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Proposal for improvement in the logistics process of Codelco Ventanas Division

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Abstract: Cargo transportation of mining products in Codelco Ventanas Division, is hiring the services of loading, transport and unloading of copper cathodes to perform the physical movement of products, considering a price for performing them, so the total cost paid for these services is a factor to consider if you want to achieve greater operational efficiency. In the process of warehouse management and delivery of products, a number of problems concerning the loading of trucks are detected, causing alterations in its flow. This is because the truck returns to the winery, lack of weight according to the contract that the carrier has to remove the loads to the port areas of Valparaiso and San Antonio; and on the other hand excess weight according to the provisions of the law to traffic on the roads in Chile. Along with these two elements, it is also another reason which generates returns truck to the winery, and this is due to improper stowage of the truck which does not allow you to pass the dynamic scale, exceeding the axle weights permitted by law. The proposed solution to the problem found is to improve the flow of trucks through the implementation of RFID technology in the sector of final products division. This improvement of the current process allows expedite clearance packages cathodes trade, achieving an increase in responsiveness to changes in the program, greater fluidity in the charging process and a reduction of time and additional costs generated today. With the proposed improvements reduced waiting time by 33% by suppressing returns from trucks to the winery, and decreased costs due to operational efficiency. In addition, the opportunity cost improvement, achieving meet customers in the terms agreed in the contract.

Key words: Copper cathodes, flow simulation trucks, warehouse and inventory management, truck loading process

1. Introduction

Currently Codelco Ventanas Division produces copper cathodes in the form of trade, by lineament with annual sales program sent from the Commercial Vice President, located in the Headquarters of the Corporation. The final product, by hiring cargo services, transportation and unloading, should be mobilized to different customers, which has as setback high delays in reaching your destination, mainly due to high retention rates of trucks within of the company.

The problem is evident in the high residence times of the trucks on the ground, mainly due to the variability of weights packages cathodes, so drivers should protect and be wary of low or overweight your vehicle, thus generating a delay in the flow of goods and long waiting times for drivers, resulting in higher operating costs for the corporation, increases spending by outsourcing staff for extras loading and dispatch, and causes difficulties to send finished products, so that does not allow changes in the program office under the stipulated requirements, directly affecting the service of different customers both nationally and internationally.

What is intended is to propose an improvement in load management truck Codelco Ventanas Division, through a system that allows the recording of barcodes of each package cathode that will be placing on the truck for delivery, providing information the weight of

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each truck, speeding up orders cathodes trade to different customers, in turn maximizing the use of space and equipment available for storage in the cellar, and reducing the costs associated with the work of office by an uprising data , modeling and optimization of the current process, in order to have an increased responsiveness to changes in the program, allowing greater operational efficiency, shown by an increase in the speed of task dispatch, generating both an exploitation of cost and shipping time.

1.1 Objectives

As the process of industrial office, through trucks with trailers, is similar in different companies producing copper cathodes, the interest of the study focuses on reducing costs and delivery times. One of the biggest costs associated corresponds to cellar management, so the approach given to this work is the search optimization mainly in that process, as in other operations in which circulate the trucks. From this context, the following objectives are defined.

1.1.1 General objetive

The overall objective of this project is to improve the charging process by implementing a system that allows the recording of barcodes on packages of copper cathodes, to reduce time and costs, both load as office truck Codelco Ventanas Division.

1.1.2 Specific objetives

The specific objectives necessary for the fulfillment of the overall objective are:

- Study the current status of operation of the processes, to know the work of the operators, through field trips and interviews with workers.
- Discover and prioritize the problems and bottlenecks that are generated in the flow of trucks to understand its causes, considering the time spent on the different processes.
- Develop a simulation model that reflects the relationship between the various processes involved, in order to propose improvements to critical issues through a specialized software to perform such activity.
- Evaluate the expected benefits of the proposals, to estimate the optimal solution by comparison with the current process.

2. Methodology

The development process of the project consists of the following stages. On the one hand, knowledge of the current process and then identify the issues that generate a greater impact within it, to propose improvements to the system point to the comprehensive solution of the problem under study, as detailed below.

2.1 Lifting perform processes

First of all, it is necessary to have full knowledge about how the process operates, areas and people involved in the operation.

This removal process is developed through field trips, plus interviews with both managers shift as much of the personnel involved in the different stages, operational and functional level. Thus, working with diagrams to visualize the actors involved to do their observations, capturing reality in depth the current process.

2.2 Analyze the problems encountered

With a lifting validated by the various participants processes, it is possible to begin to identify and analyze the problems that arise, so you can inquire into the causes and the impact that cause each of these.

Following the above, it is possible to internalize and describe the problems that arise on a regular or ad hoc basis, based on this the root causes of these problems are identified, and some of these include: storage outdoor storage without procedure set, returns to warehouse trucks with loading difficulties, the irregularity in the beginning of the study, among others.

