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Article

Diagnostic, analysis and management of the routes of a Distribution Center of a dairy producer in the State of Mexico

Diagnóstico, análisis y gestión de las rutas de un Centro de Distribución de una productora de lácteos en el Estado de México

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Abstract

Distribution Centers are an important part of an organization, since the goal of this area is to ensure that products reach their destination in a timely manner. In the case of the dairy producing company, one of its distribution programs was diagnosed, analyzed and managed due to the decrease in efficiency. The status of the project was diagnosed as a priority, and the strengths and areas of opportunity were identified. Subsequently, an analysis of the first ten critical paths with the lowest indicator was carried out. The implementation of quality tools and methodologies continued to identify the main causes and the root cause of low effectiveness. Likewise, efforts were made to increase the indicator and reach its minimum standard. In addition to a final evaluation of the results obtained after the implementation of the pre-established countermeasure plan.

Diagnosis analysis and management of the routes of a Distribution Center of a dairy producer in the State of Mexico		
Objectives	**Methodology**	**Contribution**
Increase the degree of effectiveness of the distribution route project to 90%	The research type is basic and explanatory level.	The degree of effectiveness increased by 4.1%, achieving 90.3%, on average; applying quality techniques.

Distribution Center Management, Quality, Effectiveness

Resumen

Los Centros de Distribución son parte importante de una organización, ya que esta área tiene como meta lograr que los productos lleguen a su destino en tiempo y forma. En el caso de la empresa productora de lácteos se diagnosticó, analizó y gestionó uno de sus programas de distribución debido a la disminución en la eficiencia. Se diagnosticó de forma prioritaria el estado en el que se encontraba el proyecto, se identificaron las fortalezas y las áreas de oportunidad. Posteriormente, se realizó un análisis de las primeras diez rutas críticas con el menor indicador. Se prosiguió con la implementación de herramientas y metodologías de calidad para identificar las causas principales y la causa raíz de la baja efectividad. Asimismo, se realizó una gestión para aumentar el indicador y alcanzar su estándar mínimo. Además, se realizó una evaluación final de los resultados obtenidos después de la implementación del plan de contramedida preestablecido.

Diagnóstico, análisis y gestión de las rutas de un Centro de Distribución de una productora de lácteos en el Estado de México		
Objetivos	**Metodología**	**Contribución**
Incrementar el grado de efectividad del proyecto de rutas de distribución a un 90%.	El tipo investigación es básica y de nivel explicativo.	Se incrementó el grado de efectividad en un 4.1%, logrando un 90.3%, en promedio; aplicando técnicas de calidad.

Centro de distribución, Calidad, Efectividad

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Introduction

Distribution centres (CEDIS) are another element of study for the optimisation of supply chains. In this sense, the logistics area in an organisation requires its distribution process to be efficient in each of its stages. In the case of the company under study, whose activity is the production of dairy products, a drop in productivity was detected in one of the projects implemented for the distribution of goods.

Therefore, it was necessary to carry out a diagnosis where problems such as downtime, delays in the entry of some operators, lack of constant monitoring and evaluation, among others, were detected. The analysis was carried out by applying quality tools, then improvement strategies were determined, implemented and the results were evaluated, improving the programme's productivity.

Framework of Reference

Efficient management in the operation of a CEDIS is the key to customer satisfaction and optimisation of the resources required for this task. Therefore, it is not enough to deliver the product; it is also necessary to continuously detect areas of opportunity to improve the operation of the storage, delivery and service process. Nowadays, companies around the world are currently managing their stocks as a valuable aspect of logistics and they are considered to be the fundamental asset of the company. In this way Giovana Toro expresses the importance of quality management in distribution centres.

It should not be forgotten that even if the production, marketing, finance and human resources areas have carried out their activities according to the organisational manual, if the logistics part does not function properly, the success of the company is put at risk. For this reason, administrative and technological strategies have been implemented for the proper functioning of this area.

Distribution centres are places where goods are stored and orders are processed. More and more technological resources are used to manage them, to the extent that there are fully automated technologies that make material handling equipment, personnel and controls less necessary.

However, adopting new technologies requires a significant investment, which micro, small and medium-sized enterprises (MSMEs) cannot afford in the short term. Therefore, it is important to generate an internal and external analysis of the department that carries out such an important storage and distribution activity.

Hence the relevance of having personnel with the right profile who are able to develop a methodology that achieves the objective of analysis for monitoring the logistics system of the organisation.

Distribution centres have an infrastructure designed to perform operations efficiently, with high speed. [...] they group infrastructures that provide an adequate environment to temporarily store goods and materials [...].

The design of a CEDIS must be in accordance with the needs of each company, it is necessary to observe the flow of activities from the moment the product is in the warehouse until it reaches the customer's hands. It is necessary to assess the elements that must be integrated in the CEDIS infrastructure in order for it to function optimally.

The distribution centre is an area equipped for the development of logistics activities. For Antún, the CEDI is a logistics centre, which must have at least: a layout for the transit of vehicles, logistics warehouses with platforms, areas for the parking of transport vehicles, areas for logistics operators, areas for complementary services for vehicles, and in some cases, areas for complementary services (training, meeting rooms, banking services, customs services and health controls, among others).

These elements enable an organisation to geographically concentrate its distribution operations and have an efficient flow of cargo.

A distribution centre (DC) can be defined as a planned space for locating, holding, handling and transporting goods and materials.

There are two dominant elements: warehousing and materials handling.

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The main goals of a CEDI are to minimise the total cost of operation, provide adequate levels of service to the end users, take care of the maintenance of the stored products, provide the necessary infrastructure for its operation and develop traceability of the products handled to validate their effective flow.

