REDUCTION OF RICE PROCESSING TIME USING LEAN CONCEPTS: A CASE STUDY OF A HUMANITARIAN ORGANIZATION

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ABSTRACT

This study investigates the STAR organization, a humanitarian group in Myanmar, addressing delays in food delivery operations. The organization experienced an average lead time of 66 days—21 days longer than the target of 45 days—between the contract stage and warehouse delivery. Ensuring timely food delivery is critical to STAR's mission. Lean tools, including process mapping, fishbone diagrams, and five-whys analysis, were employed to identify and resolve root causes of delays. Data from 2023–2024 and employee interviews supported the redesign of processes, implementation of actionable steps, and improved monitoring procedures. Implemented in early 2024, these changes eliminated the 21-day delay and further reduced delivery time by 8 days, achieving a total lead time reduction of 29 days. This study highlights the potential of Lean methodologies to enhance the efficiency of humanitarian supply chains.

Keywords*: Delay Lead Time, Fishbone diagram, Leans, Process mapping, Procurement*

บทคัดย่อ

งานวิจัยนี้ศึกษาการดำเนินงานขององค์กร STAR ซึ่งเป็นองค์กรมนุษยธรรมในเมียนมา โดยมุ่งแก้ไขปัญหาความล่าช้าในการจัดส่งอาหาร องค์กรประสบปัญหาระยะเวลาการดำเนินงานเฉลี่ย 66 วัน ซึ่งนานกว่าเป้าหมายที่กำหนดไว้ 45 วัน อยู่ถึง 21 วัน การจัดส่งอาหารให้ทันเวลาถือเป็นปัจจัยสำคัญต่อภารกิจขององค์กร เครื่องมือลีน เช่น การทำแผนภาพกระบวนการ แผนภาพก้างปลา และการวิเคราะห์ 5-whys ถูกนำมาใช้เพื่อระบุและแก้ไขสาเหตุของความล่าช้า ข้อมูลจากปี 2023–2024 รวมถึงการสัมภาษณ์พนักงาน ช่วยสนับสนุนการออกแบบกระบวนการใหม่ การกำหนดขั้นตอนปฏิบัติ และการพัฒนากระบวนการติดตามผล ในช่วงต้นปี 2024 การเปลี่ยนแปลงเหล่านี้สามารถลดความล่าช้า 21 วัน และลดระยะเวลาการจัดส่งได้อีก 8 วัน รวมเป็นการลดระยะเวลาทั้งหมด 29 วัน งานวิจัยนี้แสดงให้เห็นถึงศักยภาพของวิธีลีน ในการเพิ่มประสิทธิภาพโซ่อุปทานด้านมนุษยธรรม

คำสำคัญ: ระยะเวลาดำเนินการล่าช้า แผนภาพก้างปลา การวางแผนกระบวนการ การจัดหา

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INTRODUCTION

A humanitarian organization, called STAR organization has supported assistance to people with food, livelihood, and nutrition, mainly in difficult areas due to man-made disasters or natural disasters. It needs to procure rice locally to ensure uninterrupted life-saving assistance to internally displaced persons and cyclone-affected people in Myanmar.

In 2023, the delivery process for 500 metric tons of rice was completed, which took 66 days. This processing time was 21 days longer than the typical processing time, although the organization was able to provide food assistance within the timeline in the past. The normal processing time is 45 days until delivery is completed for an order of rice 500 MT (metric ton). The consequence of this exceeded delivery time was that STAR faced the problem of losing the grant due to the validity period of the grant from the donor. The level of donor trust decreased, which affected the reputation of the organization. As a humanitarian organization, it relies on donor grants to do essential work and provide assistance to the people. Therefore, the problem of donor trust affected the organization.

The objectives of this research were to identify bottlenecks and factors that cause delivery delays, to eliminate waste and to improve the monitoring process efficiently and effectively. Based on these objectives, it was proposed to enhance the efficiency of the operations and ensure the delivery of high-quality rice.

