9th North American Conference on Industrial Engineering and Operations Management
Washington D.C., USA, June 4-6, 2024
Publisher: IEOM Society International, USA DOI: 10.46254/NA09.20240259
Published: June 4, 2024

Improvement Model to Increase the Service Level of a SME Coffee Producing Company with the Application of Centroid Method, ABC Analysis and Kanban

Fiorella Pinedo-Albán and Gabriela Santillana-Saldaña and Alberto Flores-Perez
Facultad de Ingeniería
Universidad de Lima
Lima, Perú
20181467@aloe.ulima.edu.pe, 20181761@aloe.ulima.edu.pe, alflores@ulima.edu.pe

Abstract

This research shows the study of a small company dedicated to the roasting and packaging of coffee, being its main bottleneck the capacity to deliver the product to its customers, originating a service level of 79% and with an economic impact of approximately USD 56,329 per year. Through the diagnosis, it was found that the main reasons were the unlimited flexibility for order fulfillment caused by the lack of inventory, since the demand is variable; the second reason was the loss of time in the delivery of orders, due to disorganized routes, large number of trips and lack of order tracking. To address these problems, an improvement model was developed based on the implementation of the Centroid Method and Kanban to organize orders and propose delivery routes, reducing time and transportation costs. In addition, the ABC Analysis will be implemented to determine the most demanded products. For validation, a two-week pilot was carried out, which showed an improvement in the level of service to 93%, making consumers more satisfied with the company's response. This demonstrated that the application of engineering tools has a positive impact on the company's efficiency. Finally, the project was evaluated with @RISK to demonstrate different scenario.

Keywords
Coffee, Lean Manufacturing, Centroid Method, ABC Analysis, Route Design.

1. Introduction
Coffee is one of the most consumed products worldwide. This is made up of two large groups: arabica coffee and robusta coffee. Peru is one of the main producers of arabica coffee (Gestión 2023), being one of the most demanded qualities, followed by mild arabica, which is reflected in the exports of green coffee, which have shown a value of USD 1,236 million in 2022(Gestión 2023).

The coffee company has the objective of offering the national and international public a sample of the best Peruvian coffee beans, which are rigorously selected, evaluated and roasted daily by our team of tasters, roasters and professional baristas. They have certified raw material suppliers that produce specialty coffees between 1,200 and 2,000 meters above sea level in the high jungle of Peru. This company offers roasted coffee, roasted and ground coffee, coffee concentrate and testing services. On the other hand, it has a special line of Blends for its Horeca customer (hotels, restaurants and café).

After a data collect, was found that the company had a service level of 79% which is below the ideal scenario of 100%, this is caused by three main reasons. First, the company has a pull system, which means that they do not manufacture prior to customer demand, which is sometimes counterproductive because the demand is very variable, and the stock of roasted coffee is not sufficient when clients place orders after the due date. Secondly, not having a correct route plan causes many trips and loss of time. Finally, not tracking the order causes problems to deliver it, because the

© IEOM Society International

delivery man takes almost 11 minutes to contact the person to receive the order which delays other orders. In addition, these problems have an economic impact of USD 56,392 per year. For this reason, we propose the implementation of the Centroid Method, Kanban, the application of the ABC Analysis.

This article is composed as follows: introduction, which presents the situation of the sector with focus on the main problems, bibliographic review to verify the success cases related to the proposal, the contribution methodology, the validation and finally the conclusions.

1.1 Objectives

The main objective of this article is to increase the company's service level to 92% in order to enhance the customer experience and reduce costs in product distribution. This will be achieved by addressing the main causes: aiming to reduce inventory shortages by using ABC Analysis to study demand, thus reducing the customer loss rate to 0.5%; designing routes to establish a system that enables quick product delivery and reduces the number of trips made per day to achieve a 30% reduction in time; finally, Kanban will be used to have readily available and organized information so that the production and distribution area has data on the product and the consumer, which will help improve order tracking.

2. Literature Review

2.1 Centroid Method and route optimization

The Centroid Method helps companies determine a location based on the geographic location of destinations, volume and transportation costs. It allows you to make location decisions since one of the main impacts is cost reduction (Carro and Gonzales 2012). The centroid represents the central position between a set of points dispersed in "x" and "y" directions and is determined by the following formula:

$$Centroide = \left(\frac{1}{n}\sum_{i=1}^{n} x_i ; \frac{1}{n}\sum_{i=1}^{n} y_i\right)$$ (Subhashree et al. 2017)

With this method, as is expected that a uniform distribution in the demand groups will be achieved, even if they change in the different periods (Islam and Arakawa 2021). It must consider that the planning of the location of the warehouse, plant or distribution center is of utmost importance to achieve an optimal picking and delivery operation (Chiang et al. 2021). In addition, it has been used to propose a better transportation route, reducing costs from USD 7,315 to USD 2,081, that is almost 28% savings by reducing travel time to 7 hours (Koohathongsumrit and Chankham 2022). With this research, we can conclude the effectiveness of the use of the method.