2.3 Identification of critical issues

Once the problems in the process analyzed, it is necessary to establish which of these are the most important, and affect in a major way in the dispatch of finished products, which actually creates inefficiencies in the process, pointing to the Pareto principle or rule of 80-20.

Through the data and information collected from field and simulation analysis using the Arena v14 software, it is possible to distinguish the bottleneck, which is related to the variability of weights packages cathodes stored in the hold, which It does not allow an adequate weight distribution trucks in relation to the loading of these.

Currently exists in Chile a Supreme Decree of the Ministry of Public Works determines a maximum of 45 tons per vehicle load, so overcome that weight will result in the return of the truck, from area crossed out or weighing area, a wine cellar, generating a loss of time in the task of loading, delaying the continuous flow of trucks inside the plant.

2.4 Propose improvements

With the problems identified, the impact evaluated, the study of related literature and similar processes, proposals that mitigate the unwanted effects in the process, to allow a continuous release of finished products are generated.

In addition to the above, once the study done and made proposals for improvement, process restructuring, integrating the proposed improvements so as to generate a redesign cellar management that can effectively meet the objectives set at the beginning of the study.

2.5 Validation of the proposal

Once the optimization proposal is made, this is validated and quantified by analysis of the outputs of Arena software, so as to achieve the impact that is obtained by adopting the improvement in the process. Considering as valid quantization parameters decreasing costs associated with activities re manipulation, storage capacity of the winery and the opportunity cost that allows to have a greater capacity to respond to changes in the program office.

3. Solution

Once we have done the lifting of processes and analyzed the problems encountered, improvements that help optimize circuit trucks in Codelco Ventanas Division are proposed.

The improvements are presented below, they aim to holistically solve the problems outlined in the introductory chapter, and these are.

3.1 Truck entrance system

Today every truck entering to withdrawal of a product or material division should be tared, because in this way is controlled to compliance with the current regulations of traffic corresponding to Law 19,171 which requires roads that “every company generating load, understand such that annually produce 60,000 tons or more in each place of shipment or receipt, they must have systems weighing of cargo vehicles, according to the general rules of a technical nature imparted by the Ministry of Works public, by supreme decree.”

The division has a weighing system for cargo vehicles and complies with the general rules taught, has information about the type of vehicle and along with this there which is the maximum limit that can load according to their combination.

Structurally trucks are capable of carrying 50 tons, but nevertheless, the law only allows traffic on the roads of Chile with up to 45 tons. So it is at this point where the knowledge of the equipment before loading becomes important.

The first proposal for improvement is related to the prior identification of the team that entered, which is the axis configuration and rolled to thereby perform stowage and allowing not overdo on the total weight of the truck, and also does not exceed the maximum weight per axle, in line with what the law says.

The following image shows what is stated above.

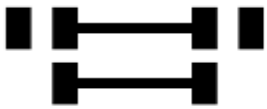
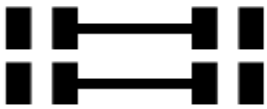
Ejes Convencionales			
Eje		Límite (Ton)	Tolerancia (Kg.)
	Simple	7	350
	Doble	11	600
	Simples	14	700
	Doble y Simples	16	750
	Dobles	18	900
	Simples	19	950
	Doble Doble y Simple	23	1100
	Dobles	25	1200
Peso Bruto Total del Vehículo (Tara + Carga)		**45**	**1400**

Fig. 1 Axle weight limits for vehicles on public roads. Source: Compiled from decree Nº 158/80 and Nº 519/96 DS MOP.

The proposed procedure is as follows.

- The truck entering the division should be directed to the scale to be tared.
- Once positioned on the scale, the operator must record the tare Roman truck, plus the type of team that entered as detailed below.

Tracto-Camión	
Ejes	**Código**
Simple RD	A
Doble RD	B

Semirremolque plano	
Ejes	**Código**
Simple RD + Simple RD	1
Doble RD	2
Simple RD + Doble RD	3
Triple 1RS + 2RD	4
Triple RD	5

Camión patente	DVXC-16
Código equipo	B-3

Table 1 Classification of equipment. Source: Prepared.

- This information is sent electronically to the dispatcher found in the cellar of Final Products.
- Once received, the dispatcher observes its manual procedure for clearance of goods, and starts loading maneuvering equipment, according to the recommendations for each type of configuration.

3.2 Implementation of The radio frequency identification (RFID) in warehouse Final Products

RFID is one of the fastest growing technologies and benefits that companies can take now.

RFID refers to a technology of wireless data exchange, reading and recording of these is from the electronic product code (EPC), specifically, packages cathodes, as each of these has an identifying label of the product as can be seen below.

Fig. 2 Label cathodes. Source: Recovered from warehouse finals products in CodelcoVentanas Division.

RFID technology allows remote access from a number of readers to devices, labels or RFID tags that attachments are placed (glued) to items or goods that you want to do a specific follow, from placing these labels can be processed information and enter it into management systems.

Generally, this system consists of three parts: Labels on each package commercial cathode, a reader with portable terminal and software to process the data.

