock, facilitates and streamlines any type of process. Inventory control is a very important activity because having an efficient storage of products, avoids double purchases of products, not knowing clearly the existence of products that are already in inventory, and avoids keeping obsolete materials and products in the warehouse. All organizations need to have a control of supplies and sales to maintain optimal levels of supply and delivery of products to both customers and suppliers.

ISSN-On line: 2539-1372

Obtaining effectiveness within the organization implies productivity with efficiency and effectiveness, achieving added value to the products through controlled processes implies the optimization in the use of materials.

Notwithstanding the importance that has the provision of services of the department of measurement, connection and services of the Federal Electricity Commission in the city of La Paz, B.C.S., The workers that make up the crews for repairs and corrective and preventive maintenance, once they are assigned to the work, enter the area without control to obtain the materials and equipment they consider necessary to provide the requested service, but there is no format or list to record the exits from the warehouse. Having an effective control process and the use of technology makes it possible for the materials and equipment located in the warehouse to be used more efficiently and effectively.

The benefits to be obtained are: optimization of resources, avoidance of losses of equipment and materials, risk prevention by not having the material well organized both for the workers and for the organization itself, and for the users it represents that the costs in the receipts of energy consumption provided by the company can be reflected in lower service costs, since the costs of materials and equipment increase the costs of the organization, which in turn impacts the prices charged to consumers.

Inventory control methods. This is the set of procedures for planning and controlling the products or materials used by a company to operate efficiently. Its management brings benefits such as the reduction of losses and storage costs. It is a process that helps to ensure that an inventory is available when it is needed (Caurin, 2017), among others are:

The EOQ (Economic Order Quantity) system is also known by its Spanish acronym CEP model (Economic Order Quantity) or by economic order batch, takes into account a constant demand and known a priori, and based on this tries to know that through the cost of maintaining an inventory and the cost of ordering the order can obtain the optimal quantities to order, all while minimizing the cost of inventory to the maximum. (Betancourt, 2022)

ABC method, is an inventory classification method that allows associating each SKU with a class or category of products, with respect to their importance for the company. This method identifies the products that are critical for the success and profitability of the business (Madero, 2022). This is achieved by calculating the consumption value of each SKU, i.e., the number of units sold, multiplied by their unit cost.

- Warehouse layout: The design and distribution of space is apparently a simple matter, but it is complicated to solve in practice. When deciding the layout that a warehouse should have, both internally and externally, there can be three different situations that may require a different space allocation, such as the installation of new warehouses, the expansion of existing ones or reorganization. (Mecalux, 2023)

The location of machines, tools and accessories in the right place; the rational input and output of materials and products before, during and after their process in the plant, passing from the material warehouses, requires knowledge and preparation (training) for the good of the company. (Montana, 2021).

The general distribution of a facility must be in accordance with a good storage system that covers needs such as:

– The best use of space
– Minimization of the handling of the goods
– Ease of access to the stored product.
– The maximum possible rate of rotation
– Maximum flexibility for product placement.
– Ease of control of the stored quantities (Mecalux, 2023).

To carry out the research, the Strategic Planning method was used: A process that allows defining and executing a set of actions to achieve the objectives or purposes of the organization in the short, medium and long term. This is done through an analysis of the internal and external environment of the company to take advantage of opportunities and mitigate risks. A strategic plan allows the company's managers to define the objectives to fulfill the organization's mission and achieve its vision.

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All companies, regardless of size, need to work under a strategic map, since with a determined route they can efficiently take advantage of resources and time management. It is a tool that involves the entire organization, since a strategic analysis serves to jointly determine the objectives and the action plan to achieve them. It is extremely useful to align the work team to employ a common language with the same information, fostering a sense of responsibility and motivation to achieve the goals in the desired future.(Decoletaje, 2019).

Advantages of strategic planning:

- Reduces uncertainty in risk management.
- It fosters motivation and commitment of employees.
- It operates with the essential focus on objectives and results.
- It intensifies efficiency in the use and optimization of resources.
- With the competitive advantages it provides, it promotes differentiation with respect to the competition.
- All decisions are aligned with goals.
- Improves decision making.
- It allows the analysis of measurable data and performance indicators to evaluate the performance of both employees and the company.
- Increases profitability, as well as market share.