2.2 Kanban to organize distribution

The implementation of a Kanban system seeks to achieve productivity, organization and process efficiency, this technique was created by Toyota, it is part of the Lean Manufacturing methodology, and its application involves Just in Time techniques (Castellano 2019). The use of Kanban implies an organization in production, it means that if a requirement has not been entered, the system does not produce, which eliminates the excess of products and leads to cost savings (Goulart et al. 2019).
In a study conducted for the delivery of components to construction sites, the Kanban tool was used, observing that by setting up a delivery plan, inventory minimization is achieved, which is directly related to costs and times (Tongguang et al. 2021).On the other side, the tool was used for a delivery project using an assigned task plan, which resulted in improved communication and reduced lead times (Weflen et al. 2022).

2.3 ABC Analysis for demand review

The ABC model is often used in the supply chain of companies, since its objective is to classify products to facilitate the management of inventories, identifying those that are most required to generate profits (Manzo et al. 2017, as cited in Daza and Rafael 2020). When the analysis is applied to products, it is possible to identify the displacements of each product according to its rotation (Macías Acosta et al. 2019).

This methodology consists of classifying products into three categories: A represents the highest sales volume; B for those with regular sales; and C, those with lower sales volume. According to the classification, the first has a percentage of units consumed accumulated up to 80%; the second, are the products with accumulated percentage up to 95%; and the last one is the remaining 5% (Flores Gutiérrez et al. 2023).

© IEOM Society International

3. Methods

Customer satisfaction has always been a motivation for companies to offer a better product, but equally important is the way of delivery it and the speed of response to changing consumer needs. Therefore, this research is proposing Lean Manufacturing, Route Design and ABC Analysis tool to improve the flow of order reception and delivery. Table 1 shows the articles that this investigation considers.

Table 1. Matrix of comparison of causes vs state of the art

Component	Causes		
	Lack of inventory	**Disorganized routes**	**Order tracking**
Yanke, D. et. al. (2023)	ABC Analysis		
Tongguang et al. (2021)			Kanban
Islam and Arakawa (2021)		Route Optimization	
Chiang et al. (2021)		Route Optimization	
Proposal	**ABC Analysis**	**Centroid Method**	**Kanban**

3.1 Proposed model

This work is focused on increasing the level of service in the distribution of orders, through a model that involves the Lean Manufacturing tool: Kanban; distribution tools: Gravity or Centroid Method; and ABC Analysis to attack the main causes of low level of service in the company, reducing the loss of sales, customers and delivery time.

The case of study is located in a company that produces roasted and bagged coffee in different presentations, which presents a low level of service (79%) due to its lack of efficiency in the delivery of products.

Figure 1 shows the steps to be followed to achieve the objective of increasing the level of service.

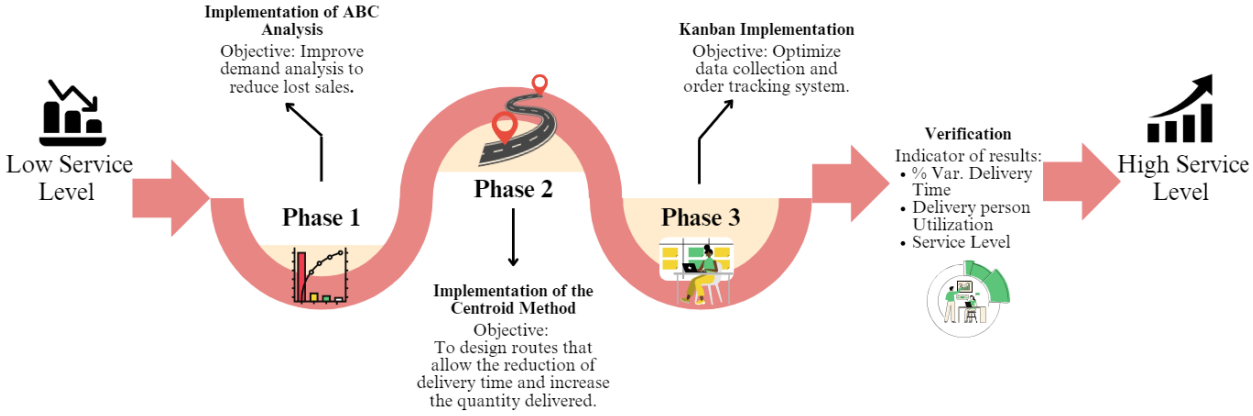

Figure 1. Proposed model for service level improvement

3.1.1 Phase 01 – Application of ABC Analysis

The ABC Analysis is a process that aims to divide the items or products into three classes, according to monetary value or consumption, therefore, this method is equivalent to the creation of a Pareto chart (Carro Gonzalo 2012, as cited in Pérez and Wong 2018).