The labels are applied to products and are part of a sticker in which specific information is stored, such as weight, batch, origin, among others.

The reader is an autonomous unit, primarily intended for weight control of each packet to be loaded on the truck in the hold. These are integrated with a portable terminal for individual use hand dispatcher.

The reader device which is responsible for collecting the information, receiving a unique identification number for each package cathode. It is as if the reader asks the tag or label what your information, and it responds by sending it its unique identification number. Then the reader sends a radio signal, which is received by the SEC computer system.

The SEC (cathode statistical system) will process the data sent by the reader, storing information, then prepare reports release of products, and at the same time, generate the waybill for carriers.

The following figure simplifies the way the system operates.

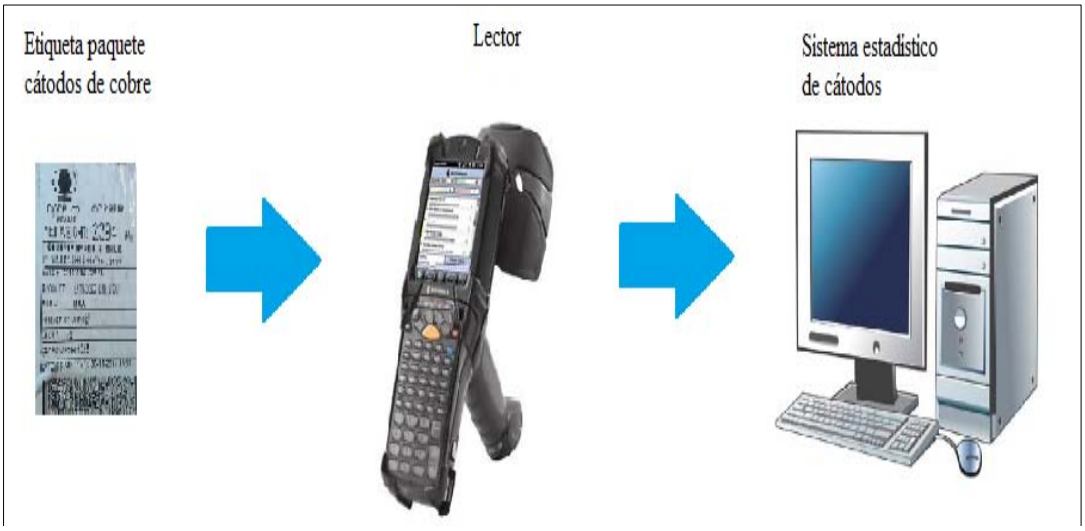


Fig. 3 Operation of RFID technology in the office products. Source: Prepared with figures obtained from the google search engine.