The study was based on the historical data of a normal case and a delayed cause occurred between January 2023 to Sep 2023. The purchasing department and warehouse management on the buyer's side were the main places to obtain information. The production department and the contract management department were the main sources of the supplier.

The data and information were obtained through documents and interviews with the respective employees. The main topics of the interview processes were workflow processes, challenges, and possible root causes to find solutions together. After that, the implementation was carried out in late 2023. In addition, the results were monitored until the end of February 2024 and maintained in consistency to the present.

REVIEW OF RELATED LITERATURE

Lean Concepts

Lean is a continuous improvement approach that aims to eliminate wasteful and unnecessary non-value-added activities in the process. The Lean name was born from the Production System of Toyota (Liker, 2020). According to Womack, Jones, and Roos (1990), Lean manufacturing techniques and tools can eliminate waste, improve inventory management, enhance product quality, and achieve overall financial and operational improvements when used appropriately. The Lean concepts are particularly useful for reducing waiting times or delivery times. This can improve the delivery process of logistics functions. The studies by Supatn and Lertpongpipat (2010) and Supunnigar and Chamnong (2004) confirmed that the Lean concepts were useful for reducing waiting times or reducing delivery times. This could improve the delivery process of logistics functions and result in a positive return on investment.

Lean Tools

Lean tools are systems and technologies that help organizations improve waste management, increase efficiency, reduce costs, and make better in productivity, and that can be used to solve problems (Roughan, 2024). They are also essential to achieving operational excellence and help identify inefficiencies, enhance quality, shorten lead times, and deliver better value to customers (Oleg, 2024). Among the several Lean tools, the process mapping tool can eliminate waste and focuses on the identification of "value-added" workflow and "non-value-added workflows (necessary and unnecessary) in a process. In addition, several root cause analysis tools, such as the Five Whys analysis and the Fishbone Diagram (CED), can be used to determine the cause of the problem (Mahto & Kumar, 2008).

Process Mapping

Process mapping is a useful tool for enhancing quality, identifying bottlenecks, and improving lead times. Process planning can also make things easier and more efficient in the process (Conger, 2011). It is also a visual tool that shows the sequence of activities in the working process, highlighting how each task is interconnected (Anjard, 1998). Lertpongpipat and Supatn (2010)and Thangsampan and Smutkupt (2017) examined that it was an effective tool for identifying bottlenecks, non-value-added activities, and elimination of waste. In addition, purchasing lead time was significantly improved through the application of the process mapping tool in their studies.

Cause and Effect Diagram (CED)/Fishbone Diagram

The cause-and-effect diagram (CED), also called the Fishbone or Ishikawa diagram, was recommended as a tool for quality development by Dr. Kaoru Ishikawa (Ishikawa, 1986). It is an effective tool when the root causes of the problem are properly identified and used to link numerous possible causes to a single effect (Mahto & Kumar, 2008). Additionally, analysis and evaluation of the current process to find the problem area can be conducted using fishbone and this leads to the actions to improve this process to be the best operational practices (Southern, 1995). In the case study of the plastic compound manufacturer by Sutamnartpong and Puttibarncharoensri (2018), the fishbone diagram was applied in the analysis stage to find the possible root causes and classify which section needs to be improved. The improvement plan was proposed after analyzing the root causes using a fishbone diagram. The implementation outcome was successful, which resulted in cost savings and decreased defect rates.

Five Whys Analysis

This analysis is a brainstorming technique that repeats the "why" question five times until an acceptable solution is found. Each response to the questioning and interview of people directly or indirectly involved in the problem can lead to a logical sequence of subsequent questions until a possible result is obtained (Mahto & Kumar, 2008). Additionally, there are three key elements to using the 5 Whys technique effectively: effectively: (i) accuracy and completeness of problem statements, (ii) integrity to answer the questions completely, and (iii) determination of root causes and ways to resolve them (Serrat, 2017). Numerous studies by Amatyakul (2018) and Thangsampan and Smutkupt (2017) confirmed that five whys analysis was used to discover the root causes of issues related to the value-added activity, the non-value-added activity (waste) and delivery times in critical areas.