It has been shown that 90% of the total cycle time of the chain corresponds to movement and/or waiting times, so reducing this time is the most important challenge for the logistics function of each company within the supply chain, with the consequent reduction of inventories and costs.

Considering the above statistics, it is necessary to propose a productive management in the distribution process towards customers, focused mainly, as Galindo describes, on the adequate use of transport and storage resources such as the transport fleet, the number of platforms, the number of visits or stops per transport unit, storage capacity, and transport capacity, among others.

It is essential to assess the human, material, technological and logistical resources, among others, that are required to operate a CEDI; otherwise, there will be economic consequences for not delivering the goods in time and form, bottlenecks will form, there will be expired products and products that are mishandled due to mishandling, etc.

In this sense, there are methodologies that can help in the proper design of a CEDI. The company Portal Logístico proposes a methodology called IPISI, whose components are, according to its abbreviation: Infrastructure, Processes, Inventories, Work Safety and Indicators. The methodology is interesting because it includes safety at work, a legal and regulatory aspect that is mandatory in Mexico within the framework of the Mexican Official Standards.

The phases of the IPISI methodology include: analysis of infrastructure and areas, analysis of processes, analysis of inventories, implementation of labour and occupational safety, and implementation of logistical indicators.

There are a variety of tools that can be used to carry out an organisational diagnosis. For the purpose of this research, only the following will be described: PEST diagnosis, which is a technique that consists of studying the environment through political, economic, socio-cultural and technological aspects. And the most widely used, which is the SWOT Analysis.

Some of the quality tools that can be applied in the analysis of any organisation are shown in Table 1. Each author establishes the techniques that from their point of view are appropriate.

Box 1

Table 1

Quality Tools

Author	Quality Tools
(López, 2016)	Cause-effect diagram, Pareto diagram, scatter diagram, check sheet, control charts, histogram.
(Chang, 2019)	Tree diagram, Pareto diagram, sequence flow diagram, process flow diagram, scatter diagram, operation diagram, control chart, histogram.
(Vargas, 2014)	Cause-effect diagram, histogram, Pareto diagram, dispersion diagram, control charts, stratification diagram, check sheet
(Vilar, 2018)	Affinity diagram, relationship diagram, tree diagram, prioritization matrices, matrix diagram, decision process diagram, arrow diagram.

Source: Own elaboration

The techniques used in the project are described below, starting with the Ishikawa diagram, followed by the Pareto diagram and ending with the Gantt chart.

The Ishikawa or fishbone diagram is a technique used to identify the possible causes of a central problem, also used to improve processes and resources in an organisation.

The aim of this quality tool is to identify the effects and their respective causes. It is suggested to start with the opinions or ideas of the people involved in the problem. Then the main problem is sought in order to list the causes with the analysis of the structure of the Ishikawa diagram, which consists of five variables: work method, machinery, materials, labour and environment.

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A Pareto diagram is a graph that represents in order, in terms of importance or magnitude, the frequency of occurrence of the different causes of a problem.

The Pareto principle, also known as the 80-20 principle, dictates that few problems are more important than the many that can be observed, but are of no significant importance. 20% of the problems cause 80% of the consequences.

The Pareto diagram is practical and simple to construct. First, the problems that exist in the area being monitored must be located, then the information that causes the problem and its consequences must be collected. Then, they are ordered in descending order, from most to least frequency of occurrence.

It is suggested to quantify them in order to better appreciate the impact of each of the problems. This is how this tool is used to make decisions.

Another important tool is the Gantt chart, which according to (Terrazas, 2011) is a graphic system that is executed in two dimensions; on the abscissa axis the time is placed and on the ordinate axis the activities to be developed are placed.

This diagram is very useful to show the sequence of execution of operations of an entire work package and has the virtue that it can be used both as a planning tool as well as a monitoring and control tool.

Problem statement

The company currently has 37 delivery routes, each with its own driver, 4 operations supervisors and 13 assistants. The distribution process starts when the delivery operators arrive at the CEDIS at 6:30 a.m. to receive a daily talk and training from the supervisors to the collaborators, in which the operators are given new updates so that they can carry out their activities better.

They are reminded of the safety measures they must execute at all times, to prevent accidents, in terms of using their personal protective equipment, among other activities.

The operators then count the product that the warehouse workers have loaded into their units in the early hours of the morning.

The delivery drivers must accurately count the goods to be delivered, as they are only provided with the exact product to be delivered and the warehouse managers are not exempt from errors, and often make mistakes with the quantities of product they load onto the trucks.

When the operators finish counting their merchandise, they continue by filling out a checklist, which is used for operators to indicate the condition of their unit, so that if the unit is damaged, it can be reported and corrected as soon as possible.

Finally, workers should clean their units before leaving on route, check that they contain the necessary documentation to be able to circulate without problems, and lock their refrigeration boxes.

Once the operators are on the road, each one must record and scan each visit through an application, i.e. each time an order is delivered to a customer. When a visit is recorded, the number of records generated by each route driver is displayed in real time.

This data is updated hourly and the visit report is provided to supervisors so they can identify critical routes and take action to speed up their deliveries and finish on time.

At the end of their visits, the delivery drivers proceed to return to the CEDI; if they return to the CEDI before 7:30 pm, it would be established that they have complied. It is worth mentioning that the project called Project 7 X 7, refers to the fact that operators should not spend more than 12 hours to deliver their merchandise.

Regardless of the time they leave and arrive, they must do so in less than 12 hours, and if they do so, they receive an economic bonus.