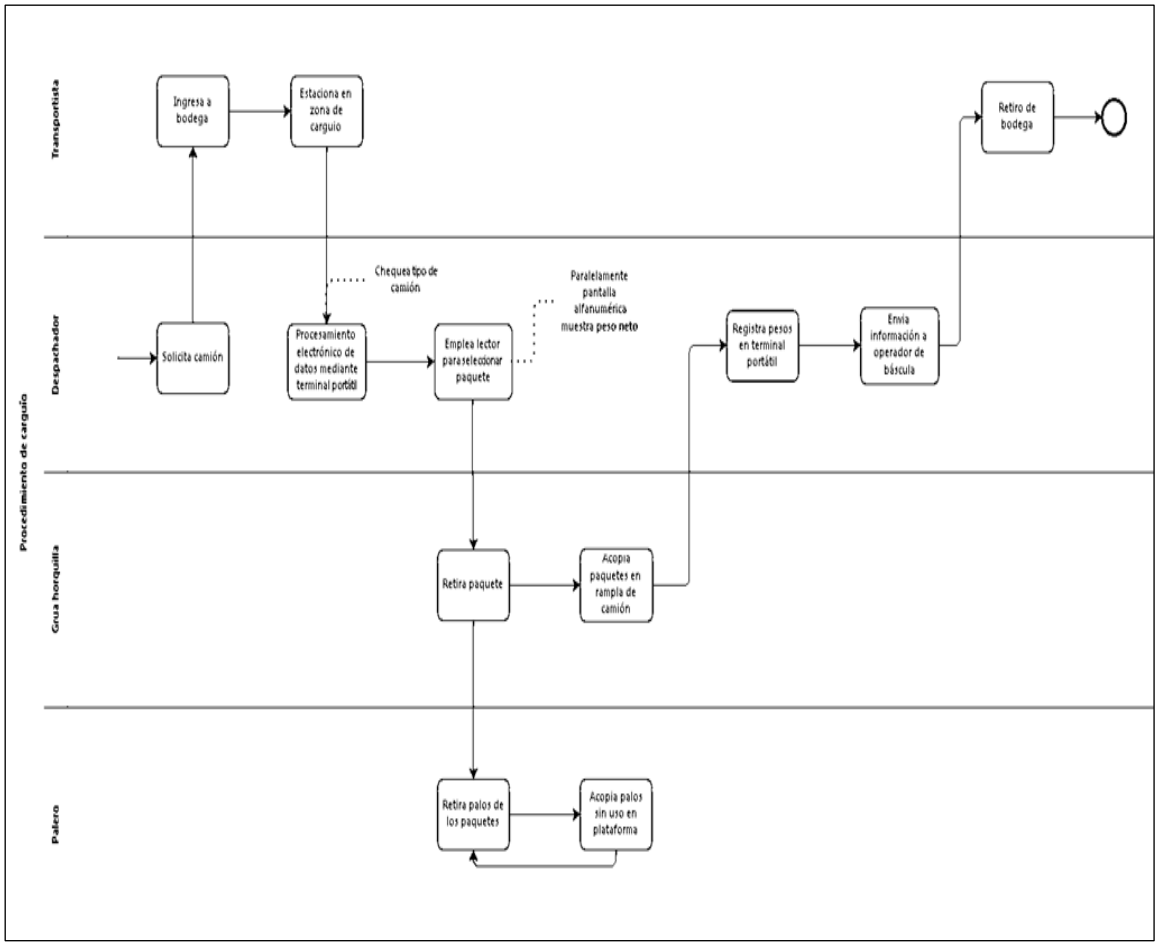


Fig. 4 Diagram loading procedure. Source: Prepared.

In addition to the above, when registering a package cathode, the reader will send a signal to an alphanumeric display on the front loading area of trucks, so that truckers know how much weight they are charging you to your vehicle. This information will be extremely important for them, because they know instantly the net weight they carry.

The alphanumeric display should be large measures, that can be appreciated by all participants in the process cargo hold. 5 meters wide by 1 meter high: the following dimensions is proposed.

That said, the procedure for loading the trucks can be seen depicted in the Fig. 4.

The dispatcher is the operator oversee and manage the work load packages into trucks cathodes. In view of that, it is recommended that the operator manage the portable terminal, since the information supplied with this device is of utmost importance to fulfill their work.

As they leave recording information packs cathodes automatically waybill, which the scale operator is sent at the entrance of the plant, this in order to further optimize be generated the circuit trucks within the Ventanas Division.

Generally, a new clearance procedure, it starts from the truck that will make retirement packages cathodes enters the division, and ends when the carriage is removed with the load destination originates. The procedure is the next.

- The carrier enters the plant, prior call for Commercial and proceeds to tared.
- In the static scale, the truck is identified by the method of entry truck described in the first proposal.

- Once the team identified the scale operator sends electronically, the required vehicle specifications dispatcher found in the cellar of Final Products.
- The truck proceeds to position themselves in the parking lot, then it goes to the sleeve, which is the previous sector entry into the cellar. The driver must wait for the dispatcher, located in the cellar, seeking admission.
- The dispatcher asks income, using a loudspeaker, which makes triggered by a button, alerting the carrier is first in the row is the time to enter the cellar.
- The driver guides his truck to warehouse, then position themselves in the demarcated to park within it sector and stop the engine of your vehicle.
- The dispatcher, once you know the type of equipment to load according to your configuration, proceed to maneuver packages loaded cathodes.
- Select the package cathodes and capture your information by electronic reader, so that the crane fork coupled undertake the collection in the truck, to complete the equipment load. Simultaneously, it will show the weight of each package on the alphanumeric display and also generates the waybill, which is sent electronically to scale operator.
- The truck goes directly to the slinging area, where ensures the load.
- After passing through the dynamic and static scale, where the operator of the scale gives him the waybill, according to execute the release of the goods, later to retire bound client.

