

Design of Inventory Management System for La Teacia Artisan Milktea Business

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Abstract. With the continuous growth of the Milktea industry, new competitors appear every time. La Teacia Artisan Milktea offers various Milktea flavors and additional menus that attract customers. With the high demand and the low supply for certain products that have been overlooked, it results in opportunity loss. The researchers proposed and designed an inventory management system called \mathcal{A} system. The system allows users to create, add, subtract, and display supplies and have access to reports such as daily, weekly, and monthly reports. \mathcal{A} system improved the efficiency, lead time, and productivity of the ordering of supplies process of La Teacia Artisan Milktea that can eliminate the opportunity cost and improve customer satisfaction.

Keywords: Inventory management system, business process Re-engineering, empathy

1. Introduction

The famous tea drink with added milk and pearls, commonly known as milk tea, has successfully captured the attention of the Filipinos, especially the young generations. The continuously increasing number of people who love tea drinks has resulted in numerous milk tea shops that keep on popping up with their own menus. La Teacia Artisan Milktea is a physical store that is handled by the owner, who oversees the work of their employees, employees who are assigned to do the job inside the store, and employees who are assigned in the delivery of the orders. The store focuses on making unique flavored drinks at a very affordable price. The customers can send their orders through the official Facebook page, walk-in, and Grab application. As the business started only months ago, they have encountered different problems in terms of their customer service and administrative security. The problems of the business are the following: mistakes in bulk orders because of the manual listing of orders, long waiting time of delivery if there are numerous orders at the same time, unauthorized changes in the record book.

2. Review of Related Studies

2.1. Review of Related Literature

Business Process Reengineering (BPR) as a tool that organizations can use to improve their quality, customer services, cut operational costs, and become leaders in their industry. BPR could also be utilized as a strategic tool to gain sustained competitive advantage in a certain field against foreign companies, whether public or private. In short, it focuses on changing existing business processes. Oftentimes, it is used by companies on the brink of disaster to cut costs and return to profitability. Hence, BPR is not easy as it may compromise a company's competitiveness and capacity as it bets on its future growth. Thus, undertaking strategic initiatives before performing reengineering can greatly help outweigh the cons of BPR. Such initiatives include providing understanding of the markets, their competitors, and the position of the organization within the industry. Moreover, for business process reengineering to be successful, it needs to be top down, meaning it needs to take the complete organization as well as the complete end to end processes. Finally, it needs to be supported by certain tools to alleviate the hardships in performing the reengineering process and for easy tracking and analysis of such processes [5].

2.2. Review of Related Systems

The traditional way of managing inventory has many shortcomings like low efficiency, poor security, and over the time, it will produce a large number of files and data causing a problem in finding, updating and maintenance. Thus, inventory management system is essential and will provide users with adequate information in the inventory. The system will provide data on organization summary statistics and storage, breakdown of inventory items, accounting to month, quarter, year and etc., and can query inventory of a variety of information conveniently and fast [11].

Inventory is one of the primary parts of an organization's operation since it makes a record of commercial and productive activities. It must provide a way to prevent excess product supply that can cost the company a large sum of money and avoid shortage in supply. This system is designed for small and medium enterprises in which Information and communication technologies (ICT) were adapted, this will work as an effective solution that does not require training to be used and answers to the needs of current technology at low cost [3].

An inventory management system has their specific features that will help an organization to keep track of their stocks to be able to meet the demand of the customers and to avoid the loss of expense because of the overstocks. This involves organizing, analyzing, managing the inventory data of a business. Next, cycle counting, receiving automated prompts that count the inventory in order to establish the safety of the stock levels. And, the display of the availability of the items on the website, this is to reflect the availability of the items on the different online platforms of the store [1].

Denaks Frozen Foods is a start-up business which provides their customers with frozen food. The business is composed of four working staff excluding the owner, two sales people and two butchers. The company is not effective and efficient in tracking and monitoring their stock. The proposed software is Orderly POS that has relevant management features they need which allows them to monitor the inventory, the use of bar code scanner in counting products, and signals them when there is a low stock in their inventory [4].

Paper aims to replace manual inventory management in one of the oldest retail stores in their area with a computer-based system of inventory management. It is a window-based system with a friendly user interface for no IT background staff. The system has features of Database of sales, generates a daily and weekly report of the stores inventory, Quality control to check inventories expiration dates, and points of sales that records transactions with customers. The template is used to format your paper and style the text [8].

Delays in the delivery of raw materials can cause negative feedbacks and negative customer relationships because the orders cannot be fulfilled. With improved or better inventory management this will result to positive feedbacks and positive customer relationships. Inventory management includes forecasting that will most likely increase the chances of fulfilling the customers' requirements [6].

The existing inventory management is time consuming, very tedious, information is separated, a lot of paperwork that has to be accomplished, slow data processing, not user-friendly system. Another main problem that the current inventory system is historical data is not maintained, which is used in the estimating the requirements for raw materials. The researchers implemented an inventory management system that tracks the current stocks of the business, assists in purchasing and receiving, manage inventory in retail locations, and many more [10].

Inventory management is essential to businesses that make use of inventories because this can control the current situation of the business and decrease their costs. Inventory management avoids out of stock situations and overstock situations. The study analyzed an existing inventory management to decrease the costs of the business because of overstocking. The recommendations of the research are forecast demand, have safety stocks, and identify a reordering point [2].