The next day, they receive a file by mail with the database generated the previous day, which is used to visualise that the routes have been completed.

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According to the reports, there is a percentage of effectiveness lower than its standard, which is 90% compliance, generating repercussions, such as: a decrease in the delivery of the product to the clients, impossibility of reaching the maximum effectiveness in the report of daily visits, a reduction in the company's profits, and an affectation in the performance and commitment of the delivery collaborators.

Based on these reports, it has been detected that some of the indicators are not favourable to the expected results, generating a lower effectiveness than established, in terms of compliance with the standard.

Likewise, it has been detected that the performance of delivery employees has been decreasing or lacks good practices since months ago, when several changes of supervisors and managers were managed.

For example, the number of accidents at work has increased, the number of delivery vacancies has increased, and the efficiency of product delivery has decreased, among others. In the process of delivering products to retail customers, it has been identified that there is a lot of downtime generated by the operators, where some of this downtime is due to the lack of standardised processes that prevent employees from wasting time, from the moment the delivery drivers arrive at the distribution centre until they return from their routes.

For the aforementioned reasons, the objective of the research was to increase the degree of effectiveness of the distribution routes project to 90%.

Methodology

In order to achieve the proposed 90% effectiveness target, the present work comprises 3 stages: diagnosis, analysis, management and evaluation of the project to improve the effectiveness of the distribution centre's deliveries to retailers.

Diagnosis: This stage involves the process of recognition and evaluation of the phenomenon under study, in which the trends, the general context, as well as the historical data of the problem are determined.

Among the tools that allow for the diagnosis of specific events, problems or situations is the SWOT analysis.

According to , SWOT analysis is a strategic planning tool. The acronym SWOT stands for the study of the Strengths, Weaknesses, Opportunities, Opportunities and Threats of a company or an individual. The SWOT analysis can be applied to any situation in which an analysis or study is needed, which is why it was decided to use it in this research.

In order to carry out the SWOT analysis, it is imperative to gather information that shows the real situation of the problem, so the following steps were taken:

a) Information was collected on the effectiveness of delivery to retailers, by route, by delivery driver and by supervisor for the last 3 months.
b) A comparative analysis was carried out with the information collected using bar graphs.
c) Routes with the highest delivery effectiveness rates and routes with the lowest levels were identified.
d) Routes were identified as critical, i.e. routes with delivery effectiveness rates below 90%, which is the company's target.
e) Supervisors of routes with critical effectiveness rates were identified.
f) A comparative analysis was carried out by route and supervisor of the routes with effectiveness rates above and below 90%.

Based on the above information and with the support of the supervisors, a SWOT matrix was drawn up, which shows a complete picture of the current situation of the improvement project.

Analysis: This stage involves a thorough process, which is based on determining and detecting the main causes - potential causes that generate problems or areas of opportunity within an organisation. It is important to mention that for this stage, several meetings were held with the operations team, as well as with the supervisors of the retail distribution routes.

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The analysis tools used were the Ishikawa diagram or cause-effect diagram and the Pareto diagram.

In the first instance, the Ishikawa diagram was used to show the possible causes of the low effectiveness of the distribution routes to retailers.

a) Ishikawa diagram. The cause-effect diagram was developed by brainstorming with operational staff and supervisors, who concluded that the main cause of low effectiveness is due to downtime and the number of customers assigned to the different routes.

Downtime includes the following factors: driver absence, poorly planned routes, closed customers, use of alternative routes and customer delays.

b) Pareto diagram. According to , the Pareto diagram is a graph where various rankings of data are arranged in descending order from left to right by means of bars after data have been collected to rank the causes so that priorities can be assigned.

With the information from the cause-effect diagram and the opinion of those involved in the project, the importance of the potential causes affecting the effectiveness of retail distribution was evaluated.

For this purpose, during the month of October, when the delivery person did not meet the established target, he was asked to fill in a form in which he had to specify the cause of non-compliance.

With the data obtained, a Pareto diagram was drawn up to determine the relative importance of each of the potential causes and to focus the company's efforts on reducing and/or eliminating the vital causes.

Management and evaluation of the retailer distribution improvement project. Once the main causes (vital causes) of the low effectiveness of distribution to retailers had been identified, corrective or management actions were designed to tackle the current problem.

For this stage, it was decided to use different tools to visually identify the activities to be carried out, the people in charge, the time in which these activities will be carried out, among other aspects, in order to standardise the operating procedures and the activities to be carried out.

A Gantt chart was drawn up establishing the improvement activities (countermeasure plan) that were carried out over a period of 2 months.

These activities focus on supervision and standardisation of procedures. The Gantt chart shows the activities, the description, the responsible persons and the time period in which they were carried out.

To support the improvement activities, formats were developed to serve as control: delay format, critical route supervision format and critical route audit format.

The activities proposed and approved by management were implemented starting in November and December.

The evaluation of the impact of the improvement project (countermeasures plan) on the effectiveness of the delivery routes was carried out based on the results obtained in November and December, comparing them with the indicators obtained in the months taken as historical data (August, September and October).

Results

In order to comply with the objective of the research, which was to increase the degree of effectiveness of the distribution routes project to 90%, the results are presented starting with the diagnosis stage, in this stage the trends, the general context, as well as the historical data of the problem are determined using the SWOT analysis.

To carry out this analysis, information was collected to show the real situation of the project, starting with the effectiveness of distribution to retailers, by route, by delivery person and by supervisor for the last 3 months.