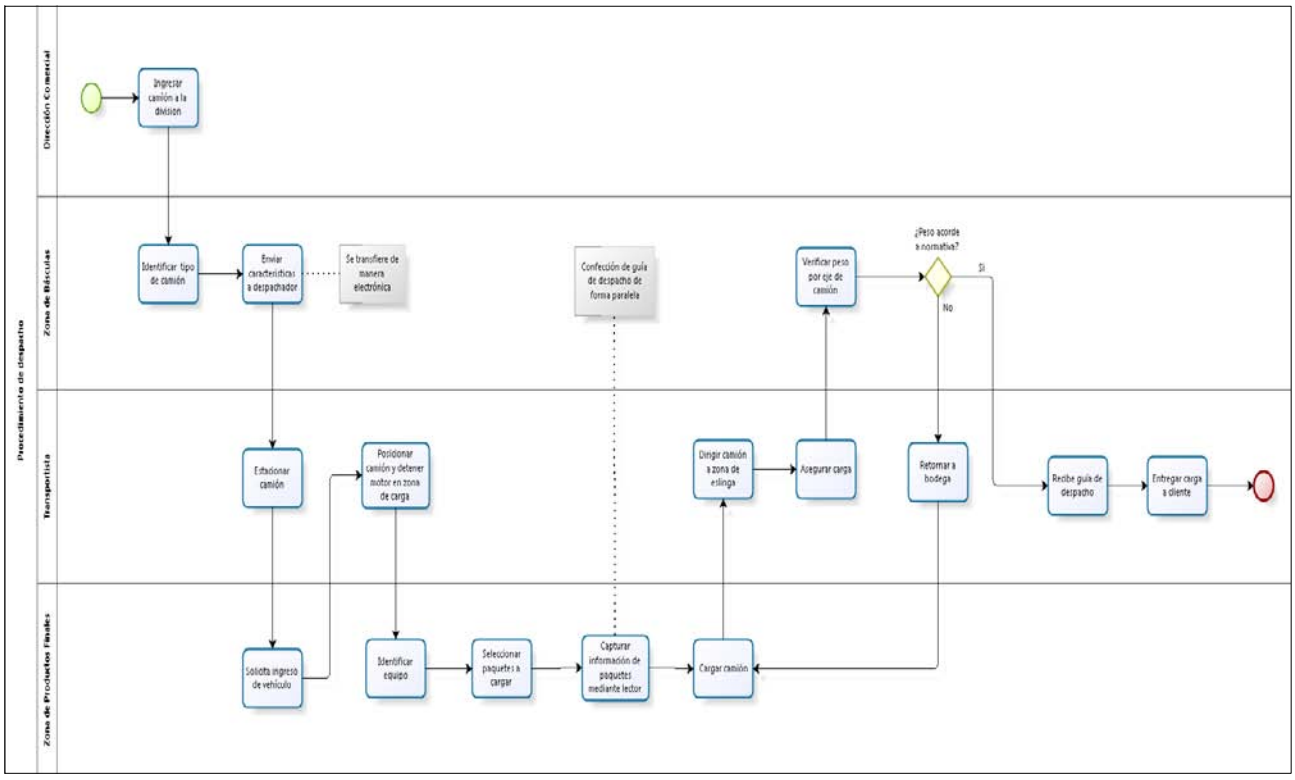


Fig. 5 Diagram clearance procedure proposed. Source: Prepared.

3.3 Truck dispatch system

The information provided by the dispatcher, by reading the weights of each package cathode and that is reflected on the alphanumeric display, truckers, transcends greatly to the current way of working, because the drivers are now going to know the exact net weight they carry in their vehicles.

In view of this, the process of plaque, where an operator gets on the truck to verify each package weights is eliminated. This happens because there is no need to perform this task, since the weight of the packages will be known within the warehouse, when the dispatcher use reading cathodes by the portable terminal.

Once placed in the sling, truckers will not have the need to be returned to the winery to retreat waybill, because this document is created electronically when the dispatcher use the reader. So once secured the load, proceed to direct their vehicle to the dynamic scale, if stowage is the right move to the static scale where the operator of the roman gives the waybill, concocted electronically from the Final Products cellar.

This new form of dispatch trucks permanently change the mentality of current job, because truckers are demanding that ought not to be the ones who are returned to the winery to remove the waybill, or merely to walk a long way to go search the document takes up time that could take on other things. With this proposal, the manual system is removed and becomes something completely new for both truck drivers and service workers, as well as for Codelco Ventanas Division.

3.4 Redesign jobs

Finally so that they can carry out the mentioned proposals, modifications are needed to existing jobs, to allow new activities assigned to each operator if necessary.

The jobs are:

- Charge Time Deliverables: Coordinates the activities of reception, storage and dispatch of cathodes trade, must also monitor compliance with the monitoring indicators and must submit a weekly report to the Chief Engineer of final products and our commercial director, with the results obtained in these measurements.
- Dispatcher End Products: Run and controls the work of dispatch of commercial lots. It is responsible for making data collection by the reader and labels each packet of cathodes. In addition you must load each truck according to the type of equipment present, so must perform stowage most appropriately.
- Operator weighing Final Products: Performs commercial weighing and maintains online using Excel spreadsheet, the availability of tonnage for daily office. It also is responsible for label each package cathode with their respective information.
- A forklift operator: In addition to the activities of their daily work, incorporating for the correct way of extracting packages, supervised by the dispatcher, who by reading data will indicate which package should remove adds.
- Drainer: Is one operator who removed the sticks that serve as support packages cathodes. This worker must labor continuously to avoid interruption of ongoing expedition truck.

These are the jobs that are affected by the redesign of the current process, thus ensuring that the implementation of each activity is carried out correctly and with proper knowledge of each participant.

3.5 Control

Proposals to meet the goal of producing a positive impact in the process, it is necessary to control it.

In this way, you can know how the process behaves. That is, the actual performance in relation to expected performance, so that if necessary they can take corrective improvements to the system, allowing close as possible to the realization of the objectives of the company and to generate improvements for the process to deliver the expected results.

Unlike what happens within a company of any kind, in division Ventanas becomes impossible to perform measurements that are comparable to sales revenue, as this process is channeled directly to the head office of the corporation.