Out of stock and over stock situations is an unpredictable issue for the business because of the lack of an effective inventory management. One of the causes of this is because they are still new in the industry and the manager of the business still cannot read the demand of the market which is

needed for forecasting. To avoid the out-of-stock situations the business should have safety stocks and determine the ROP (Re-Ordering Point). For the overstocking situations, the business should control their costs [9].

3. Methodology

Firstly, the background and the state of the company is analyzed. Organizational structure and 7's analysis were used for this analysis. Organizational structure was used to be able to determine the roles and responsibility of each individual department. 7's analysis, used to determine the elements of the company. Moreover, SWOT analysis is conducted to assess La Teacia's internal understanding of its business's various advantages and disadvantages. In the analysis, the processes inside the company were identified and how this can be an edge or a weakness to the company, the researchers also identified the possible strategies that the business can improve on. Inventory management system, Business Website, Franchising, and Partnering with Popular Influencers are the recommendations of the researcher based on the SWOT analysis. Additional analysis was used in deciding which project would be more beneficial for the company. Why-why diagram is the first analysis tool that is used to be able to pinpoint the root cost of the company's problem. The next analysis that was used is the Empathy map to determine how the customer reacts to the company. The last was the decision analysis and it is used to determine which of the following projects that was recommended by the researcher is the most beneficial for the company in its current situation. BPMN and process charts were used to map the current process to identify the pain points and determine the value-added and non-value added activities of the process. With the analysis conducted, the researchers mapped a proposed BPMN and process chart to differentiate the efficiency and productivity of the current and proposed processes.

4. Selection of Business Processes for REDESIGN

4.1. SWOT Analysis Mind Mapping

As seen in Figure 1, the reserachers recommend 4 projects. First is the inventory management system, looking at the business's current situation, specifically their inventory department, they only check inventory levels once a week which makes their information about their inventory not updated. They also don't have information on how much of each supply they consume daily or weekly. The inventory management system can store and update their inventory levels. Additionally, this provides the business' reports that will help them understand how many supplies are they consuming, this can also be a basis if their sales are going up because of the supplies they are consuming on a day-to-day basis. Ultimately, this helps the business reduce missed sales with optimal inventory levels.

Second is a business website, analyzing the current situation of the business, the business needs to gain more customers and increase their online exposure, thus a business website is needed. A business website will also give the business more freedom to present their products and services. The business website can be used as a platform where they can interact with their customers. They can share the information of the business such as day to day updates, menus, promos, and other services. Aside from customer interaction, this website will serve as their marketing strategy and increased online exposure to attract potential customers.

Third is a franchising, since the business is looking to expand and grow in the next few years, franchising the business would be a good next step for La Teacia. Most of the time, businesses in the milk tea market achieve more success with their brands being franchised. With the business being franchised, delivery delays would also be reduced along with the long waiting times.

Lastly, partnering with famous influencers, La Teacia eyes to improve its marketing strategy. While posting and paying for paid advertisements on Facebook are good business strategies, the business might see higher marketing boosts if they collaborate or form partnerships with local public figures and famous influencers. Sponsoring for some of the YouTube videos and Instagram posts of partner influencers might greatly increase the exposure of La Teacia's products.