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Box 2

Table 2

Effectiveness of delivery to retailers, by route and by supervisor in the last 3 months

ROUTE	SUPERVISOR	AUGUST	SEPTEMBER	OCTOBER
1	SUPERVISOR W	96%	92%	100%
2	SUPERVISOR W	100%	92%	85%
3	SUPERVISOR W	100%	85%	100%
4	SUPERVISOR X	81%	62%	50%
5	SUPERVISOR W	100%	88%	96%
6	SUPERVISOR X	88%	81%	65%
8	SUPERVISOR X	100%	100%	85%
9	SUPERVISOR X	85%	77%	92%
10	SUPERVISOR X	100%	100%	92%
11	SUPERVISOR Z	100%	96%	85%
13	SUPERVISOR Z	88%	77%	69%
14	SUPERVISOR Z	96%	100%	96%
15	SUPERVISOR Z	73%	88%	81%
18	SUPERVISOR Y	96%	100%	100%
20	SUPERVISOR Y	62%	81%	85%
21	SUPERVISOR Y	88%	92%	77%
22	SUPERVISOR Y	96%	100%	100%
23	SUPERVISOR Y	81%	85%	69%
24	SUPERVISOR Y	96%	100%	69%
25	SUPERVISOR Y	69%	69%	54%
26	SUPERVISOR Y	81%	73%	81%
27	SUPERVISOR Y	92%	81%	88%
28	SUPERVISOR X	62%	69%	46%
30	SUPERVISOR Y	38%	62%	46%
32	SUPERVISOR W	100%	92%	100%
33	SUPERVISOR X	100%	96%	92%
34	SUPERVISOR Y	96%	96%	100%
35	SUPERVISOR W	100%	100%	100%
36	SUPERVISOR Y	81%	73%	65%
38	SUPERVISOR X	81%	85%	85%
39	SUPERVISOR X	81%	58%	73%
40	SUPERVISOR Z	96%	88%	100%
41	SUPERVISOR X	100%	100%	96%
42	SUPERVISOR Z	100%	100%	100%
45	SUPERVISOR Z	92%	92%	96%
46	SUPERVISOR W	73%	85%	85%
47	SUPERVISOR X	96%	92%	92%

Source: Own elaboration

According to the effectiveness of distribution by route and supervisor, a comparative analysis is presented in table 2, which contains the percentage of effectiveness by supervisor for the three months of August, September and October of the diagnostic analysis to represent it in a bar graph.

Box 3

Table 3

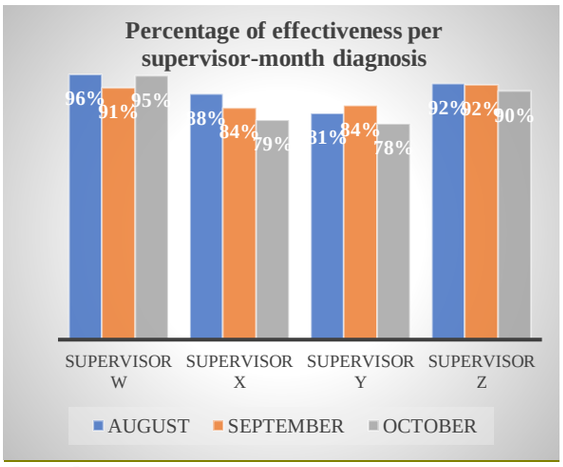
Percentage of effectiveness per supervisor months diagnosis

SUPERVISOR	AUGUST	SEPTEMBER	OCTOBER
SUPERVISOR W	96%	91%	95%
SUPERVISOR X	88%	84%	79%
SUPERVISOR Y	81%	84%	78%
SUPERVISOR Z	92%	92%	90%

Source: Own elaboration

Table 3 shows that supervisor W has the highest route effectiveness and supervisor Y remains in the lowest effectiveness position with respect to the other three supervisors (graph 1).

Box 4



Graph 1

Percentage of effectiveness per supervisor-month diagnosis

Source: Own elaboration

The routes with the highest delivery efficiency rates and the routes with the lowest levels per month in the last three months of the diagnostic analysis were identified.

In the month of August, of the 11 efficient routes, five correspond to supervisor W, while supervisor Z has only one efficient route. In September, nine routes show the highest efficiency, of which three are from supervisor X, three from supervisor Y, two from supervisor Z and only one from supervisor W.

The last month of diagnosis is October in which nine routes are efficient, four from supervisor W, three from supervisor Y, and only two from supervisor Z. Supervisor X has no efficient routes (see table 4).

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Box 5

Table 4

Routes with the highest effectiveness rates in August, September and October

RUTA	SUPERVISOR	AUGUST	SEPTEMBER	OCTOBER
1	SUPERVISOR W	96%	92%	100%
2	SUPERVISOR W	100%	92%	
3	SUPERVISOR W	100%		100%
5	SUPERVISOR W	100%		96%
32	SUPERVISOR W	100%	92%	100%
35	SUPERVISOR W	100%	100%	100%
8	SUPERVISOR X	100%	100%	
9	SUPERVISOR X			92%
10	SUPERVISOR X	100%	100%	92%
33	SUPERVISOR X	100%	96%	92%
41	SUPERVISOR X	100%	100%	96%
47	SUPERVISOR X	96%	92%	92%
18	SUPERVISOR Y	96%	100%	100%
21	SUPERVISOR Y		92%	
22	SUPERVISOR Y	96%	100%	100%
24	SUPERVISOR Y	96%	100%	
27	SUPERVISOR Y	92%		
34	SUPERVISOR Y	96%	96%	100%
11	SUPERVISOR Z	100%	96%	
14	SUPERVISOR Z	96%	100%	96%
40	SUPERVISOR Z	96%		100%
42	SUPERVISOR Z	100%	100%	100%
45	SUPERVISOR Z	92%	92%	96%