That's why the focus of the measurements will be related to two key aspects for process development; first of all what is related to the output of the product, and secondly about the storage and use of warehouse space.

Then using KPIs be exposed.

3.5.1 Compliancerate

This indicator seeks to obtain the percentage of fulfillment of deliveries dispatched within the enabled shift or during a period to be analyzed in relation to the total number of shipments and scheduled deliveries. It refers to the tons scheduled for dispatch and actually shipped.

It can be used daily or monthly, by analyzing the behavior of the process with respect to what happened in the monthly program.

This KPI is calculated.

$$Tasa\ de\ cumplimiento = \frac{Despacho\ real\ (Ton)}{Despacho\ programado\ (Ton)}\ (\%)$$

It should be considered a minimum level of compliance. In this case will always be greater than ninety percent of deliveries, this tolerance is because eventually the carrier may not arrive in time to remove the product, as they must download articles that came from origin, before heading to remove the Ventanas division.

3.5.2 Quality of service

This second indicator is related to the quality of service delivered by Codelco Ventanas Division with respect to meeting the delivery requirements, specifically with regard to timing, also can be used to measure the quality of service in order picking, with regarding the requested product is delivered, ie picking quality.

This KPI is due to the following expression.

$$Calidad\ del\ servicio = \frac{Nº\ de\ reclamos\ de\ clientes}{Envios\ totales}\ (\%)$$

The percentage of this indicator will have to get as close as possible to zero, since at this point it is vital that the customer receives the product you requested, because this is a critical raw material that can damage equipment because the processes to be applied for use they are in constant flux.

3.5.3 Process efficiency

This indicator allows us to know how it is operating the entire set of activities within it. You can measure the time delay in the truck with its load out, in relation to the ideal time should remain within the process.

This KPI is measured by.

$$Eficiencia\ del\ proceso = \frac{Tiempo\ real\ del\ camión\ en\ \ el\ circuito}{Tiempo\ ideal\ del\ camión\ en\ el\ circuito}\ (\%)$$

When the calculated value is greater than one, you will be aware that something is not working properly, and should analyze activities where that generates inconvenience that the process takes more than estimated time occurs. In the event that this value is maintained below one for a considerable period of time, remember to set the ideal time of the truck within the circuit.

3.5.4 Occupancyrate

This indicator provides information about the use of the space available to store, considering that the capacity estimation is performed by sector, we have the following.

$$Tasa\ de\ ocupación = \frac{Tonelaje\ real\ almacenado}{Tonelaje\ calculado\ por\ sector}\ (\%)$$

If the employment rate indicates on one, corrective action must be taken immediately, this value means that the winery is supersaturated, many of final products and other items.

Acceptable occupancy rate must not exceed 80%, because it is at this point where they begin to generate operating space conflicts and complicate the work of officials cellar.

Those responsible for carrying out the fulfillment of these indicators is the area of final products, specifically the chief engineer, who is credited with the commitment and the task of running them, because it is responsible for planning, coordinating and supervising the activities occurring in that area. The operator will have to submit a report on the situation to business management and the workers responsible for serving.

The use of the indicators above allows to know periodically how the process behaves in order to identify anomalies that may occur in the area of end products, aiming to correct or modify what generates a malfunction. This is stipulated to have continuous improvement, and that is also flexible so that if necessary can be modified to align with the objectives seeking the company.

4. Results

This chapter aims to validate the practicality of the proposal, by studying the flow of trucks inside the plant at Codelco Ventanas Division, through a simulation analysis with which results are obtained based on cost and operating time the vehicles.

That said, this validation can be corroborated by observation of sharply reducing the time the flow of trucks within the company, which is expected to decrease in costs associated with that task.

The expected benefits by implementing the proposals that have been presented in relation to the improvement of the overall process are as follows.

- Faster loading process.
- Increased storage capacity.
- Increased responsiveness to dispatch.

4.1 Decreased time spent on the ground truck

The decline in truck stay within the plant is produced by:

- Lack of truck returns to the winery: The implementation of RFID technology will know the total weight of the truck at the time of loading, so there will be no re-entry vehicle into the storage sector cathodes.
- Elimination of tallying process: Because as trucks are loaded weight is recorded directly through RFID, no need to cross out or cathode registering packages with such vehicles.
- Absence of returns by the drivers to the cellar to fetch waybill: Because when registering packages cathodes, information of each of these is sent directly to Roman sector, entry division, here is where it will attach and drawing, electronic, that document.
- Reduced time in the processes occurring in the flow of trucks at the plant: optimization loading meant to reduce the time not only the process, but it brings an improvement to the overall system, because the speed of the flow depends directly from this stage.

That said, the process is raised as follows.