In this case, a good classification of the products will allow the company to place the necessary number of orders for each type of production line or to have an inventory back-up according to its demand, without exceed the production.

3.1.2 Phase 02 – Implementation of Centroid Method

The study conducted to locate a new distribution center uses the Centroid Method to find the best option to locate in a geographic area that will save on supply chain costs; this research showed that the good location generates a decrease in routes (Guamán and Moyano 2020).

© IEOM Society International

Therefore, this method is used to visualize the order points, establish an appropriate routing for the delivery drivers, which will allow them to reach the destination more quickly. This will lead to a reduction in delivery times and lower transportation costs.

3.1.3 Phase 03 – Kanban Implementation

The Kanban tool is used under the Just-in-Time philosophy, it can be used as an inventory policy by defining what needs to be delivered to the customer (Hasani and Hessameddin 2019), also allows to achieve better flexibility in the execution of delivery orders (Tomaszewska 2023).
In this case, Kanban will allow us to perform a better follow-up of the activities, managing to organize the orders to achieve a reduction in delivery times and costs related to inventory and distribution of the product. This will be achieved based on 3 steps: determination of tasks and people in charge, assignment of orders and delivery times, and training of collaborators for the continuous of the implementation of the tool.

3.2 Indicators

The indicators allow for reviewing the progress that has been achieved; therefore, after the implementation of the tools, it is desired to compare the current situation with the final one in order to review the results and establish a conclusion regarding the proposed model. For this purpose, 4 main indicators have been determined:

Variation in the delivery time: Allows measuring the time the delivery man takes to complete all the orders. Currently we have 14.6 hours, and we plan to decrease 30% in the implemented trip, that is approximately 10.2 hours.

$$Var.delivery\ time = 1 - \frac{New\ route\ time}{Initial\ route\ time}$$

%Delivery man utilization: Will help to know if the total hours paid for are being used. Currently, the delivery driver spends 88% of his time on company deliveries and 12% on other orders. With the implementation of the new routes, it is desired to increase utilization from 95%.

$$\%Delivery\ person\ utilization = \frac{Number\ of\ hours\ used}{Number\ of\ hours\ available} x\ 100$$

Service Level (SL): Allows us to measure the percentage of the company's order delivery performance that meets its expectations. The aim is to increase the service level to 92%.

$$SL = 1 - OOT\% - LS\%$$

Where OOT% is the percentage of the Out Of Time orders that means the orders, they couldn't delivery on schedule, and LS is the percentage of Loss of Sales that is the requirement that the company couldn't attend.

4. Data Collection

4.1 Initial Diagnosis

The study is set in a SME in coffee industry. With the collected data, it was found that in the last 6 months, the service level had decreased, averaging 79%.

To identify the causes, an analysis was first conducted using VSM to observe the supply chain and production process as its shown in Figure 2. Focusing on delivery time, the company only allows two days for order fulfillment, and after measuring times, it was observed that it takes them 14.6 hours to process 50 orders.

© IEOM Society International

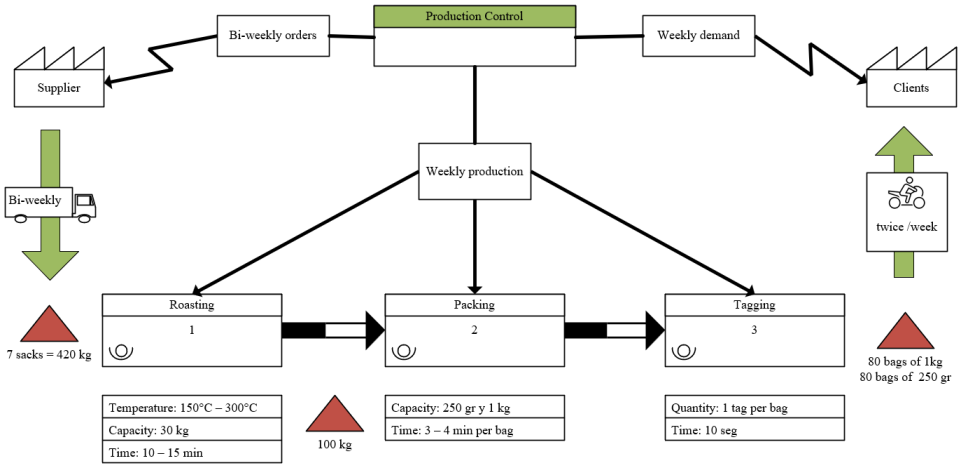

Figure 2. VSM in a coffee-producing company

When investigating the company's supply chain, it was found that main problems in process were the loss of time in order delivery (84.5%) and the limited flexibility to receive orders (15.5%) as is shown in Figure 3 as a problem tree to summarize the diagnosis.