Source: Own elaboration

The routes that were considered critical, as they have delivery effectiveness rates of less than 90%, which is the company's goal, are shown in table 5 and are grouped by supervisor in order to identify those routes with lower efficiency (graph 2)

Box 6

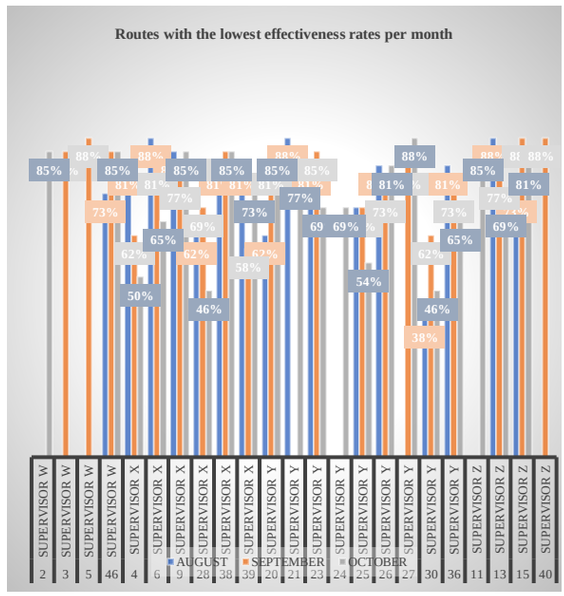
Table 5

Routes with the lowest effectiveness rates per month

ROUTER	SUPERVISOR	AUGUST	SEPTEMBER	OCTOBER
2	SUPERVISOR W			85%
3	SUPERVISOR W		85%	
5	SUPERVISOR W		88%	
46	SUPERVISOR W	73%	85%	85%
4	SUPERVISOR X	81%	62%	50%
6	SUPERVISOR X	88%	81%	65%
9	SUPERVISOR X	85%	77%	85%
28	SUPERVISOR X	62%	69%	46%
38	SUPERVISOR X	81%	85%	85%
39	SUPERVISOR X	81%	58%	73%
20	SUPERVISOR Y	62%	81%	85%
21	SUPERVISOR Y	88%		77%
23	SUPERVISOR Y	81%	85%	69%
24	SUPERVISOR Y			69%
25	SUPERVISOR Y	69%	69%	54%
26	SUPERVISOR Y	81%	73%	81%
27	SUPERVISOR Y		81%	88%
30	SUPERVISOR Y	38%	62%	46%
36	SUPERVISOR Y	81%	73%	65%
11	SUPERVISOR Z			85%
13	SUPERVISOR Z	88%	77%	69%
15	SUPERVISOR Z	73%	88%	81%
40	SUPERVISOR Z		88%	

Source: Own elaboration

Box 7

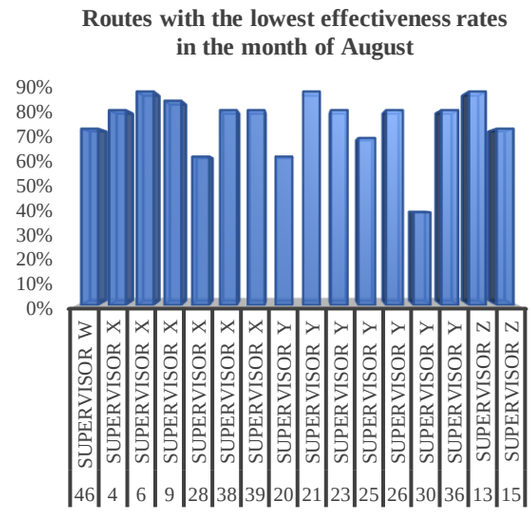


Graph 2

Routes with the lowest effectiveness rates per month

En la gráfica 3 se muestran las 16 rutas con eficiencia por debajo del 90%, en agosto.

Box 8



Graph 3

Percentage of effectiveness by supervisor and route in August

Graph 4 shows the 19 routes with the lowest efficiency in the month of September, seven from supervisor Y, six from supervisor X, both representing 68%, three from supervisor W and three from supervisor Z

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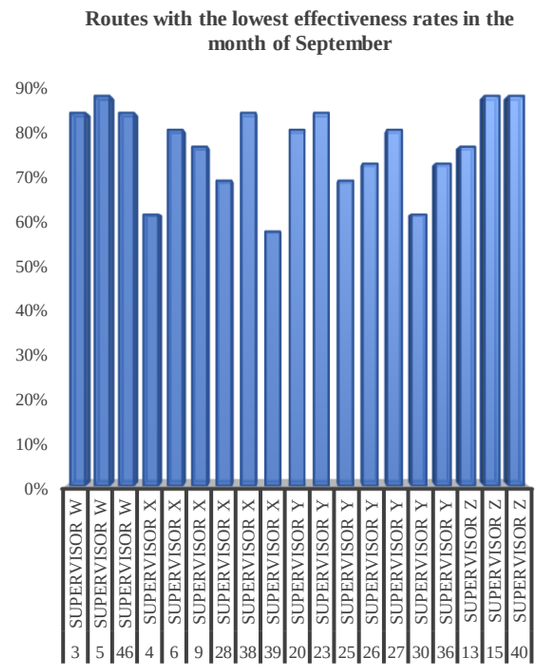
Box 9