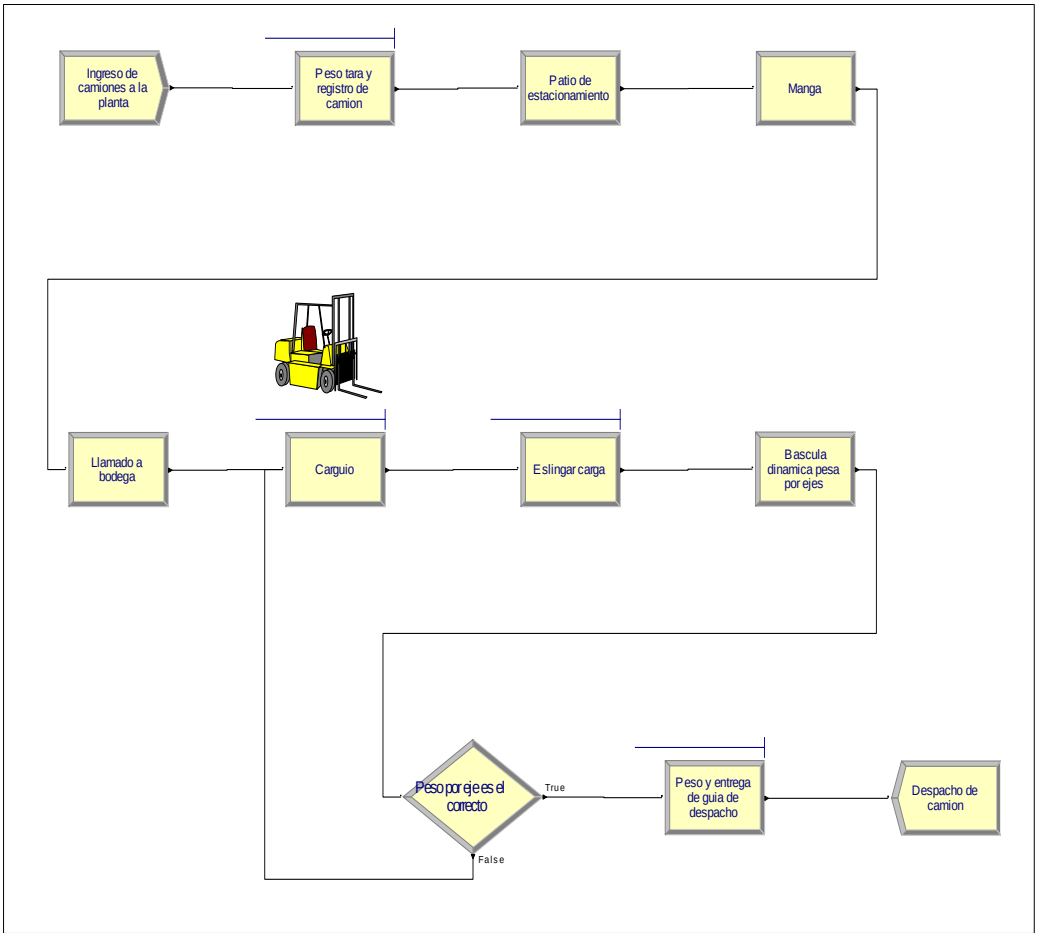


Fig. 6 Circuit truck at the plant proposal. Source: Prepared.

In the picture above, you may notice that two processes disappear in relation to the current situation, these are the sink and the withdrawal of the waybill. With this has a definitive elimination of their times, giving a total of 20 minutes, whereby the flow of trucks has proposed a third less than the original time.

Besides the above, other processes shown in Figure 6 are justified and simulated, giving the following characteristics.

N°	Proceso	Tiempo (min)	Acción	Recursos
1	Peso tara y registro tipo de camión	2	SeizeDelayRelease	Bascula estática
2	Patio de estacionamiento	17,5	Delay	
3	Manga	16	Delay	
4	Carguío con apoyo de RFID	7,2	SeizeDelayRelease	3 Grúas horquillas
5	Eslingar carga	10	Delay	
6	B. dinámica pesa por eje	3	SeizeDelayRelease	2 Basculas dinámicas
7	Peso total de camión y entrega guía de despacho	6	SeizeDelayRelease	Bascula estática

Table 2 Characteristics of processes with proposals truck circuit. Source: Prepared from the outputs of Arena software.

It can be seen that the total processing time is 62 minutes, less than proposed in the current situation (92 minutes). The fact of implementing RFID processes directly affect 2, 3 and 4, this makes sense because if the loading is improved previous two processes so will have action as delay and do not use resources.

This box results it is concluded that the time the truck in the circuit decreases by 33%, which reduced this time can be used to do other work.

4.2 Reduction and elimination of office after hours

In addition to the benefits mentioned in the previous point, it will generate an improvement in the responsiveness that will have the winery in relation to changes that may incur the program office. This will allow for flexibility at the time of release of the products, due to expediting the bottleneck that occurs in Final Products warehouse and can respond to any changes that arise.

The above-mentioned will allow to be deleted:

- Shipments after 20:00 hours on days Monday through Friday.
- Shipments after 16:00 hours on Saturdays.
- Shipments in holidays and Sundays.