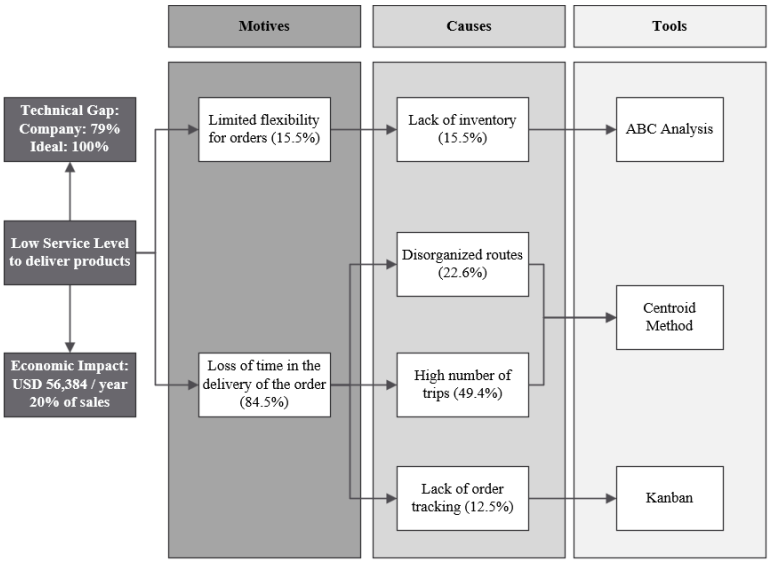

Figure 3. Problem and Causes Tree

In the last 6 months, its service level had dropped from 86% to 67%, mainly because of late orders and lost sales, which caused an economic impact of approximately USD 56,400.

A detailed root cause analysis showed that they did not have a good system for receiving and tracking orders, because of this, contacting the customer to receive the order took 11 minutes approximately, causing delays for other orders. On the other hand, the lack of organization of the delivery man and the continuous detours caused delays in delivery, taking more than 7.3 hours per day to deliver only 25 orders. Finally, the lack of knowledge of the client's behaviour did not allow the company to foresee the products and have a faster response to their needs.

4.2 Validation Design

As phase 1, the ABC Analysis was performed to determine the most demanded products and guide the company to produce according to the customer's needs and in turn increase the company's sales. In phase 2, the design of routes

© IEOM Society International

is studied based on the Centroid Method to organize the delivery points, optimize times and distances; additionally; a new distribution point is proposed with the help of Solver. Then, in phase 3, a Kanban card model is presented that allows to have all the information of the requirement at hand and with which the follow-up can be easily done. Finally, a one-week pilot (2 days in which deliveries are made), where Google Maps was used to interact and review the time it takes per route. In addition, the time the customer takes to receive the order was taken to compare it with the initial scenario. The aim is to obtain accurate data on the operation of the tools.

4.3 Improvement: Pilot

Phase 1 was carried out with the ABC Analysis shown in Figure 4, where it was found that most of its customers opted for the same products found in family A: "Smokers Only", "Dark Side", "Taita" and "Geisha", so it was recommended to the company to focus on producing a safety stock of these products in order to have stock to meet the changing needs of the sector, consequently it would increase sales. In relation to family B: "Ratio/Cold Brew", "Curibamba" and "SID" are almost as important as family A, so it is suggested that based on advertising and giving away trials of these products, the production of these lines should be promoted to arouse the interest of consumers.

In addition, it was found that only 4 kg of "Oliver Twist" were sold, which indicates that it is not a very profitable product for the company, so it is advisable to evaluate the production of coffees that are little consumed and thus reduce production costs.