Graph 4

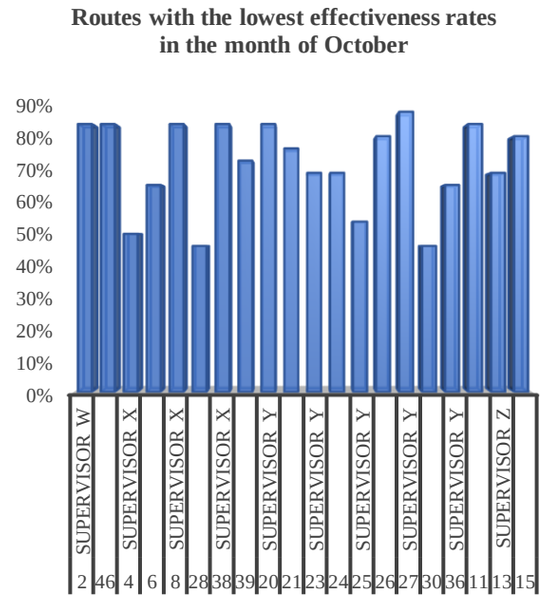
Routes with the lowest effectiveness rates in September

In October, the number of routes with efficiency below 90% increased to 20, of which eight belonged to supervisor Y, six to supervisor X, two to supervisor W and the last two to supervisor Z (Figure 5).

As part of the diagnostic stage, a SWOT matrix was drawn up (Table 6), where the constant monitoring of delivery operators by supervisors and the record of visits made by delivery operators during the course of their day were identified as strengths, as well as the company's ability to award an economic bonus for compliance with the schedule on their route. In terms of weaknesses, the main one is the low effectiveness of the programme, as it is below standard.

In relation to the opportunities, the use of technology is important and the threats are reflected in the fact that the effectiveness can be affected by people or events external to the organisation.

Box 10



Graph 5

Routes with the lowest effectiveness rates in October

Box 11

Table 6

SWOT MATRIX

SWOT MATRIX OF THE 7X7 PROJECT	Strengths (S)	Weaknesses (W)
	S1. Provide a financial bonus if 7X7 is met. S2. Constant monitoring of delivery operators through supervisors. S3. Constant monitoring of the record of visits that delivery operators carry out throughout their day.	W1. 7X7 effectiveness below its minimum standard. W2. Existence of quite a few dead times. W3. Effectiveness subject to the performance and effectiveness of delivery collaborators.
Opportunities (O)	**Strategies SO**	**Strategies WO**
O1. Technology to carry out more accurate monitoring of the performance of delivery operators. O2. Technology to visualize the fastest and most viable routes for each operator. O3. Technology to forecast future events.	S2, O2. Design an incentive plan to provide an economic bonus to the operator who complies with their deliveries. S3, O2. Implement adequate technology in delivery units so that operators can detect the fastest and most viable routes to follow.	W1, O1. Generate feedback to delivery drivers so that they can increase their standards from supervisors using advanced technology. W2, O3. Develop a route program that includes possible contingencies that may occur with the support of technology.
Threats (T)	**Strategies ST**	**Strategies WT**
T1. Project effectiveness may be affected by natural events. T2. Project effectiveness can be affected by people outside the organization. T3. The effectiveness of the project can be affected by situations external to the organization.	S3, T2: Design a control format to corroborate deliveries with clients to generate greater effectiveness. S2, T2. Have a communication system that allows monitoring by supervisors and by operators, the reporting of any external contingency that influences the visit is achieved.	W2, T2. Prepare weekly planning involving delivery drivers to reduce downtime and avoid losing effectiveness on delivery routes. W1, T1. Provide a training course regarding the actions of delivery drivers in case of risk situations.

Source: Own elaboration

For the analysis, we first used the Ishikawa diagram or cause-effect diagram as a tool to show the possible causes of the low effectiveness of the delivery routes to retailers (table 6).

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Subsequently, experts from the operations team were interviewed and several potential causes were identified, such as downtime, the absence of drivers, the number of customers, long routes, among others.

Members of the operations area recognise that they pay attention to downtime. Delivery drivers tend to waste time at different points in their working day from their arrival at the distribution centre to their return after delivering products to customers.

The causes and main effect are shown in the Ishikawa diagram in figure 1

Box 12

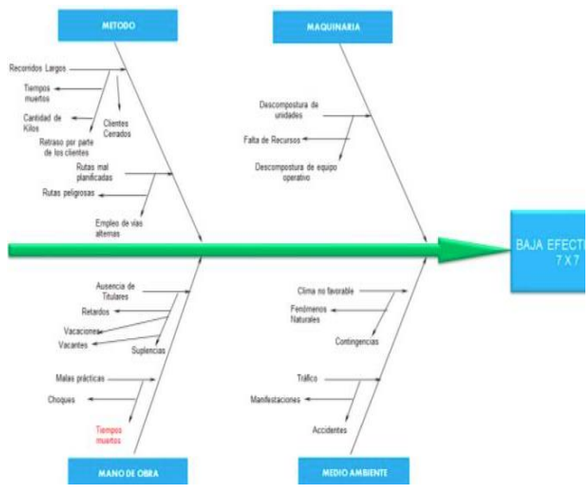


Figure 1

Ishikawa diagram

Source: Own elaboration

With the information from the cause-effect diagram and the opinion of those involved, the importance of the potential causes that do not allow the standard of distribution to retailers to be achieved is evaluated, specifying the cause of non-compliance.