To quantify the benefit of eliminating the office in the circumstances described, it should be mentioned that the winery works every day of the month, even though it is a holiday or Sunday, also operates in the form of shift system 4 by 4, where each of these works 12 hours starting the morning shift at 8:00 and ending at 20:00. The night shift starts at 20:00 and ends the next morning at 8:00 am.

The shift manager dispatch products as its main activity is the morning, unlike the night shift only dedicated to preparing and storing products in storage. It happens that the second shift, when to dispatch, time and resources used in such activity, generating that preparation does not meet the goals set for the shift. What brings a delay that accumulates and eventually causes offices in unscheduled days, using resources and time to deliver the goods, and so on causing a closed cycle.

4.3 Elimination of extra shifts in port for receiving products

Finally, as a result of improvement in the process of entry and exit of trucks of the plant, in addition to speeding up the loading of these, along with procedures for proper stowage of equipment, you have to activities scheduled release have been met within set times and days. As a result of this, it may remove enabling additional shifts for receiving loads, both in the port of Valparaiso, such as San Antonio, being fundamental to Codelco Ventanas Division, as these shifts are canceled by the same company, currently ranges from 10 to 12 work shifts unscheduled.

The values for the above shifts were not delivered by the division thus benefit calculation is based according to information available at the port of Valparaiso, and this is.

Habilitación terminal horario hábil (mínimo 3 hrs)		US$150 por hora	
Despacho en tipo de días	Cantidad días	Cantidad hrs	Valor US$
Hábiles	12	3	12 x 3 x 150 = 5.400
Inhábiles	2	8	2 x 8 x 150 = 2.400
Total Mensual			**US$ 7.800**

Table 3 Costs associated with additional shifts in Puerto Valparaiso. Source: Based on information from Puerto Valparaiso.

It can be seen that the average additional cost in relation to enabling additional shifts for receiving goods at the port is US $ 7,800 per month, equivalent to US $ 93,600 per year.

It should also be noted that to improve the current process of loading and dispatch, can serve customers time, avoiding fines for breach of contract.

5. Conclusions

The study is done is conducted through a detailed process knowledge cellar management and subsequent dispatch of copper cathodes, once you internalized it is possible to know what are the causes that the process responds poorly about the objectives that it has, which in this case are to meet customer requirements regarding product delivery and quality of picking, ceasing to be timely and also generating additional costs to the process.

Knowing the process and those involved can identify at which points the problems are generated, and by measuring within a period of time, is achieved quantify the amount of tons that can be stored in the cellar, and even more, occupying a smaller capacity than the available products should be stored in areas not assigned for this purpose, hurting the transit of forklifts and trucks also put the safety of workers at risk.

Having the knowledge about the deficiencies in the process, it is possible to define the objectives for this project, and enable turn apply a methodology that helps to solve them.

The submitted proposals that solve the shortcomings of the process are based on the result of the interaction between the entities involved in the daily work and best practices currently being carried out in the warehouse management in companies, obviously led to the actually the type of product which by its nature can not store the way the market is proposed.

The expected benefits of the proposals are to reduce by 33% the stay of trucks inside the plant Codelco Ventanas Division, this period is currently 92 minutes, with the proposals submitted this duration is reduced to 62 minutes. These improvements will it be accompanied by other benefits such as the ability to respond to the request for commercial lots by customers, have a process control through performance indicators, there is also a decrease in fuel consumption, both teams operating in the hold of final products and carriers, because there will be no retreat by the latter, because they know the net weight of cargo when released from the storage area.

The abolition of the process of withdrawal of the waybill from the area slinging the warehouse sector through electronic data transfer with RFID the area of Roman, produces a more pleasant environment, specifically truck drivers, as they are responsible for executing this process. Along with this, there is the exclusion of the sink, which the company can manage and use the operator of this process in another area of relevance, depending on the needs of the contractor.

This increases the competitiveness of the company, along with other intangibles such as improving the image of Codelco against other industries, enhancing its innovative feature not only the mining area, but also to service providers and their clients. An important advantage by implementing technological solutions of these features is that they are completely scalable and attachable to other information systems, which are seen as a step to support the development and growth of the company.

To increase the likelihood of acceptance of RFID is necessary that all parties see the need for change, through tangible benefits or demonstrating that the processes and operating today have difficulties in the future, so it is advisable to recognize its implementation with the benefits that this implies, and should be cross-training in the company, including from strategy, as is commercial direction to the operation, with the area of final products.

It is considered important that training on identification technology are conducted radio frequency, so that in this way the companies can quantify how likely it is that factor that may present technical flaws in the system (such as collapse of the server, lock software, etc.) is considered a real risk.

Finally it can be concluded that with the proposals made in the present work, the total time the truck

circuit inside the plant is around 62 minutes, representing a decrease of 33% compared to the current situation. In addition, the company additional expenses associated with shifts in port, due to the improvement in the flow of trucks, with an annual value of US $ 93,600 is saved. This seeks to update the system because it works so long, and even when it responds to the program, but sometimes with effort and additional costs.

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