RESEARCH METHODOLOGY

This section presents the research methodology to meet the objectives, the possible tools to define the root causes of the problem that causes the delay in delivery and other procedures to achieve the desired outcomes.

Process Mapping

The process mapping from the contract stage to the delivery completion stage was illustrated to clearly understand the current process including information for each stage. There was a total of 7 steps and the 21-day delay in the food distribution process was due to bottlenecks, waste, and non-value-added activities within these 7 steps. Figure 1 is an illustration of the workflow map.

In addition, the data and information were obtained through documents and interviews with the respective employees. Table 1 was effectively used to compare the time taken by each step between the normal process and the delayed process.

Figure 1: Process Mapping

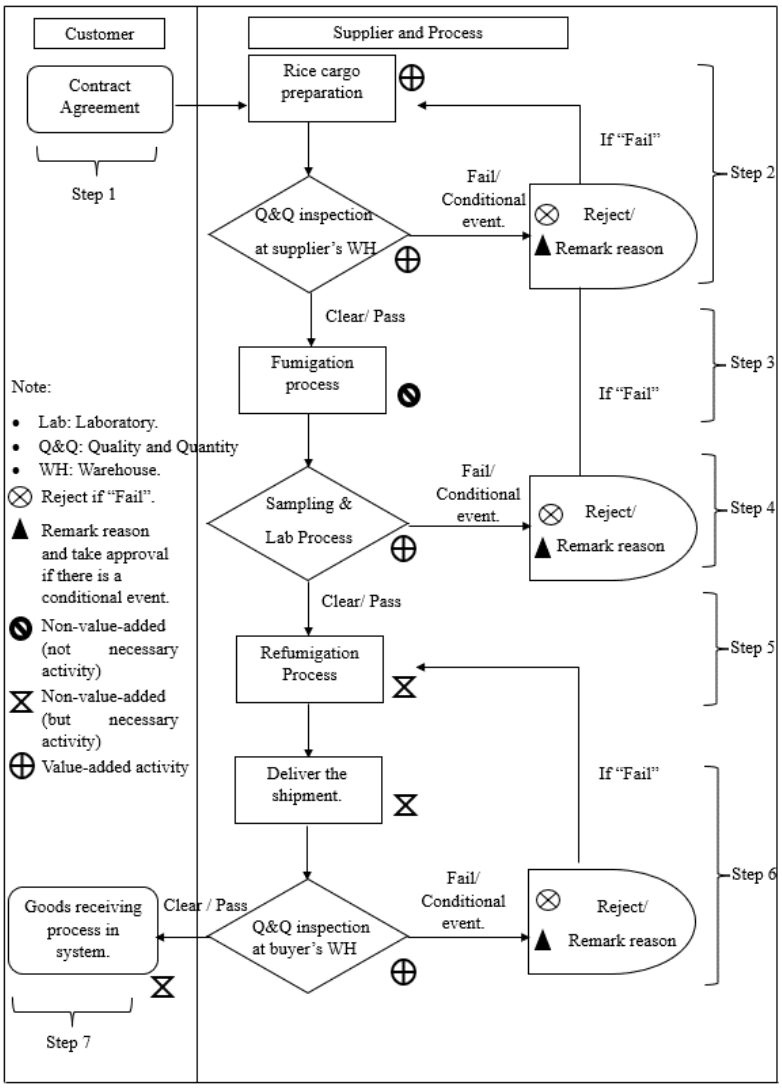


Figure 1 is the process mapping from the contract stage to the delivery completion stage. Value-added activity, non-value-added activity (necessary) and non-value-added activity (not necessary) are identified in the process mapping.