Stages: Creation of the strategy, Planning of the strategy, Alignment of the organization's efforts with the strategy, Planning of the operation in the organization, Control and learning of the operation.(Decoletaje, 2019)

One of the vital objectives of the organization is survival and the main factors of survival are: products, services or satisfiers, market with customers who have needs, but can choose, competition from other organizations for the market, technology, personnel and capital (Antonio, 2023)

Methodology

Type of research

Research is applied and field research

Development

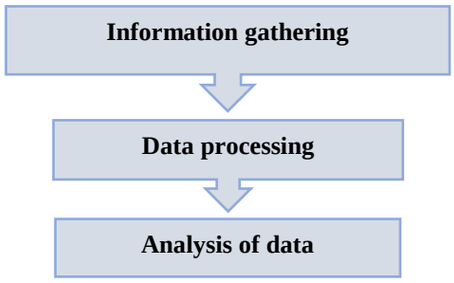

Figure 2 Diagram of the research development

Four instruments were used to collect the information:

1. Questionnaire that was applied to the crew chiefs to know how the management of resources and equipment necessary to carry out their tasks is carried out.

2. Interview with the head of the department, to know the current status of the problems that occur systematically in the area.

3. Observation matrix to visualize the current situation of the warehouse.

4. Ichikawa Diagram to know the root cause of the current situation of the warehouse area.

Data processing

For the questionnaire applied to the crew chiefs, they were plotted with Excel application, obtaining:

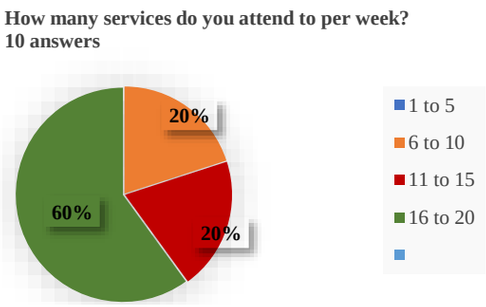

Figure 3 Frequency of service attention

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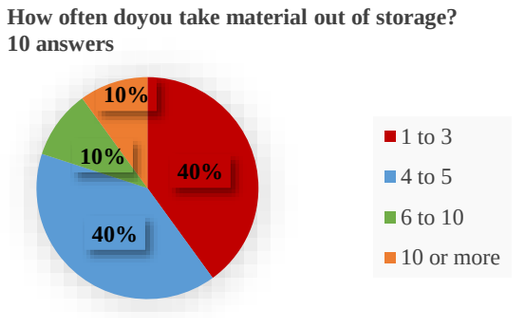

Figure 4 Frequency of material requirements

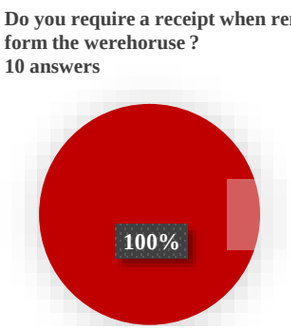

Figure 5 Use of receipt for materials

¿What type of materials do you use most frequently?
10 answers

-Connectors, insulating tape, drop cable.
-Safety ring, connector, adapter.
-Insulating tape, cover

Figure 6 Frequency of use of materials by type

What type of material do you use least frequently?
10 answers

-Blades, lightning separators
-Plug base terminal, multiple cable
-Blades, lightning separators
-Fifth terminal
-Fifth terminal

Figure 7 Frequency of lesser use of materials

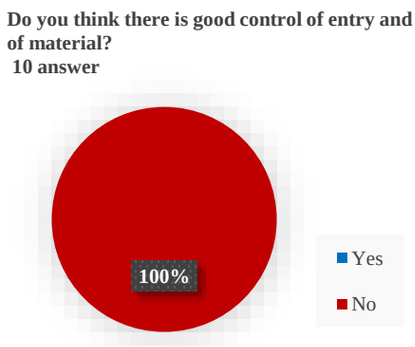

Figure 8 Use of warehouse controls

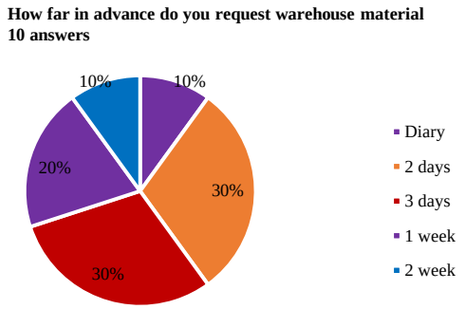

Figure 9 Lead time in requesting materials from the warehouse

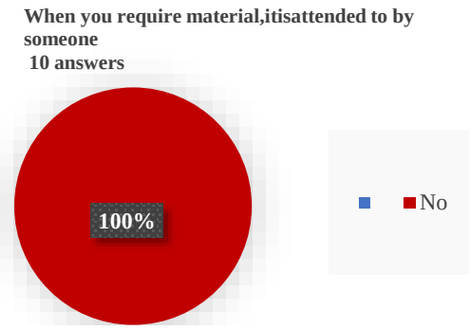

Figure 10 Attention by warehouse personnel

The interview conducted with the head of Metering, Connections and Services, the information was processed in a concentrator table (see table 1).