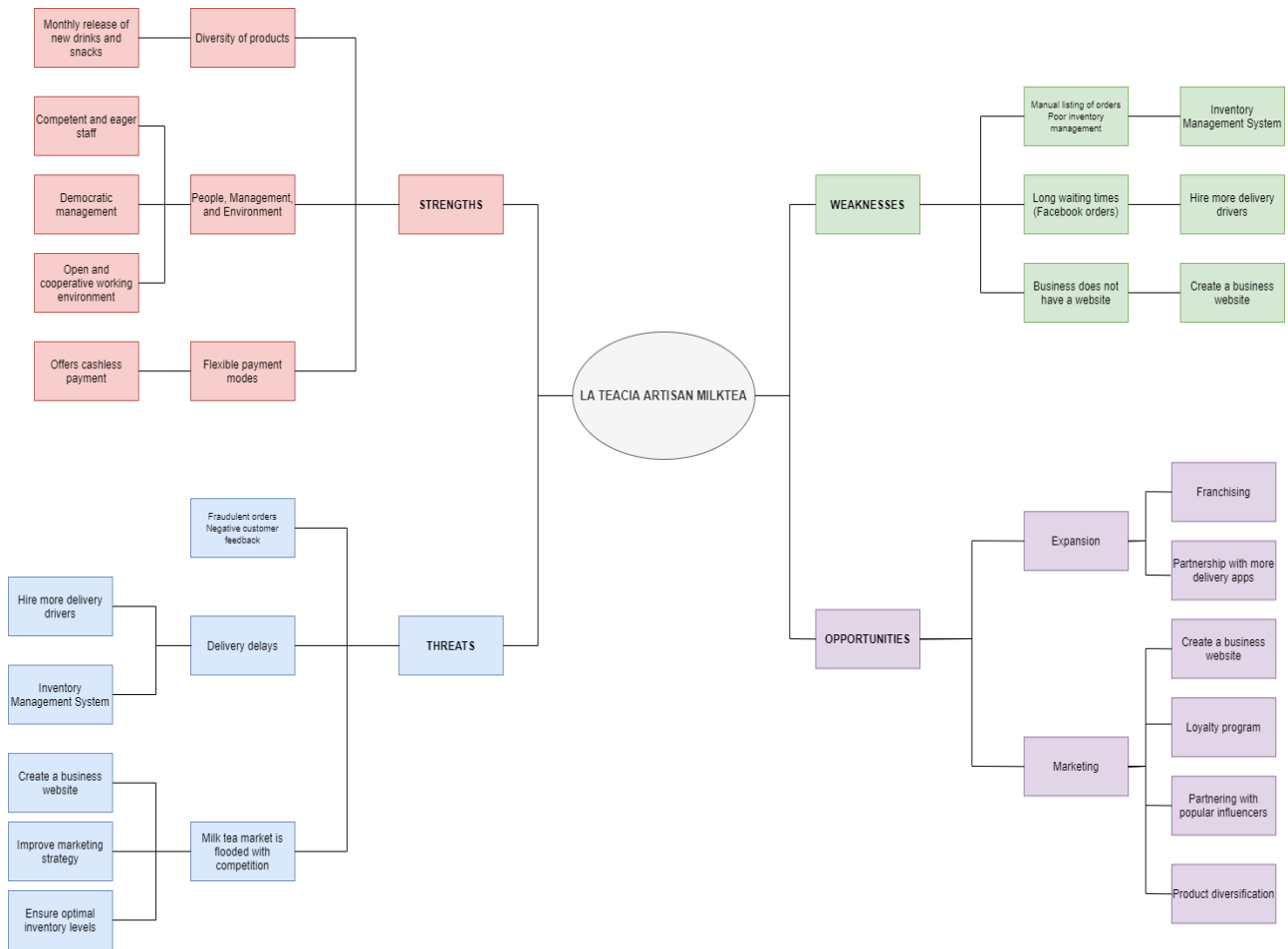


Fig. 1. SWOT Analysis of La Teacia Artisan Milktea

4.2. Design Thinking Empathy Phase

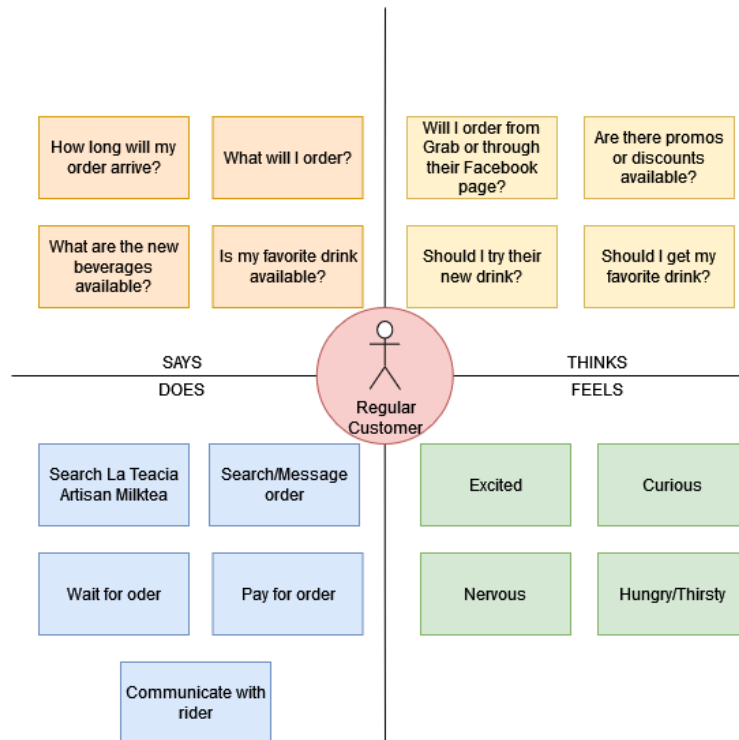


Fig. 2. Empathy Map of a Regular Customer of La Teacia Artisan Milktea

4.3. Root Cause Analysis

In Fig. 3, why-why diagram was utilized to identify the root cause of the opportunity cost problem, this is caused by having lesser customers buying the business' products. The cause of this is having unsatisfied customers. Unsatisfied customers can be caused by product was delivered late or there are certain products that are unavailable. Focusing on the late deliveries of the products, this can be caused by the distance between the store and the customer and traffic on the way or the preparation of drinks took too much time. Many orders piled up is one of the causes of the lengthy preparation and the materials needed for the preparation of the products were not available for both the lengthy preparation and certain products unavailable. The root cause of this is the materials needed for the preparation of the business' products were not available.