Table 1: Comparisons of Time Taken in Each Step between the Normal Process and the Delayed Process

Procedure		Time Taken (Days)		Difference (Days)
		Normal Process	Delayed Process	
Step 1	Contract Agreement	1	1	0
Step 2	Rice Cargo Preparation and Inspection	16	21	5
Step 3	Fumigation	5	5	0
Step 4	Sampling and Laboratory Process	14	21	7
Step 5	Re-Fumigation Process	5	10	5
Step 6	Delivery and Inspection	3	7	4
Step 7	Good Receiving Process in System	1	1	0
		45	66	21

Table 1 is the comparison table that indicates the number of days each step takes. Exceeded processing time in steps 2, 4, 5 and 6 is defined as waiting time waste. In addition, there is a duplication of the fumigation process in steps 3 and 5. Fumigation is necessary to prevent the adhesion of live insects, and rice with live insects can occur for a long storage period. In this case, longer storage is not needed because of the preparation of fresh rice received from the rice milling machine and there is less chance of live insects adhering to the rice. In addition, the fumigation process before laboratory testing – step 4 cannot have an impact on the result of laboratory testing. Therefore, step 3 is called a waste of over-processing and non-value-added activity.

Fishbone Analysis of Delay

The process involved investigating the root cause of the problems between the contract agreement stage and the delivery completion stage. Relevant people working on each step of the above 7 steps were interviewed and asked detailed questions. The main topics of the interview processes were workflow processes, challenges and possible root causes to find solutions together.

After the interviews, the observation results and interview points were represented in a fishbone diagram to provide a simple visualization and ensure that everyone understands the problems. The interview results are as below:

Process: It was due to the change in operating procedure by the new food technologist. Therefore, the main cause was the transition of staff in the food safety unit, which caused changes in the process.

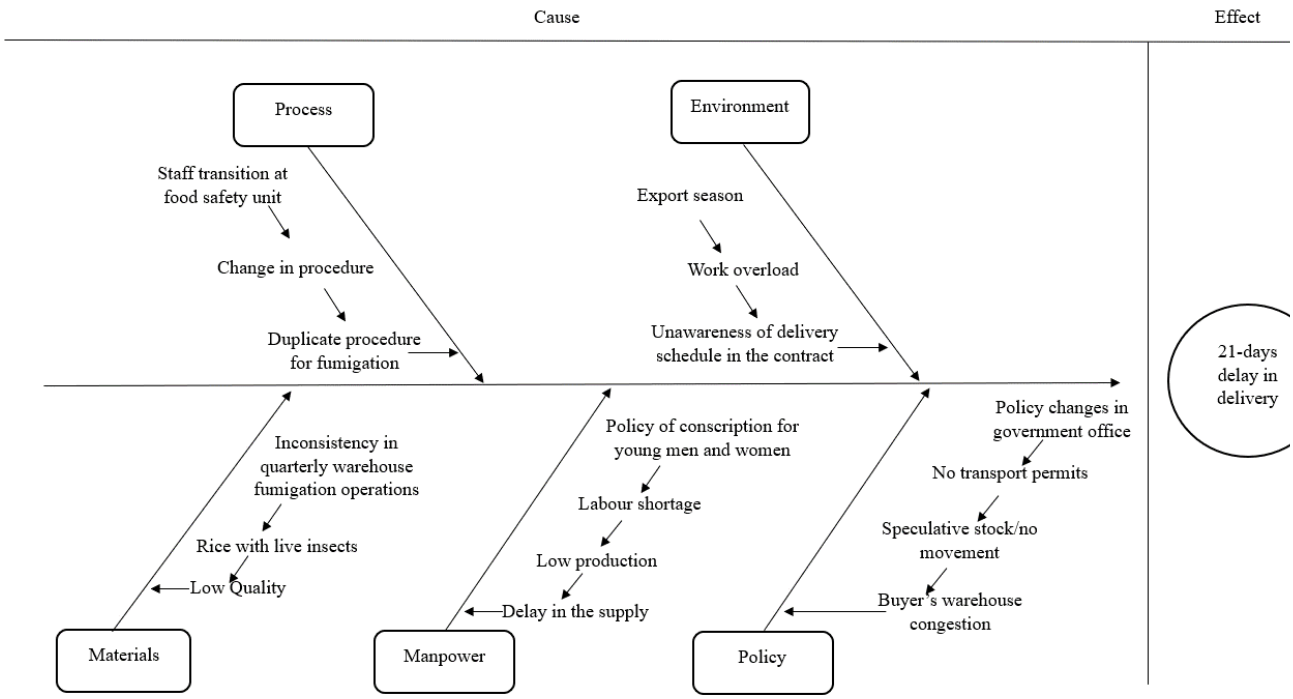
Environment: The root cause of the delay was due to unawareness of the contract delivery schedule. The supplier's warehouse was overloaded with other export-related operations. Since the export operation was seasonal, it required timely completion, resulting in a huge workload.

