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Loveland, Jennifer L. *Filling Orders Faster*

Abstract

Customers continue to want superior service and quick response times. The purpose of this study was to identify what was happening in each step of the order fulfillment process, benchmark external research, collect internal data, and analyze all the data to find the root cause of the delays at Company XYZ. The main objective was to propose solutions of what needed to be done to fill customer orders in two days or less. Utilizing lean manufacturing tools, benchmarking external data, and evaluating real time order processing data, Company XYZ would have the ability to improve the order fulfillment process.

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Table of Contents

Abstract2

List of Tables6

List of Figures7

Chapter I: Introduction.....8

 Statement of the Problem.....10

 Purpose of the Study10

 Assumptions of the Study10

 Definition of Terms.....11

 Limitations of the Study.....12

 Methodology13

 Summary14

Chapter II: Literature Review16

 Customer Service Expectations16

 Discussion of Lean Methodology18

 Summary22

Chapter III: Methodology24

 Data Collection and Analysis.....24

 Kaizen Event.....25

 Process Map27

 Time Study.....27

 Seven Wastes28

 Gemba Walk28

Gap Analysis and 5 Why's	29
Tracking Results	31
Summary	31
Chapter IV: Results.....	32
Data Collection and Analysis.....	32
Kaizen Event.....	33
Process Map	35
Time Study.....	35
Seven Wastes	36
Gemba Walk	37
Gap Analysis and 5 Why's	38
Tracking Results	39
Summary.....	40
Chapter V: Discussion	42
Limitations	43
Conclusion	44
Recommendations.....	45
References.....	47

List of Tables

Table 1: Example of Time it Took to Fill Customer Orders.....	25
Table 2: Example of Timeline of Activities for the Kaizen Event	26
Table 3: Example of Tracking Documentation.....	28
Table 4: Time it Took to Fill Customer Orders	33
Table 5: Timeline of Activities for the Kaizen Event.....	34
Table 6: Tracking Documentation	36
Table 7: Time it Took to Fill Customer Orders	40

List of Figures

Figure 1: Example of a Process Map	27
Figure 2: Example of Seven Wastes	28
Figure 3: Example of Visual Board	29
Figure 4: Process Map	35
Figure 5: Seven Wastes.....	37
Figure 6: Visual Board.....	38

Chapter I: Introduction

The customer service industry continues to move faster with increased technology and automation. Customers expect to be able to find, order, and receive products within a day or two. This continues to challenge many companies to move faster, and to stay competitive in the market place. One company that faces this challenge is the focus of this study.

A service and repair company, referred to as Company XYZ to protect the company's confidentiality for proprietary information, was focused on improving the timely service of delivering parts to its customers. A privately owned, 25-year old company located in Minnesota, engaged in parts sales and service repair of products used in hospitals and other health care clinics located all over the United States. These products included sterilization units to sterilize items used in surgical procedures, and warming units used by patients during those surgical procedures. In addition to supporting the United States, Company XYZ also sells and ships parts all over the world. In total, Company XYZ supports over 50 different products globally, and supports over \$2 billion dollars in annual revenue. This research focused only on filling customer orders in the United States. The repair operations and global shipments were not in scope of this study.

When Company XYZ began, they were proud of their ability to service the customer quickly and effectively. This was the foundation to which they grew. As a family owned and operated company, they could make changes quickly to adapt to the customer need over the years to stay competitive. However, in the more recent years, the ability to fill parts orders continued to be an unresolved challenge.

Company XYZ leased a small building for both operations and office support staff. There was one dock door for both receiving and shipping. To support the parts area, there was

one full time person doing the shipping, receiving, and stocking of parts during a nine to five schedule, Monday through Friday. Also, there was one full time material planner who kept track of the supply and ordered additional parts when stock was getting low. Both people reported to an operations manager who then reported to the company owner.

There were multiple computer systems used by Company XYZ to support the operations. Customer orders and inventories were entered and tracked through an AS400 computer software program. Also, supply planning was either done manually in excel spreadsheets, or through an internal system used to store planning parameters and forecasts. Furthermore, there was another system used for placing orders from and paying suppliers. Together these systems did share some information, but there were many limitations to the data sharing abilities.

Over the past 25 years, to increase market share and stay competitive, the amount of product types expanded at the same time the number of customers grew. Due to increasing products offered and a growing customer base, the volume of orders had grown dramatically. This stressed the capacity of the order fulfillment operations, and orders began to see greater delays over time. Hospitals and clinics were starting to complain about the time it took to receive parts. If a product was not working for a hospital or clinic, it could mean an operating room did not get sterilized tools and may needed to delay procedures, or a patient room could not be used because it is not properly equipped. This was costing the hospitals money and lost revenue.

In 2017, Company XYZ received over 40,000 orders to fill from the Minnesota location. There were over 600 different stock keeping units (SKU's) in stock, and the customers expected all orders to be filled within two days. Recently, some orders were taking over thirty days to fill.

Statement of the Problem

In 2018 at Company XYZ, order fulfillment was taking more than eight days and was no longer meeting the customers' expectations. This left many customers dissatisfied and put the organization at risk of losing business.

Purpose of the Study

The purpose of this study was to identify what was happening in each step of the order fulfillment process, benchmark external research, collect internal data, and analyze all the data to find the root cause of the delays. The main objective was to propose possible solutions of what needed to be done next at Company XYZ to fill customer orders in two days or less.

The owner of the company also wanted to be sure the identified solutions could be implemented for long term success including growth and changing marketing dynamics. This included increased volumes and cost constraints, therefore automation, employee involvement, and accurate reporting processes were important to develop.