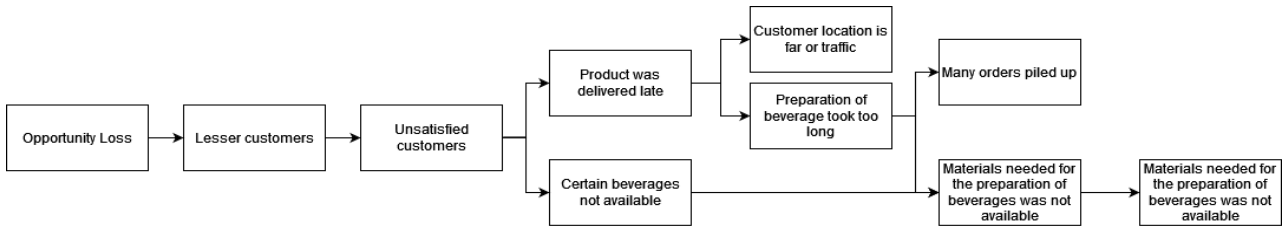


Fig. 3. Root cause analysis of La Teacia Artisan Milktea (why-why diagram)

5. Business Process Analysis

5.1. Current Process (BPMN and Process Chart)

As seen in Fig. 4, the warehouse department first manually checks if the supply is still enough. If the supply is still enough it goes straight to preparation. If not, the warehouse department signals the purchasing to purchase supply. The purchasing department requests for the supply to the supplier. If the supplier has everything the business needs, then the finance department would pay for everything and request for delivery. If the supplier does not have all the requested supply the financing department purchases the available items with the supplier, then the purchasing department requests for the remaining items to a different supplier. The logistic department then receives the package and unpack and send the package that would be used by the preparation department. Once the supply reaches the preparation department. They prepare the supply that they would be needing for the day and everything else before the opening of the company.