With this information, a Pareto diagram was drawn up to determine the relative importance of each of the potential causes and to focus the company's efforts on reducing and/or eliminating the vital causes: Number of customers, climate, lack of drivers, route and closed customers account for 79% of the causes of non-compliance with the established standard, which can be seen in table 6 and in the Pareto graph (graph 6)

Box 13

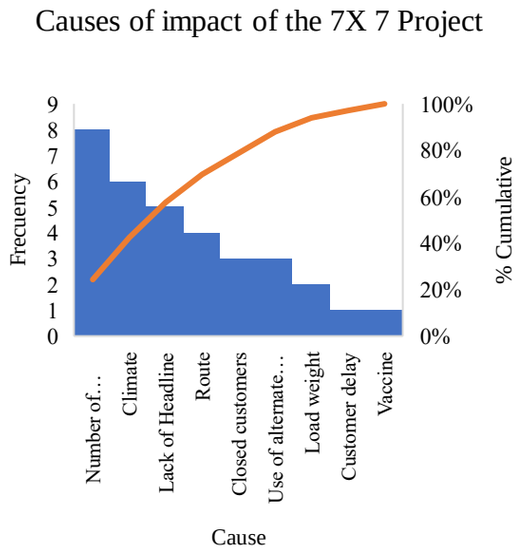
Table 7

Main causes and their frequencies

NUMBER	CAUSE	FREQUENCY	% INDIVIDUAL	CUMULATIVE	% INDIVIDUAL COMULATIVE
1	Number of customers	8	24.24%	8	24.24%
4	Climate	6	18.18%	14	42.42%
6	Lack of headline	5	15.15%	19	57.58%
7	Route	4	12.12%	23	69.70%
3	Closed customers	3	9.09%	26	78.79%
5	Use of alternate routes	3	9.09%	29	87.88%
2	Load weight	2	6.06%	31	93.94%
8	Customer delay	1	3.03%	32	96.97%
9	Vaccine	1	3.03%	33	100.00%
		33	100.00%		

Source: Own elaboration

Box 14



Graph 6

Main causes and their degree of frequency

Once the main root cause of the low effectiveness of the 7 X 7 project was identified, and in order to improve the effectiveness of the project, the management and evaluation of the retailer distribution improvement project was carried out with the planning and development of a countermeasure plan to address the problem of downtime, as well as the development of actions to improve effectiveness. To this end, a Gantt chart (figure 2) was drawn up, as shown below, with the programming of the following activities:

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Delay format, Critical route supervision format, Management of registration machine applications, Standardisation of arrival, Load Counting, Priority review filter at departure, constant monitoring of visitor registration, Assignment of assistants to critical routes and, finally, Route audits.

Box 15

7 x 7 countermeasure plan				Month 1 November semana					Month 2 December semana				
				1	2	3	4	5	1	2	3	4	5
Number	Activity	Description	Responsible										
1	Delay format	A delay form will be created so that delivery people who arrive late can sign it so that there is evidence of it.	Resident										
2	Critical path monitoring format	A supervision form will be created which the supervisor will fill out in their audits of the critical routes.	Resident										
3	Application management of registration machines	Of the operators who have been identified as wasting a lot of time using the phone and not for work matters, applications that could distract them such as WhatsApp, Facebook, among others, will be removed.	Supervisors										
4	Arrival standardization	The keys to the units and the registration machines will be placed in the operations area so that the delivery people do not waste time searching and thus go directly to their trucks.	Supervisors and Resident										
5	Load count	As the delivery assistants arrive, they will be assigned a unit to count the load or assist the owners in filling the pulpomatic.	Supervisors										
6	Output a priori review filter	So that the delivery people do not waste time in the exit filter with the police, an a priori review will be carried out to ensure that the delivery people take their transit documents, their licenses, their locks on the boxes, in order. their drums full of water and their outlet cones.	Resident										
7	Constant monitoring of visit logs	An update of the client's visit records will be carried out every hour, and the report will be sent to the supervisors so that they can communicate with their operators and thus take action on the matter with those who have few records.	Resident										
8	Helper assignment to critical routes	From the critical routes detected at work, delivery assistants will be provided on their days with the most clients and volume of products to ensure that they arrive 7 x 7.	Supervisors										
9	Route audits	Surprise audits will be carried out on the identified critical routes to ensure that their performance is as desired.	Supervisors										

Figure 2

Gantt chart

Source: Own elaboration

Once the 7 X 7 project was implemented, the number of routes with efficiency greater than 90% increased to 25 per supervisor during November as shown in table 7 and graph 7.

The following table compares the routes for November and December in order to detect coincidences.

In November, only route 15 of supervisor Z was less than 90% efficient, and in December, routes 3 and 46 of supervisor W, 21 and 25 of supervisor Y, and only route 13 of supervisor Z lost efficiency.