Criteria	Response
Inventory problems	There is no control of materials, there is no reconciliation of materials that we are required by procedures. Therefore, there is a mess, which has neither head nor tail and we do not have any kind of order.
Negative impact, due to current inventory status	Ignorance of the costs of materials of the department and ignorance if there is misuse of not complying with the guidelines and audits that have been presented to us.
Positive impact due to current inventory status	It is kept in a locked area and only the two process managers have the key to intervene, so we can have a little more "Controlled" not completely, but it is what works best for us.
Materials difficult to inventory	Connectors, fuses, tapes
Materials that are easy to inventory	Connecting cable, short-circuit wiring and line separators.
How do you envision the warehouse inventory in the future?	With a stock of materials, maximums and minimums, updated formats, catalogs, vehicles, supervisors, historical consumption by personnel and everything very well ordered and classified to be able to find what is needed more easily and quickly.

Table 1 Interview applied to the head of the Metering, Services and Connections department.

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For the observation matrix: it was classified by department sub-areas, presenting evidence of their current status (see table 2).

Observation Criteria	Yes	no	Observation	Recommendation	Evidence
Cleaning					
Dirt and dust on floors, shelves and/or materials.	**x**		If there is soil throughout the warehouse.	Constant cleaning is recommended, as dirt will continue to appear as long as the "walls" of the warehouse are made of cyclone mesh.	
B litter on floors	**x**		There is trash, such as paper, food wrappers, and tree leaves.	It is recommended to have someone in charge of cleaning at least twice a week to keep the work area clean.	
Animals / insects or rodents.		**x**	No animals were observed.	It is recommended to keep the area clean, because if any animal is present, there is a risk of having a plague.	
Order					
Materials are in order.		**x**	Most materials numbered.	It is recommended to separate each material by categories, to make identification easier.	
Difficulty in finding materials.	**x**		Materials together and mixed.	It is recommended to separate each of the materials, either by size and utility.	
Classification					
Materials sorted by name.	**x**		Yes, they are marked with a name on the tags.	It is recommended that the tag be amended so that the information on the tag is not erased.	
Materials are found with # control.	**x**		Yes, the number is on the tag.	The recommendation is the same as in the classification of the name.	

Table 2 Observation matrix

With respect to the Ishikawa diagram used to find the root cause of the problem, the following criteria were included: service, communication, controls and organization (see figure 10).

Figure 10 Ishikawa Diagram (cause-effect)

Data analysis

After having processed the information, using the SWOT matrix, a strategic planning analysis tool, the Strengths, Weaknesses, Threats and Opportunities were determined (see figure 11).

Figure 11 SWOT Matrix

In order to determine the strategies that make up the proposed plan, we proceeded to analyze the strengths, weaknesses, internal environment vs. external environment, threats and opportunities using the Mini-Maxi Matrix. Environment against the organization's external environment, threats and opportunities using the Mini-Maxi Matrix (See Table 3).

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External environment analysis		
	Opportunities	Opportunities
Internal environment analysis	More satisfied users	More satisfied users
Strengths	Compete with alternative energies by improving their prices.	Compete with alternative energies by improving their prices.
Large amount of materials.		Opportunities
Economic resources are available.		
Space assigned for the different materials.		
Weaknesses	Adaptive strategies	Survival strategies
Poor organization.		
No personnel in charge of the area.		
Poorly conditioned space.		
No records of incoming and outgoing materials.		
Loss of material.	Optimize the use of warehouse materials using software such as "App Sheet".	Controlling cost increases for users.
Improper use of material.	Proper physical organization of warehouse materials.	Optimization of material resources.

Table 3 Mini-Maxi nuance

Through which the definition of the strategies was determined:

Opportunities for improvement detected through the analysis performed:

- Optimize the use of warehouse materials using technological innovation software.
- Adequate physical organization of warehouse materials.
- Controlling price increases for users.
- Optimization of materials resources.

Results

The objective of the project is: strategies to harmonize the physical inventory of the Metering, Services and Connections department with the organization's information system, so the strategic planning methodology has been used to finalize the strategies that make up the proposed strategic action plan to reach the planned objective (see table 4).