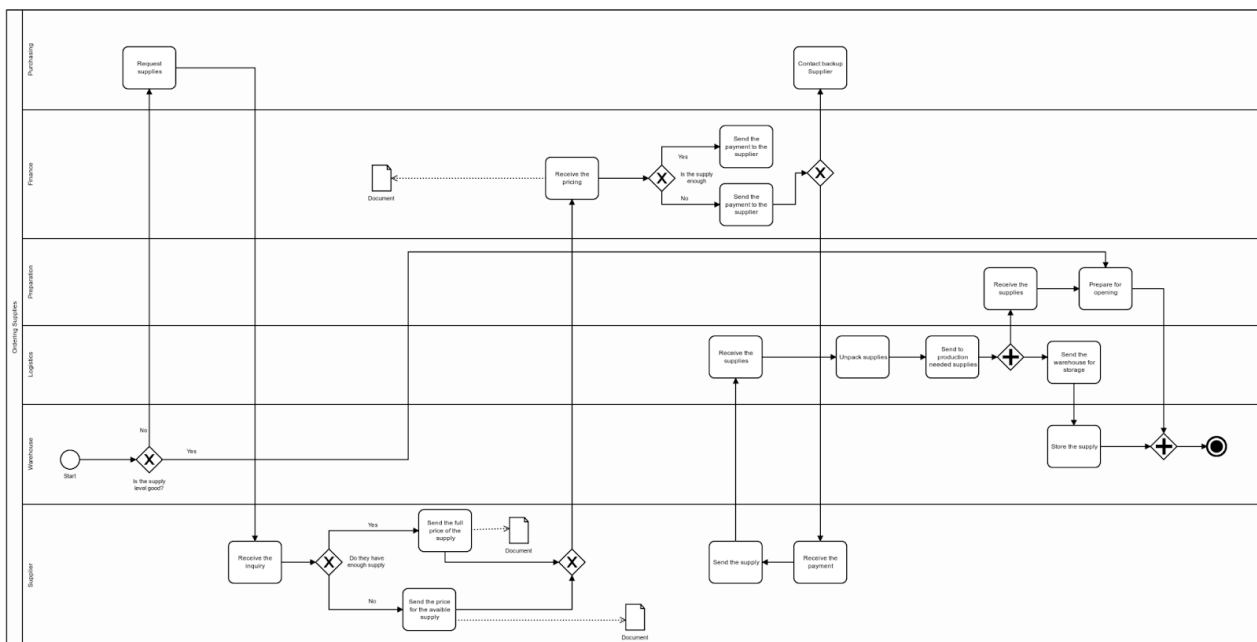


Fig. 4. Current BPMN of La Teacia Artisan Milktea

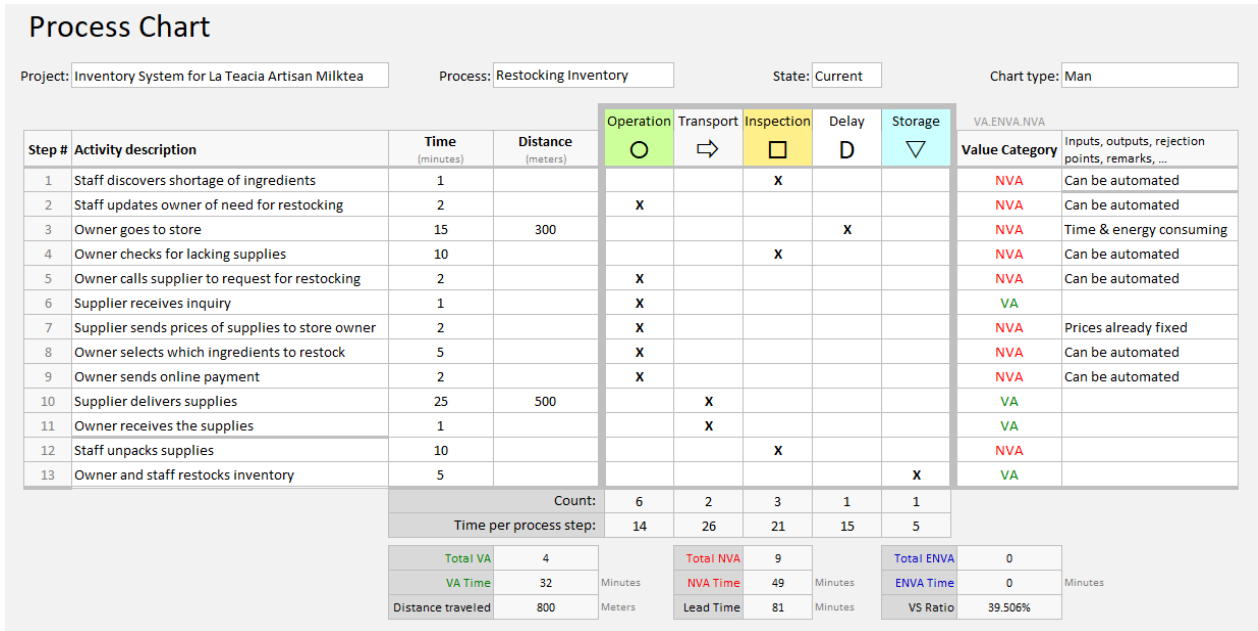


Fig. 5. Current Process Chart of La Teacia Artisan Milktea

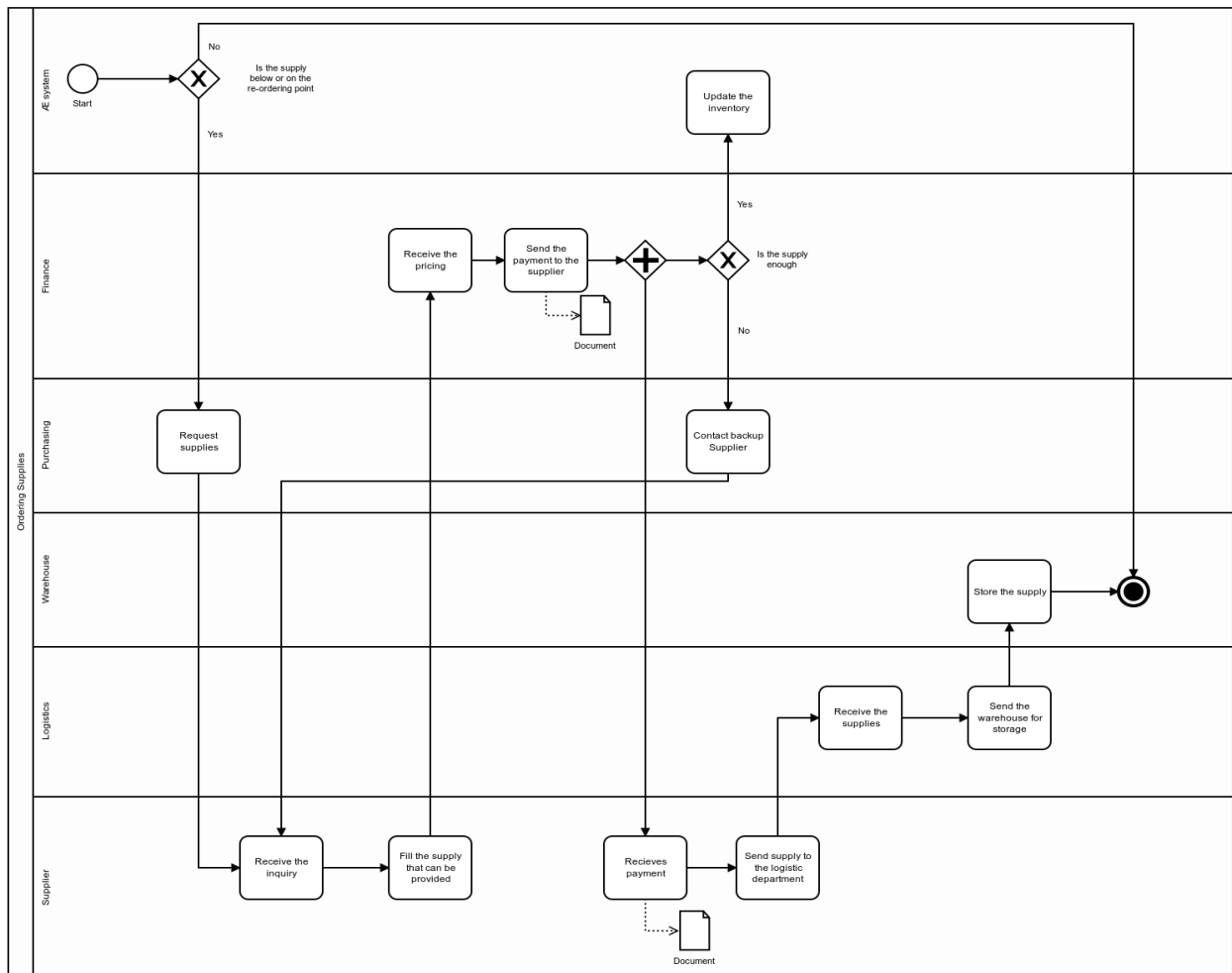


Fig. 6. Improved BPMN of La Teacia Artisan Milktea

As seen in Figure 5, the process of restocking the inventory of La Teacia Artisan Milktea starts when the staff discovers the shortage of some ingredients for their beverages. The owner will have to send the request to the supplier and as the supplier receives the request, they will send the total price for the items. The owner will

send the payment to the supplier and wait for the items. As the owner receives the items, he will unpack it with the staff to check if the items are complete before storing it in the shelves or storage room.