Box 16

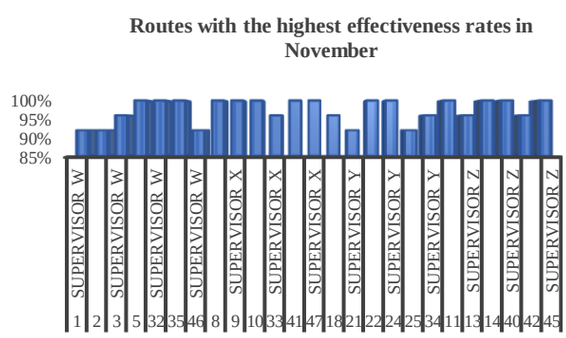
Table 7

Routes with higher effectiveness rates in November and December

ROUTER	SUPERVISOR	NOVEMBER	DECEMBER
1	SUPERVISOR W	92%	100%
2	SUPERVISOR W	92%	92%
3	SUPERVISOR W	96%	
5	SUPERVISOR W	100%	96%
32	SUPERVISOR W	100%	100%
35	SUPERVISOR W	100%	100%
46	SUPERVISOR W	92%	
8	SUPERVISOR X	100%	100%
9	SUPERVISOR X	100%	100%
10	SUPERVISOR X	100%	96%
33	SUPERVISOR X	96%	100%
41	SUPERVISOR X	100%	100%
47	SUPERVISOR X	100%	96%
18	SUPERVISOR Y	96%	100%
21	SUPERVISOR Y	92%	
22	SUPERVISOR Y	100%	100%
24	SUPERVISOR Y	100%	100%
25	SUPERVISOR Y	92%	
34	SUPERVISOR Y	96%	100%
11	SUPERVISOR Z	100%	100%
13	SUPERVISOR Z	96%	
14	SUPERVISOR Z	100%	96%
15	SUPERVISOR Z		96%
40	SUPERVISOR Z	100%	92%
42	SUPERVISOR Z	96%	100%
45	SUPERVISOR Z	100%	96%

Source: Own elaboration

Box 17



Graph 7

Routes with the lowest effectiveness rates in November

As of December, there are 21 routes with an efficiency of more than 90% per supervisor, as shown in table 7, graph 8.

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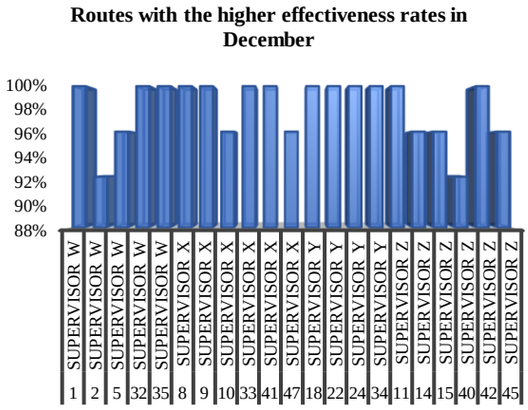
Box 18



Graph 8

Routes with the lowest effectiveness rates in December

Conclusions

At the end of this research it was observed that the main objective of this project was achieved, which was to increase the effectiveness of the distribution routes. The minimum standard was achieved, through the optimisation of times, an adequate general management of the processes and activities that contemplate the delivery of products to the final consumer; in the same way, a standardisation of positive upward trends was developed. In general terms, it can be concluded that the diagnosis, analysis and improvement plan implemented contributed positively to improving the 7 X 7 indicator. This led to a notable improvement in the reduction of substandard routes at a general level and, in particular, in the reduction of the time taken by operators from departure to their route to arrival.

This was possible with the use of basic quality tools and above all with the involvement of operational staff, supervisors and senior management. In addition, there was a reduction in absenteeism and tardiness of employees, greater motivation and commitment, as those involved participated both in the detection of the potential causes of low effectiveness in their activities and in the improvement project. There was a reduction in the number of vacancies, thus generating an operation with a robust team.

As for the areas of opportunity identified in the diagnostic stage, such as the presence of idle times, the high rate of operator delays, the lack of monitoring and constant evaluation, these were eliminated or reduced by a large percentage.

Supervisors were helped to improve their individual indicators, as well as reducing the number of non-compliant routes and increasing the delivery effectiveness of the critical routes analysed.

It is worth highlighting the importance of change in any organisation, as work teams often have a specific way of carrying out their daily activities, but when they become routine, they fail to identify areas for improvement, which is why the application of quality tools is recommended on an ongoing basis.

In operations, a lack of camaraderie was identified because in certain situations supervisors are only interested in the operation of the routes they are in charge of, when colleagues need support. It was also noted that certain supervisors team up and manage route departure planning and the allocation of helpers according to their needs.

Best practices in the work routines of supervisors and delivery drivers were identified for the design of standardised work procedures, thus drawing on the experience and skills of supervisors and operators.

In the internal context of the company, some areas lead to non-compliance with the effectiveness indicator. Such is the example of the financial department, which should streamline processes to provide it with the tools required by the operations area to achieve more effective deliveries, such as: having the invoices to be delivered on time, delivering the corresponding TAG for the payment of toll booths, resources for the payment of parking, among others.

Similarly, the commercial area, because on several occasions it causes deliveries to be less effective due to the way in which they manage customer orders, i.e., for a delivery to be convenient, customers need to be as close as possible or be in the path of the delivery person. However, pre-sales staff sometimes enter orders with customers who are outside the delivery driver's area and this causes the project indicator to be affected.

In this sense, it is necessary for the commercial department to take into account the delivery route so that the sales work is generated in the established areas.

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Conflict of interest

The authors declare that they have no conflicts of interest. They have no competing financial interests or known personal relationships that could have influenced the information in this article.

Authors' contribution.

Zenteno-Bonola, Ana Luisa: contributed with the idea of the project, development of the introduction and frame of reference, statement of the problem and formulation of the conclusions.

Calderón-Ríos, Norma Otilia: contributed to the development of the methodology, the formulation of the conclusions and the general revision of the article.

Palomar-Fuentes, María del Pilar: contributed to the elaboration and interpretation of graphs, tables and figures, and the calculation of statistical measures.

Benitez-Vallejo, Juan Carlos: contributed with the project idea, the collection and processing of information and the proposal of the countermeasure plan.

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Abbreviations

CEDIS	Center of Distribution
IPISI	Analysis methodology for distribution centers
MIPyMES	Micro, Small and Medium Enterprises

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