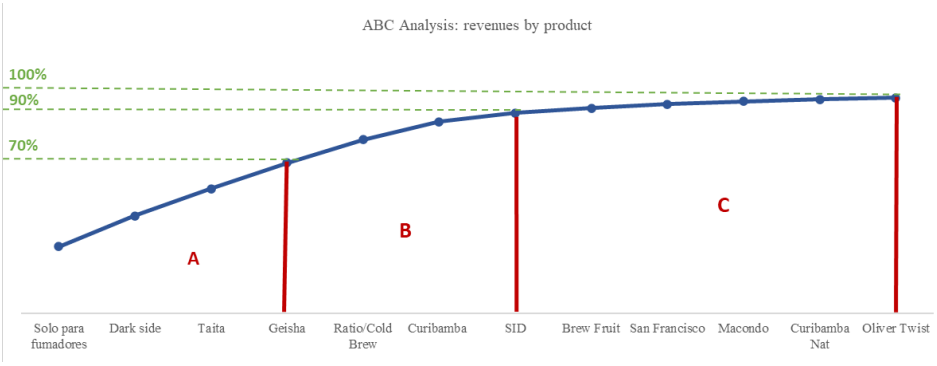

Figure 4. ABC Analysis of revenues by product

In phase 2, the Centroid Method was used and the best way to reach customers faster was analysed. Calculation took into consideration the number of delivery points, their location, the distance from one point to another, the capacity of the backpack (20 kg), the speed of the motorcycle, which was 30 km/h, and the waiting time for the customer to receive the product.

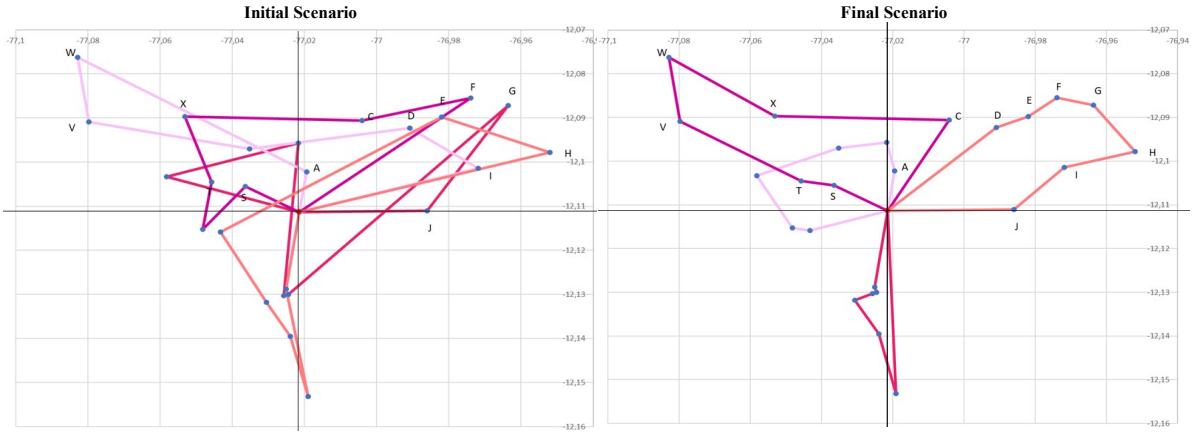

Figure 5. Use of the Centroid Method for route organization

© IEOM Society International

In Figure 5, the initial scenario shows the delivery man's routes, which were disorganized due to continuous deviations to attend to orders outside the company. It took him almost 6.9 hours to finish 25 orders, which caused complaints from other customers who did not receive their orders on time; but in a real scenario the delivery man actually took 7.3 hours to finish. On the other hand, the final scenario, shows the same routes taken by the delivery driver, but organized using the Centroid Method. The 4 routes to 25 destinations are travelled in 3.82 hours, which is 46% less than the initial scenario.

After the method was applied, a two-day pilot was carried out to evaluate the tracking of the proposed route shown in Figure 6. As can be seen, in one day the motorized vehicle covered 25 points in 4.2 hours with the maximum capacity of the backpack, which prevents to redirect to other locations to attend other orders.

This means that applying the method has a margin of error of 10.5%, due to different aspects such as the time of delivery, traffic or detours due to accidents, public works, among other reasons; in addition, it should be considered that the application of the method involves straight lines, which does not occur in a real scenario.

Taking only one day of implementation, great improvements were noted, since initially the delivery man took 7.5 hours to deliver the order, while on the first day of the application of the method, 3.2 hours were reduced. this time can be used to deliver other deliveries to use 100% of the delivery man's time.