With the process of restocking the supplies of La Teacia Artisan Milktea, the non-value-added tasks (NVA) that can be identified include the staff discovering the shortage of ingredients up to the owner going to the store to check the amount of supplies himself, the supplier receiving and placing the order or inquiry, and the payment of the business owner to the supplier.

6. Business Process Redesign

6.1. Improved Process (BPMN and Process Chart)

Fig. 6 shows the improved ordering supplies process starts with the Inventory management system called *Æ*. *Æ* System checks if the supply is below or on the reordering point, if yes the Purchasing department will inquire about the supplies that are needed to the supplier, the supplier will then receive the inquiry and reply with the supplies that they can give, how many, and how much. The finance department will receive the price and pay for the supplies. If the supply isn't enough, the Purchasing department needs to contact the back up supplier and inquire about the needed supplies, the supplier will then send the supplies that can be provided and how much. The finance department will receive the price and pay for the supplies. And, if the supplies are enough the *Æ* System will update the inventory. At the same time, the supplier will receive the payment and then send the supplies purchased by the business. The Logistics department will receive the supplies and send it to the warehouse to store the supplies.

Comparing this proposed diagram to the current diagram, the number of steps decreased from 17 steps to 11 steps. The lanes also decreased from 6 lanes to 5 lanes because the inventory management system does the work of the purchasing and finance department which lessens the actors that are needed in the process.

Fig. 7 presents the improved process of restocking the inventory of La Teacia Artisan Milktea starts when the inventory system alerts the owner and staff if the supplies are below or on the ordering point. If so, the owner then contacts the supplier for restocking of the needed supplies. The supplier then receives the order and processes it. After, the owner sends the online payment to the supplier. Once the owner has paid, the orders will then be packed for delivery, and then delivered. Upon receiving the supplies, the owner or staff will store them in the storage room.

Project: Improved Inventory System for La Teacia Artisan Milktea		Process: Restocking Inventory		State: Future		Chart type: Man					
Step #	Activity description	Time (minutes)	Distance (meters)	Operation	Transport	Inspection	Delay	Storage	VA/ENVA/NVA	Value Category	Inputs, outputs, rejection points, remarks, ...
1	Inventory system alerts owner and staff of lacking supplies	1				X				VA	
2	Owner contacts supplier for restocking	2		X						VA	
3	Supplier receives inquiry	1		X						VA	
4	Supplier processes the order	5		X						VA	
5	Owner sends online payment	2		X						VA	
6	Supplier processes the payment and packs the supplies	5		X						VA	
7	Supplier delivers supplies	25	500		X					VA	
8	Owner/staff receives the supplies	1			X					VA	
9	Owner/staff stores supplies in storage room	5						X		VA	
Count:				5	2	1	0	1			
Time per process step:				15	26	1	0	5			
Total VA		9		Total NVA		0	Total ENVA		0		
VA Time		47	Minutes	NVA Time		0	Minutes	ENVA Time		0	Minutes
Distance traveled		500	Meters	Lead Time		47	Minutes	VS Ratio		100.000%	

Fig. 7. Improved Process Chart of La Teacia Artisan Milktea

Comparing both of the process charts, the current process chart has a VS Ratio of 39.506%, while the proposed has 100%. There is also a decrease in the lead time for restocking the inventory of the business from 81 minutes down to 47 minutes. Thus, it can be concluded that the proposed process chart is much more time-saving and efficient since it not only shaves off 34 minutes from the entire inventory restocking process, but it also improved efficiency by 60.494%.

6.2. Prototype

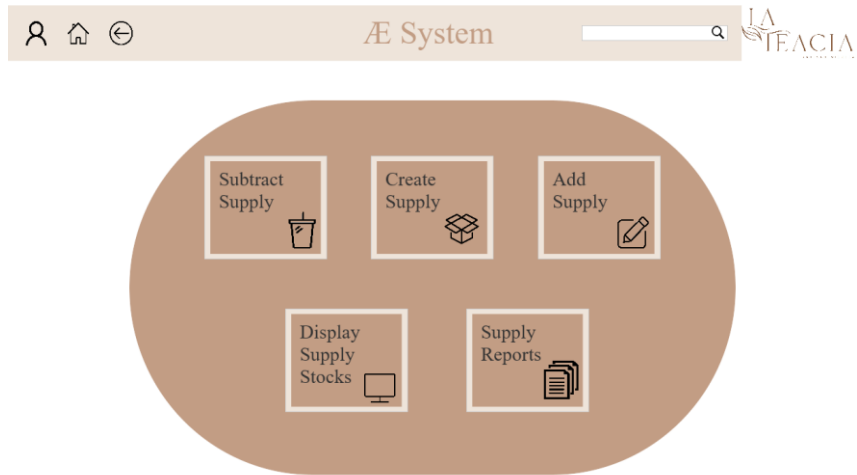


Fig. 8.Homepage of Æ System

Seen in Figure 8, there are 5 main activities that the user can do namely, Subtract Supply, Create Supply, Add Supply, Display Supply, and Supply Reports. All of the pages will have the tab at the upper part of the page that can bring them back to the Homepage and to the previous page by clicking the Home button and Back button respectively.