Materials: It was due to unqualified products/materials delivered to the buyer resulting from the inconsistency in the entire quarterly fumigation process of the warehouse. Therefore, the live insects were easy to attach and wrap in the rice bags.

Manpower: The reason was that people were leaving the country due to the new policy of conscription of young men and women. That workforce shortage reduced the productivity level and led to low production of rice and delays in the supply.

Policy: The warehouse congestion occurred due to the lack of movement of products in the buyer's warehouse because of no transportation/distribution permission from the authorities. It was the effect of changes in government policy.

Figure 2: Fishbone Analysis



Process mapping tool and fishbone diagram following five-whys analysis were used to identify the root causes of delivery delays. The two wastes could be classified under five main categories such as 1) waiting time waste and 2) over processing waste (non-value-added activity). Therefore, a new procedure was implemented following a redesigned process mapping and recommended actions along with an in-depth monitoring process. Its objective was to improve delivery time and eliminate waste or non-value-added activities.

Develop Implementation Plans for Desired Outcomes

The implementation of a new procedure, following a redesigned process map, aims to improve delivery time and eliminate waste or non-value-added activities. The first one is a deep monitoring process that includes desirable actions to be followed by both parties (supplier and buyer), and the establishment of an Excel sheet with detailed information will help support positive changes and minimize potential problems. For a more effective and productive workflow, online meetings or personal meetings will be conducted with the suppliers after signing the contract. Discussions at the meeting will allow both parties to get on the same page, learn about challenges and develop proactive solutions for unexpected events. The expected result is the identification of significant differences in various variables before and after the implementation of the new procedures, which ultimately affects the improvement in the lead time of the operation.

PRESENTATION AND CRITICAL DISCUSSION OF RESULT

Redesign the Process Mapping

One part of the processes to improve delivery time is the concern for the redesign of the process map. By analyzing the process map, a total of 10 days was taken for two fumigation processes in step 3 and step 4. The fumigation process in step 3 was defined as a non-value-added activity and a waste due to over-processing. Hence, the organization decided to eliminate 5 days from the fumigation process by removing one step. Before the elimination of this step, meetings were organized with internal and external stakeholders to inform them about the change in the cargo preparation process with the objectives of transparency and accountability. Once not everyone disagreed with this change, the new process map was redesigned by removing the non-value-added activity. The result was a new process map with a total of six steps and both parties obtained benefits in time savings and improvement in the delivery process (Figure 3).

Actions to be Supported for Improvement

The root causes of delay were identified analyzing interview points and observation results. To correct these root causes of waste, desirable actions are taken at each step of the procedure, whether the step is delayed or not. Table 2 indicates the recommended actions to improve the delivery process. Responsive units are mentioned on both the buyer and supplier sides to clarify responsibilities and reduce conflicts. All workflows and actions mentioned in Table 2 are the results of various discussion processes, which are carefully planned, monitored and optimized to achieve optimal productivity in each task.

Modification of the Monitoring Procedure

The monitoring procedure was modified to check the milestones of each activity over time to achieve the expected results. It was divided into two parts 1) order tracking system in an Excel sheet and 2) set up a meeting with the suppliers after signing the contract.

Order Tracking System in Excel Sheet

A manual Excel sheet was developed indicating the necessary or complete information along with the updated status of the current process. Its purpose was to mitigate the issue of delay due to unawareness of the contract. Then, weekly sharing of the tracking sheet with relevant units and stakeholders provided risk mitigation in the contract monitoring and delivery process.