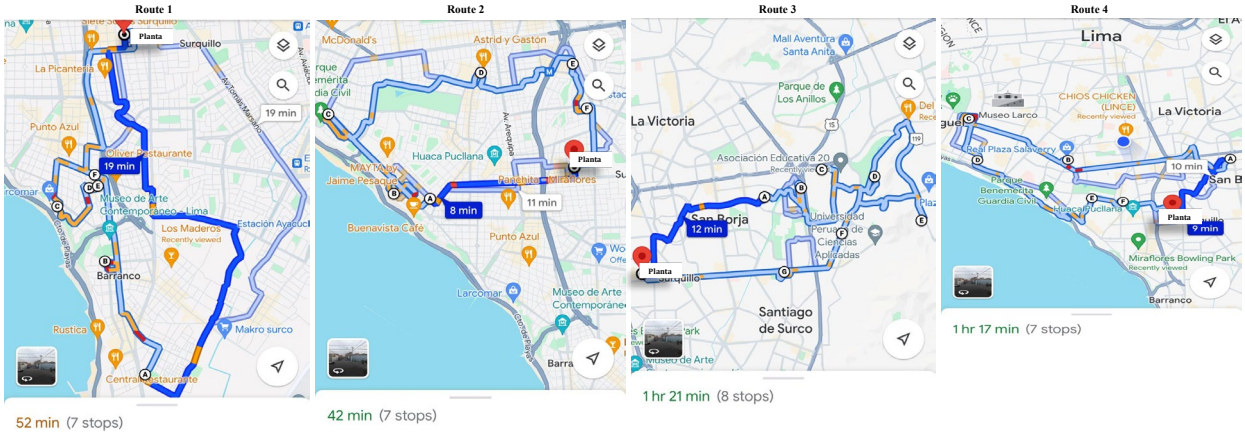

Figure 6. Pilot for route design evaluation

Table 2 shows the 2 scenarios with the same routes, number of orders delivered in a day and the speed of the motorized vehicle.

The first, is about the routes that the company uses. In the absence of a route plan, the delivery driver travels 112.9 kilometers to deliver 40 kilograms in 6.9 hours.

Seconly it is the route proposal, which was improved by allowing the delivery driver to deliver two-day orders in one day. By the same routes he travels 63 kilometers in a time of 3.83 hours for twice the amount of roasted coffee (80 kg). About times previously found, the scenario of the proposed routes was analyzed. The total time per route allows the company to have 35.0% more time to make new routes in a day. In addition, by applying this method, the company has a reduction of 3.0% to 0.5% of transportation costs over sales.

© IEOM Society International

Tabla 2. Initial Scenario vs Final Scenario after applying a route design

Route	Scenarios			
	Initial		Final	
	Km	T (h)	Km	T (h)
1	43.3	1.85	21.7	0.97
2	26.5	1.75	6.7	0.57
3	20.1	1.50	17.8	1.33
4	23.0	1.66	16.8	0.96
Total	**112.9**	**6.76**	**63.0**	**3.83**

Subsequetly, in phase 3, a Kanban card model was designed (Figure 7) and a dashboard was prepared to locate the card as "requirement", "preparation", "waiting" and "delivery". In addition, a person was assigned to move the card according to the status of the order, making it easily to follow for the next step.

Order Description				Order ID	
N° Kanban Card					
Amount		Date of order		Process start date	
Client	Name			Process end date	
	Contact Number			Delivery Date	
	Adress			Lead Time	

Figure 7. Kanban card template for order tracking

After a short training session for the employees, we proceeded with a one-week pilot to evaluate the results. In the 25 trips made by the delivery driver, there was only one point where it took 5 minutes for the customer to receive the order, that is 58% less than in the initial scenario. Table 3 shows the time study that was carried out, the use of Kanban dropped the time from 97 to 55 minutes.

Table 3. Time to deliver the product to the customer

Delivery time (minutes)	
Initial	Current
97.1	54.5

Finally, the project was evaluated by an investment of USD 14,207 to correct the economic impact in one year, having a linear income in the 4 two-month periods and an Opportunity Cost of 11.83%, resulting in an NPV (Net Present Value) of USD 27,330, an IRR (Internal Rate of Return) of 88.3% and a B/C (Benefit/Cost) of USD 2.93, demonstrating that it is a profitable project for the company. In addition, after analysing a pessimistic scenario, where the income only increases 1% per two-month period and the budget exceeds 10%, the NPV is positive at USD 27,170 as is shown in Figure 8.

© IEOM Society International

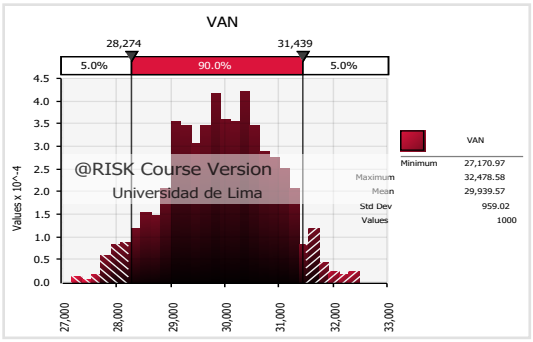

Figure 8. Net Present Value with the simulation in @RISK

5. Results and Discussion

After reviewing the results, it was observed that the project is feasible as it allows saving money and time with minimal investment. As shown in Table 4, the implementation of the model not only achieved the proposed goal but exceeded it, providing the company with a better level of service by reducing delivery times and minimizing customer loss.