In Fig. 9, the user can create supplies that the business currently has or if they added an additional supply. The inputs that the system needs is the following: Name, Current Stocks, Unit of Measurement, Reordering Point, Price, Date of Last Restock, and the Supplier of the Last Restock. When the user clicks one of the two buttons at the bottom part of the page, the system will create the supplies inputted and display a confirmation message at the lower part of the screen.

Fig. 10 shows where the user can add supplies or edit the supplies. The upper half of the page can filter the supplies that will be shown by the system, this can be filtered by the Supply ID, Name, Unit, Price, Date of Last Restock, and the Supplier of Last Restock. The user can edit any of the data and add supplies if they restocked a certain supply. When the user clicks any of the two buttons at the lower part of the page, this will save all the changes that the user made and a confirmation will appear that the edited supply has been updated.

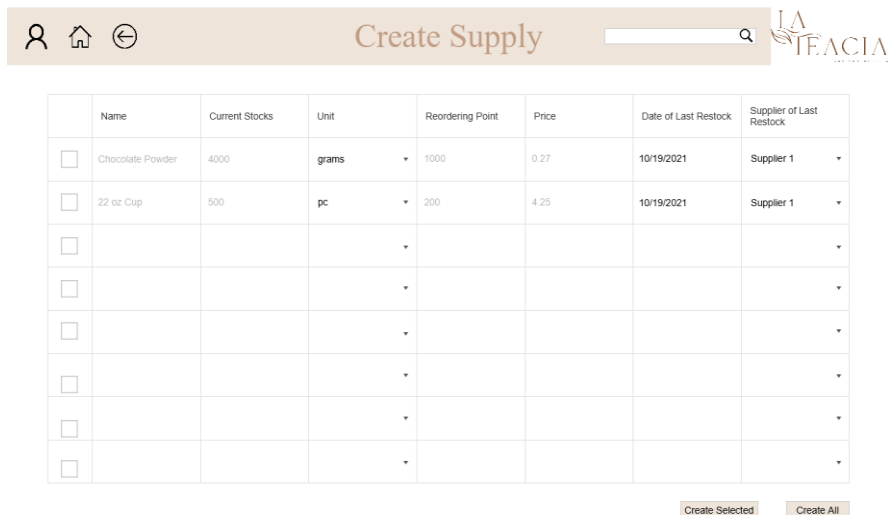


Fig. 9.Create Supply of Æ System

	Supply ID	Name	Current Stocks	Unit	Reordering Point	Price	Date of Last Restock	Supplier of Last Restock
<input type="checkbox"/>	0003	Nutella Powder	3000	grams	1000	0.27	10/12/2021	Supplier 1
<input type="checkbox"/>	0004	Chocolate Powder	4000	grams	1000	0.27	10/19/2021	Supplier 1

Fig. 10. Add Supply of Æ System

Fig. 11. Subtract Supply of Æ System

In Fig. 11, the products that La Teacia Artisan Milktea offers is displayed and when a customer orders the user clicks on the orders of the customer. A confirmation will appear at the bottom part of the page and when the user confirms the order Figure 12 will appear.

Fig. 12 displays the supplies that needs to be subtracted from the inventory per drink or order. When the user click confirm, a confirmation will appear at the lower part of the page to inform the user that the inventory has been updated.

As seen in Fig. 13, at the upper half of the page, the user can also filter the supplies by their Supply ID, Name, Unit, Price, Date of Last Restock, and the Supplier of Last Restock or display all of the supplies. The user can also arrange the supplies by their Name, Current Stocks, Price, and Date of Last Restock.

SUMMARY	
Chocolate (22oz) - 250 ml TEA - 40 grams CHOCOLATE POWDER - 30 grams CREAMER - 1 scoop ICE - 20 grams PEARLS - 3 pcs TISSUE - 1 pc SEALER - 1 pc PLASTIC - 1 pc 22OZ CUP	Nutella Lover (22oz) with Tapioca - 250 ml TEA - 40 grams NUTELLA POWDER - 30 grams CREAMER - 1 scoop ICE - 20 grams PEARLS - 3 pcs TISSUE - 1 pc SEALER - 1 pc PLASTIC - 1 pc 22OZ CUP - 2.5 grams WHITE WALLING & FINNETI