Figure 3: New Process Mapping

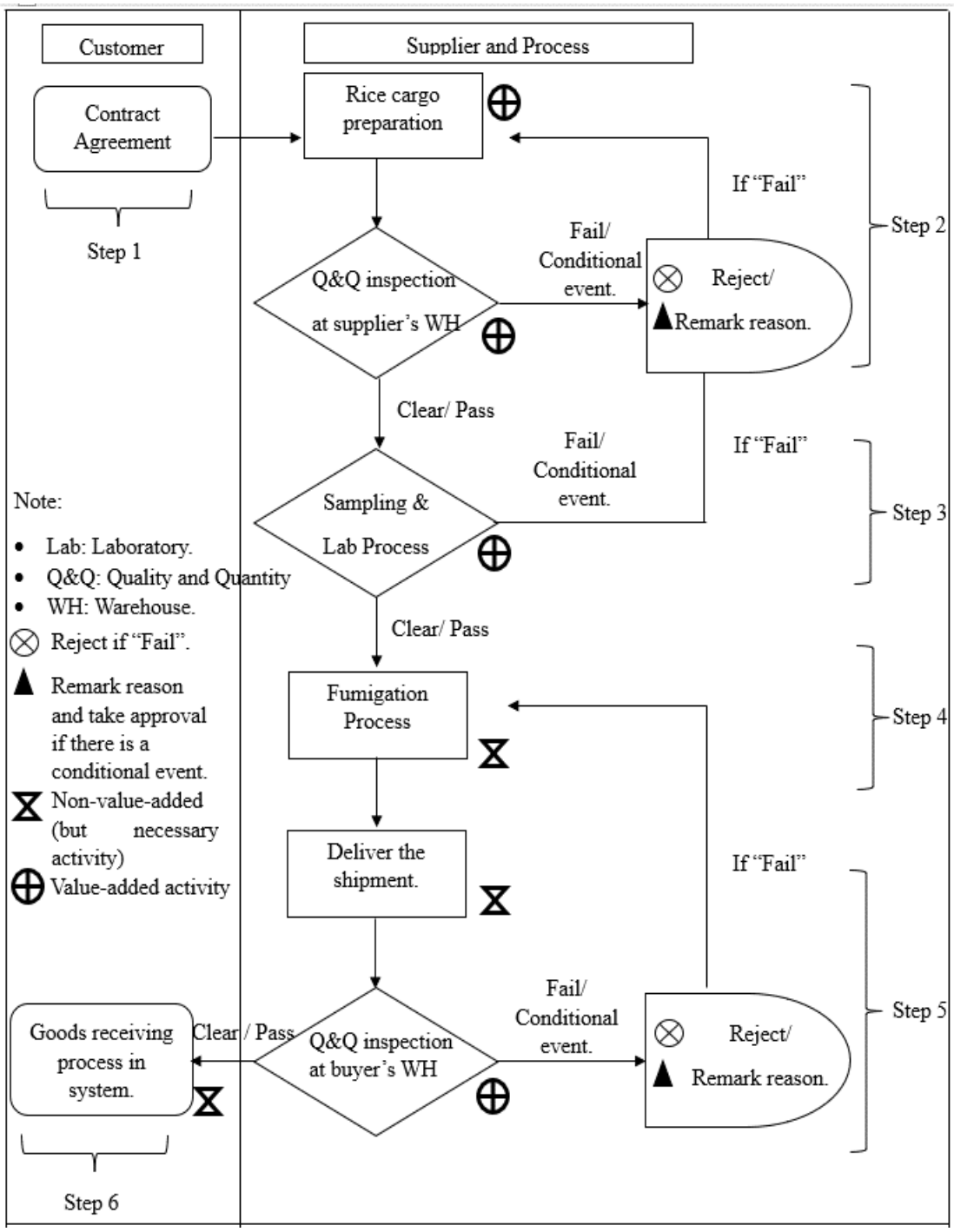


Figure 3 is a new process map with a total of six steps from the contract stage to the delivery completion stage. It can be seen that one step of fumigation process (non-value-added activity) was totally removed with the support of open communications between different stakeholders.