Table 4. Main indicators before and after the implementation of the model

Indicators	**Initial**	**Implementation**	**Variation (Esc_1 vs Esc_0)**	**Goal**
Delivery Time	13.8 hours	8.4 hours	-39.1%	9.7 hours
Delivery person utilization	88.0%	100.0%	12.0%	95.0%
Service Level	78.7%	93.8%	15.1%	92.0%

From the literature review, similarities have been found in the solutions used in this article with other case studies in companies from different sectors.

One of them is the implementation of the Centroid Method, as an objective was intended to reduce the number of routes per day to execute this method, but in this case only managed to optimize the routes and distribution time by one of them, which allows to increase more routes per day; in addition, by indications of the top management of the company to the motorized, is strictly authorized to carry products of the company, which allows it to be used at 100% of the capacity of the backpack of the distributed. Unlike Islam and Arakawa, by employing this method with an unstable demand, they were able to improve their distribution routes, which in turn allowed them to optimize the capacity of the load in their truck (Islam and Arakawa 2021).

When developing the proposal, as a result of using the Kanban tool as a solution to the lack of follow-up to the orders, optimistic results were obtained with respect to the delivery time of orders in 43.8% by a follow-up of these with the end users who purchased the product.

On the other hand, when the ABC Analysis was applied, it was concluded that the first 4 products in the production line account for 70% of the company's income, so it can be deduced that these are the products with the highest turnover. For the case study of inventory redistribution applying the ABC classification, carried out by the authors Flores, Cota and Medina, it was possible to coincide with the authors of this study, since upon applying it they identified which products have the highest weekly turnover and, unlike the present work, they calculated that the turnover increased by 39.92 units (Flores et al. 2023).

It is also advisable to use the radial and Euclidean method to have a better control of transportation costs from one point to another. This method consists of tracing radius from the distribution center to the dispatch points, which can be calculated from one point to the other in a straight line to calculate the transportation cost. It is also necessary to consider a design that takes into account the hourly windows or vehicle management time. On the other hand, one of

© IEOM Society International

the limitations when solving the order tracking was that they did not have registered customer data, so it is recommended to use a CRM software (Customer Relationship Management) to have knowledge about the customer.

6. Conclusions

The use of three engineering tools has achieved a significant improvement in the company studied, especially by reducing delivery time, allowing for a better customer experience. The design of routes accompanied with Kanban has resulted in the reduction of time; firstly, it was achieved that the delivery driver can make all deliveries in a single day, achieving a utilization of 100% of his time, on the other hand, keeping track of the order and coordinating with the customer prior to delivery, allowed the waiting time to contact the customer to reduce from 12 to 5 minutes maximum, allowing the delivery driver to make the next delivery more promptly. In addition, the Centroid Method set routes for the delivery driver to follow, thus achieving a 39% reduction in the initial time. On the other hand, the use of ABC Analysis helped to review the products that were most popular with customers, reducing lost sales from 1.3% to 0.9% in just two weeks. All these improvements managed to increase the service level to 93.8%, which is 15% higher than the initial scenario, significantly improving the company's efficiency. In addition, Kanban has been used in another area to promote the organization of tasks, with equally positive results.

References

Castellano, L., Kanban. Metodología para aumentar la eficiencia de los procesos. *3C Tecnología*, 8(1), 30-40, 2019. https://doi.org/10.17993/3ctecno/2019.v8n1e29/30-41

Carro, R., and Gonzales, D, *Localización de instalaciones*, 2012. http://nulan.mdp.edu.ar/id/eprint/1619/1/14_localizacion_instalaciones.pdf

Chiang, T.A., Che, Z.H., Lee, C.H., and Liang, W.C., Applying Clustering Methods to Develop an Optimal Storage Location Planning-Based Consolidated Picking Methodology for Driving the Smart Manufacturing of Wireless Modules. *Applied Sciences*. 11(21), 9895, 2021. https://doi.org/10.3390/app11219895

Daza, C. M., and Rafael, S. L., Técnicas de gestión de inventarios y su influencia en los costos operativos de las empresas: una revisión de la literatura científica en el periodo 2010-2020 (Trabajo de investigación). Repositorio de la Universidad Privada del Norte, 2020. Recuperado de https://hdl.handle.net/11537/25654