Fig. 12. Subtract Supply Confirmation of Æ System

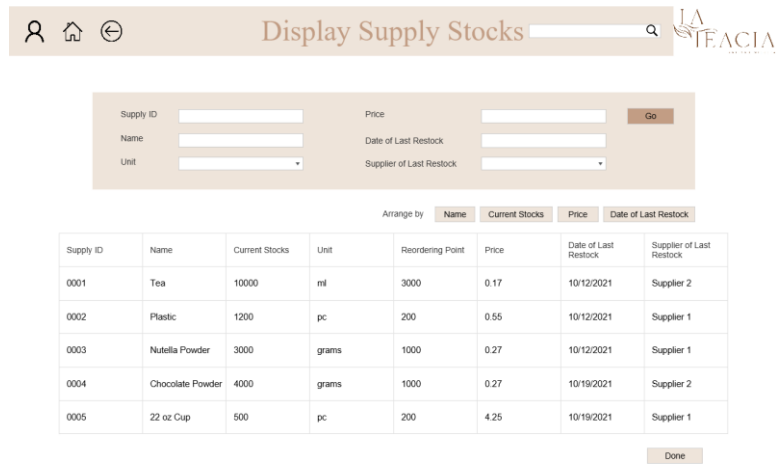


Fig. 13. Display Supply of Æ System



Fig. 14. Supply Reports Home of Æ System



Fig. 15. Daily Stocks Left Table Report of Æ System



Fig. 16. Daily Stocks Left Graph Report of Æ System

Fig. 14 displays the reports home where the user can access the daily stocks left report which will be presented in Fig. 15 and Fig. 16, weekly and monthly stocks consumed reports, and daily, weekly, and monthly stock expenses reports. All of the reports will display a table and a graph or a chart.

Fig. 15 is focused on the stocks left after a day of operating and the reordering point. This is to view if there is a need to order supplies in the upcoming days.

As seen in Fig. 16, the blue line are the stocks left and the red line is the reordering point. It can be seen that the blue line is still far from the red line which implies that the business still doesn't need to order supplies.

7. Results

7.1. Productivity

TABLE I. CURRENT AND PROPOSED VALUES NEEDED FOR PRODUCTIVITY COMPUTATION

	CURRENT	PROPOSED
Number of milk tea produce	41	52
Price per milk tea	92.5	92.5
Employee hours	28	28
Employee rate(peso/hr)	35.71	35.71
Ingredients cost	40.635	40.635
Overhead (electricity, load , etc.)	83.33	188.46
Equipment hours	10	12

TABLE II. CURRENT AND PROPOSED PRODUCTIVITY COMPUTATION AND VALUES

	CURRENT	PROPOSED
Labor Productivity	$(41*92.5)/(28*35.71) =$ 3.792955155	$(52*92.5)/(28*35.71) =$ 4.810577269
Machine Productivity	$(41*92.5)/10 =$ 379.25	$(52*92.5)/12 =$ 400.8333333
Energy Productivity	$(41*92.5)/83.33 =$ 45.51182047	$(52*92.5)/188.46 =$ 25.52265733
Capital Productivity	$(41*92.5)/(40.63*41) =$ 2.276362741	$(52*92.5)/(40.63*52) =$ 2.276362741
All-factors	$(41*92.5)/(28*35.71) +$ $(40.63*41) + 83.33 =$ 1753.157955 AFP	$(52*92.5)/(28*35.71) +$ $(40.63*52) + 188.46$ $=$ 2306.290577 AFP

With the vales used in Table 1 to be able to compute the productivity in Table 2, it can be seen that there is an increase in the number of milk teas produced by 11, increase on overhead by 105.13, and increase equipment hours by 2. The labor productivity increased by 1.01762211 in terms of peso over peso value. The machine productivity increased by 21.58333333 peso/hour. The energy productivity decreased by 19.98916314 peso/hour. The capital productivity is still the same with a ratio of 2.276362741. All-in-all, the productivity of La Teacia Artisan Milktea increased by 553.132622.

7.2. Comparision of Current and Proposed Processes

The current and proposed processes show changes on how the restocking of supply starts. The current process shown in Figure 4, manually checks the supply in order to know if the supply is enough for operation

which happens weekly while in the proposed process the \mathcal{AE} system shown in Figure 6, notifies the owner when the supply is on the reordering point and updates the supplies after operation or restocking occurred. This will remove chances of shortage of ingredients during the operations of La Teacia Artisan Milk tea.

The current and proposed process chart shows the changes in the process of restocking the inventory of La Teacia Artisan Milktea. In the current process shown in Figure 5, the owner checks the stocks weekly, so most of the time the staff discover the shortage of supplies when it is needed. Before ordering from the supplier, the owner will check the stocks himself to see if there are other supplies that also need to be restocked. With the process of the proposed \mathcal{AE} system shown in Figure 7, it will automatically alert the owner if the supplies are already on the reordering point and it constantly updates the inventory level. Based on the VS ratio, the new \mathcal{AE} system improves the process of restocking the inventory of La Teacia Artisan Milktea by 60.494%. Moreover, it reduced the total lead time by 34 minutes.

8. Conclusion

With the continuous increasing number of competitors, La Teacia Artisan Milk tea must continue to improve in order to retain their competitive advantage. It currently experiences problems with managing their stocks that lead to opportunity loss. The proposed inventory management system and its functionalities helps La Teacia improve the process of restocking the inventory and reduce its lead time by 34 minutes. The efficiency of the current and proposed process increased from 39.506% to 100%. The all-factor productivity also increased from 1753 AFP to 2306 AFP. With these improvements this can help the business improve their inventory management that can eliminate the opportunity loss by the increasing sales and improving customer relationship and satisfaction.

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