Strategy	Method	Deadline	Resources	Performance Indicator
Optimize the use of warehouse materials using innovative technological software.	1. Determine the ideal software to make the physical and digital control of the materials warehouse. 2. Training of the personnel that will carry out the software management. 3. Start up.	1 week 1 month 3 months	Acquisition of software. 3 computers 4 testing	Knowledge and implementation of the use of software in the area.
Adequate physical organization of warehouse materials. Signage of warehouse spaces in accordance with Mexican Official Standard NOM-003-SEGOB-2011. Contingency plan design.	1. Acquire the shelves. 2. Organize distribution of materials and equipment. 3. Classification according to own characteristics. 4. Organize arrangement of materials and equipment 1. Detection of areas and risk levels. 2. Knowledge of the applicable standard. 3. Preparation of signage. 4.Carry out the signage. 1. Diagnosis of risk areas. 2. Training and coaching. 3. Appointment of the people responsible for the actions to be taken according to the risks.	1 week 1 month 1 month 1 month 1 month 1 week 1 week 1 month 1 week 1 week 1 week	Purchase of 4 shelves to store the equipment and materials used for maintenance. Purchase materials to carry out the signage. Instructor	Physical location of materials and equipment on the shelves and thus maintain it in a systematized manner by 100%. Contingency plan completed and implemented 100%.
Control the increase of costs for users.	1. Systematize the use of software to keep track of all inputs and outputs	6 months		100% software implementation.
Optimization of material resources	1. Apply controls 2. Verify quality controls for the acquisition of materials and equipment. 3. 3. Expand supplier portfolio	1 mes month 1 month 1 month		1 annual audit

Table 4 Strategic plan to harmonize the physical inventory of the Metering, Services and Connections department

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Regarding the implementation of the project, work has also been done for its start-up, obtaining:

A Layout was designed to refer to the way the elements and shapes are distributed within the warehouse. A photo was added on the side of each area in order to accommodate an optimal way in which to enter a high amount of product and store it in a better way so that employees can have quick access to the materials that will be used every day. The warehouse is divided into two areas that are materials for the linemen and calibrators, on the left side should be the material for the linemen and the right side for the calibrators. In point number 4 is the roof of the warehouse, here we add the stairs and other materials that have almost no use (see Figure 12).

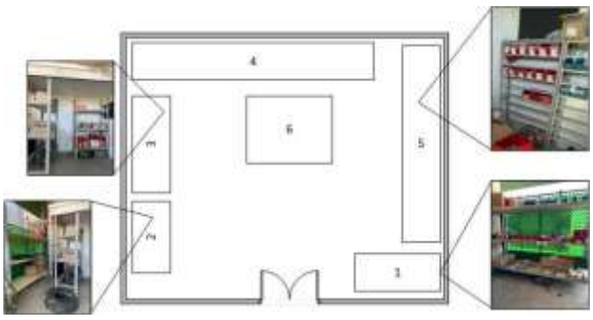

Figure 12 Layout design

App sheet application

In order to make decisions regarding the use of technology to harmonize inventory control, and after having known the attributes of the software available for this purpose, it was decided to implement this tool which is App sheet which is a friendly application where the options allow designing the catalog of materials, personnel, vehicles, etc., in addition, it can be signed digitally.

Appsheet, allows all members of the organization to create and expand applications without programming.

Advantages

– Automates business processes, such as order approvals and user notifications.

– Automatically generates actions and views based on user intent with Google AI and machine learning.

– Provides control for citizen developers to build key applications quickly.

– Creates apps that can be used on computers, mobile and tablets.

– Enables connection to multiple data sources, from Google Spreadsheets to Salesforce.

Encourages innovation: IT and citizen developers can collaborate effectively with business policy and management functions.

Streamlines work: Enables time-saving applications to be created and integrated with tools that are already in use.

Empowers workers: it enables the full potential of your data to be harnessed so that all employees can create customized applications and automations. For use (see Figure 13)

Figure 13 Logging into the application

Step 1: Access a device which contains internet and enter the Google tab.

Figure 14. Search

Step 2: enter the word "App sheet" in the search engine and click on the first link that appears.

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Figure 15 Start

Step 3: When accessing the first link the following window will appear, click on the "Start" section.

Figure 16 Log in to account

Step 4: When logging in a window will appear where it will be indicated which actions the application can perform, when reading what it indicates to press the section of "Allow". Once logged in to the application you will have several options to adapt to the needs of each organization.

Acknowledgements

This project has been carried out with the funding of the Tecnológico Nacional de México, Campus Instituto Tecnológico de La Paz, in the same have participated and supported people who in one way or another have contributed to obtain results, both students (residents), as teachers, researchers and staff of the Institute, as well as workers and officials of the organization, with the intention that the results are functional and the benefit is learning and its application, as can be mentioned the project is already in the process of implementation.

Conclusions

The objective of the research has been fulfilled: Strategies to harmonize the inventory control system of the department of Measurement, Connection and Services, of the Federal Electricity Commission, in the City of La Paz, with the information system of the organization, which facilitates the identification of the material and manages in a more systematized way through the App Sheet program with a more dynamic and accessible report for the boss and for the workers.

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