Flores Gutiérrez, X. P., Cota Pardini, Y. B., and Loredo Medina, R., Redistribución de inventario con base en clasificación ABC para mejorar el flujo de materiales en una empresa productora de alimentos en Sinaloa, México. *Ingeniería Industrial,* 44(44), 65-80, 2023. https://doi.org/10.26439/ing.ind2023.n44.6244

Gestión, Perú en el top diez de productores de café arábico a nivel mundial: ¿qué puesto ocupa?, 2023. https://gestion.pe/peru/peru-en-el-top-diez-de-productores-de-cafe-arabico-a-nivel-mundial-que-puesto-ocupa-noticia/#google_vignette

Goulart Pinheiro, N., Cleto, M. G., Zattar, I. C., and Muller, S., Performance evaluation of pulled, pushed an hybrid production through simulation: A case study. *Brazilian Journal of Operations & Production Management*, 6(4), 685 – 697, 2019. https://doi.org/10.14488/BJOPM.2019.v16.n4.a13

Guamán, A., Miño, G., and Moyano, J., Aplicación de algoritmos de optimización para la localización de centros de distribución comercial. *ECA Sinergia*, 11(1), 7-18, 2020. https://doi.org/10.33936/eca_sinergia.v11i1.1097

Hasani, A., and Hessameddin, S., Vehicle routing problem in a Kanban controlled supply chain system considering cross-docking strategy. *Operational Research*,20 (2020), 2397–2425, 2018. https://doi.org/10.1007/s12351-018-0421-2

Islam, M.M., and Arakawa, M., Rolling planning method for two-stage logistics system under unsteady demand. *Journal of Advanced Mechanical Design, Systems, and Manufacturing,* 3(3), 2021. https://doi.org/10.1299/jamdsm.2021jamdsm0030

Koohathongsumrit, N., and Chankham, W., A hybrid approach of fuzzy risk assessment-based incenter of centroid and MCDM methods for multimodal transportation route selection. *Cogent Engineering,* 9(1), 2022. https://doi-org.ezproxy.ulima.edu.pe/10.1080/23311916.2022.2091672

Macías Acosta, R., León Resendiz, A., and Limón Lozano, C. I., Análisis de la cadena de suministro por clasificación ABC: el caso de una empresa mexicana. *Revista Academia & Negocios*, 4(2), 83-94, 2019. https://www.redalyc.org/articulo.oa?id=560859050001

Subhashree, S.N., Igathinathan, C., Bora, G., Ripplinger, D., and Backer, L., Optimized location of biomass bales stack for efficient logistics. *Biomass and Bioenergy*, 29 (2017), 130-140, 2017. http://dx.doi.org/10.1016/j.biombioe.2016.11.007

Tomaszewsk, K., Comparative Simulation of the Production Flow with the Implementation of Kanban and DBR. Management and Production Engineering, 14(2), 79-87, 2023. https://doi.org/10.24425/mper.2023.146025

© IEOM Society International

Tongguang, S., Hong, X.L., Zhen L., H, L., and SangHyeok H., A Dynamic Just-in-Time Component Delivery Framework for Off-Site Construction. *Advances in Civil Engineering*, vol. 2021, Article ID 9953732, 19 pages, 2021 https://doi.org/10.1155/2021/9953732

Weflen, E., MacKenzie, C. A., and Rivero, I. V., An influence diagram approach to automating lead time estimation in Agile Kanban project management. *Expert Systems With Applications*, 187, 2022. https://doi.org/10.1016/j.eswa.2021.115866

Biographies

Fiorella Pinedo is a Bachelor of Industrial Engineering from the University of Lima. She currently works as a Financial Planning and Management Control Analyst.

Gabriela Santillana is graduate in Industrial Engineering from the University of Lima. She currently works as a professional intern in Human Resources and Commercial.

Alberto Flores-Pérez holds a doctorate degree in Education from Universidad de San Martin de Porres. Master's degree in Supply Chain Management from Universidad ESAN. Engineer in Food Industries from Universidad Nacional Agraria La Molina. Currently working as an undergraduate professor at Universidad de Lima and postgraduate professor at Universidad Nacional Agraria. Professional, consultant, businessman, and professor with more than 27 years of experience in project implementation, quality management, safety, and agro-industrial plant management. Expert in Supply Chain (supplier management, storage systems, transport modeling, and distribution systems), Supply Chain, and Operations. Specialization in integrated management system audit and Shortsea Logistics at the Escola Europea Short Sea Shipping. Leader of transformational projects, productivity, and change generator. Specialist in the implementation of Continuing Improvement Projects, PDCA, HACCP, BPM in the agro-industrial sector, trainer of national government institutions and the United Nations (UNDP). Development of a highperformance team. Member of IEEE, SCEA Ohio, IOEM, and CIP (College of Engineers of Peru).

© IEOM Society International