Table 2: Desirable Actions for Both Parties

Step	Desirable Actions	Respective Persons of Both Parties
Step 1	• Conduct an Excel monitoring sheet including the data from the contract.	• Supply chain unit including contracting unit • Other stakeholders if possible
Step 2	• Complete the tracking sheet and share it with the respective stakeholders weekly. • Set up a meeting for cross-functional efforts.	
Step 3	• Hire more labor considering the buffer quantity of labor shortage from the supplier side. • Reschedule work hours or schedule shifts for routine processes.	• HR and Admin Unit of supplier
Step 4	• Carry out the quarterly warehouse fumigation process. • Record this process.	• Warehouse team • Quality control unit • Fumigation Company
Step 5	• Consider the performance improvement plan to enhance productive performance.	• All units
Step 6	• Perform the goods receipt process without postponement. • Share that information with the internal units. • Accept the support of the technical unit for data entry into the system.	• Supply chain unit • IT unit • Delivery unit

Table 2 indicates the recommended actions to improve the delivery process. Responsive units are mentioned on both the buyer and supplier sides to clarify responsibilities and reduce conflicts

Set Up a Meeting with the Suppliers

An online or in-person meeting was organized to update the information and challenges from both suppliers' and buyers' sides as soon as the contract was signed between both parties. The objective was to achieve the products within the required delivery time with the right quality and quantity. The meeting note taken on the points discussed was circulated for the purposes of record and transparency.

Benefits of Adopting Lean Concepts

The Lean concepts aim to eliminate useless and non-value-added activities in the process. After applying the Lean concepts and the modifications of the actions proposed above, the 21-day delay was completely eliminated, and an additional 8 days of improvement was observed. Not only is it able to eliminate a 21-day delay, but it is also 8 days faster, which is a total of 29 days improvement compared to the delayed process that occurred in 2023.

Table 3 shows the time savings in days comparing the normal and delayed processes in 2023 and the new process in 2024. The improvement occurred after modifying the process map and following the desirable actions for each step.

Table 3: Time Savings in Days after Process Modification

Procedure	Time Taken (Days)			Time-Saving (Days)	
	Normal Process in 2023	Delayed Process in 2023	New Process in 2024	New Process Compared to Normal Process	New Process Compared to Delayed Process
Step 1	1	1	0	1	1
Step 2	16	21	15	1	6
Step 3	5	5	0	5	5
Step 4	14	21	14	0	7
Step 5	5	10	5	0	5
Step 6	3	7	3	0	4
Step 7	1	1	0	1	1
Total	45	66	37	8	29

CONCLUSIONS AND RECOMMENDATIONS

The research thoroughly focused on eliminating waste by identifying the root causes of the delivery delays. Lean concepts and Lean tools called process mapping, fishbone diagram, and five whys analysis are the main approaches to examining the root causes, finding solutions to the problems, eliminating waste and improving the monitoring process efficiently. It was supported to enhance the efficiency of the operations and ensure the delivery of high-quality rice. In problem-solving, the cross-functional team or different stakeholders were involved in finding possible solutions and moving forward to achieve the objectives.

By finding possible solutions, the process map was redesigned and the recommended actions for monitoring plans were implemented respectively. The use of a redesigned process map was applied to eliminate non-value-added activities and reduce the lead time for preparing a rice shipment. The recommended actions for monitoring plans were modified to improve lead time reduction. Through these support actions, the organization would benefit from shortened time in preparing the rice shipment and increased food assistance to beneficiaries promptly.

The managerial implications of this research highlights that the management's cooperation was needed to contribute to getting better outcomes and successful outcomes in every project and hence, setting goals, objectives and guidelines for the process was a key role based on real practices.

The limitations in this research are important to recognize that different forms of delayed processes may occur depending on the different categories because not all scenarios and factors are included in this study. Furthermore, effective monitoring processes, such as creating implementation plans, choosing the right tools, and maintaining consistency, could provide the benefits needed to ensure improvement in future research.

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