The benefits to the organization came from both better order execution and continuous improvement efforts. This resulted in less waste and the company gaining confidence in the ability to grow. Ultimately, if action was not taken and customers continued to be dissatisfied, the growth and revenue of the company were at risk.

Assumptions of the Study

This study was executed with the multiple assumptions. All parts orders could be filled using one standard process no matter the size, quantity, or ship to location. The standard work developed would support this standard process. Also, it assumed the local leadership would embrace the new process and wanted to deliver the improved results. The company would provide tools, systems, and resources necessary to implement a change. There was an agreement

it would take up to three months to fully implement a sustainable change, but conclusions would be identified within two weeks of data gathering.

Definition of Terms

The following is a list of terminology and definitions which provided critical insight to understanding portions of this study.

5 Why's. This is a technique to identify the true root cause of a problem. Each time a question is answered, it is followed by another question that starts with why. Usually after five times of asking why the observer can get to the true root cause (Kanbanize, 2018).

Defect (Waste). A component or other deliverable that does not meet the customer's need (Liker, 2004, p. 29).

Gap analysis. This is a method of defining the alignment of expectations of a process to the actual performance of the process. Through comparing the alignment in this way, areas of improvement can be identified to fully align a process to the expected outcome (Business Jargons, 2018).

Gemba walk. A physical walk on the operational floor to see and analyze the process first hand (Liker, 2004, p. 224).

Inventory control. This is the process of making sure all the right amount of parts is available for sale. This also includes is a company's system of tracking all incoming, outgoing, and on hand inventory in a specified location (Cambridge Dictionary, 2017).

Kaizen event. This is a planned meeting of people to review a process and identify improvements. Typically, this event is led by a facilitator with a specific scope or problem in mind (Liker, 2004, p. 276).

Process map. This is a picture that lays out the steps and order of a specific operation. Process maps can be created with simple post-it notes or complex specialized software (American Society for Quality, n.d.a.).

Seven wastes. Activities that use up time, cost, resources, or space but do not add value to the process. They include defects, over production, transportation, waiting, inventory, motion, and over processing (Liker, 2004, p. 28).

Standard work. This is a grouping of tasks that is followed in the same manner every time the operation is performed. It is meant to be the same no matter if there is a change in operators, time, or amount of work (Lean Enterprise Institute, 2018).

Stock keeping unit (SKU). A product, or a size or model of a product, that a company has available for sale, considered as a single unit (Cambridge Dictionary, 2017).

Time study. This is a direct observation technique used to assign an average amount of time a process step takes to complete. If the step is a few seconds or less, the time study approach is difficult to administer. The number of cycles that are required vary depending on the work and the level of accuracy required (Institute of Management Services, 2018).

Visual management. A process of ensuring that all current requested tasks are visible to all involved in the company (Liker, 2004, p. 153). This process allows everyone to see all potential engineering tasks. This information is then used to solve the problem of prioritization and scheduling.

Limitations of the Study

Only data from Company XYZ was used in this study. Also, this study was limited to only data collected from the location in Minnesota for domestic shipments to the main 48 states in the United States. It was limited to the current process, and was also limited to orders

received from 2018 and later. The study was also limited to only orders received for parts stocked at the facility. It did not include customer orders received for parts the location did not stock. Furthermore, the study focused only on improving the metrics for customer orders for parts, not for repair.

Methodology

This section is a brief overview of the methodology used in the study. The full details are described in Chapter 3.

During this study, internal data was collected from Company XYZ according to the limitations and assumptions noted above. The data collected during the study was to define the current process to define what was taking so long to fill customer orders. The methodology to collect the data was from the lean manufacturing principles including. The events took place over two weeks to ensure adequate data was collected. The current process was mapped out, including each step in the process. The steps were then defined by average time it took to complete.

The study incorporated a cross functional team to ensure no parts of the process were overlooked. Also, by including the cross functional team, the team members were engaged from the beginning. They learned the problem Company XYZ was facing and were engaged to help gather the data to solve the problem

A kaizen event was performed to share with the team the problem, and engage them in the process. The event was used to gather most of data used in the study. The event lasted one day. During the event, data was gathered to create the process map.

To gather the data, the team participated in a Gemba walk to visual observe each step of the process from the time a customer order was received until the parts to fill the order was

shipped. During the observations, the team conducted time studies of steps within the process. Following the Gemba walk, the process map was updated with the feedback from what the team observed and data collected from the time studies.

Once the process map was created, the team used lean manufacturing principles to perform the analysis. They started with a gap analysis. To define the gaps the team used the seven wastes of lean manufacturing. The wastes included defects, over production, transportation, waiting, inventory, motion, and over processing. Furthermore, they asked the 5 Why's to ensure the true root cause was identified.

Throughout the kaizen event some of the areas of opportunity began to emerge. By the end of the event the team had a clear understanding of the gaps and true root causes that needed to be addressed. They also had ideas on what could be done to solve the gaps.

Summary

Company XYZ supplied parts to customers and was taking too long to fill orders. As a result, the customers began to get dissatisfied. It was a concern of the company owner that this customer dissatisfaction was limiting the company's ability to grow. This study was conducted to research the problem the company was facing and identify solutions.

This study defined the problem that taking three days to fill customer orders was too long, and why this was of concern to the company. The purpose of this study was to identify possible solutions to this problem to ensure long term success for the company. The purpose also included the benefits of this study to the company.

The assumptions, terms, and limitations of this study were defined. An overview of the methodology the study used was defined. The research could identify several gaps in the existing process by using lean manufacturing principles, collecting internal data, analyzing the data, and

engaging the cross functional team in the process. Following the research, the solutions to the problem were identified and shared with the company.

In the following chapter, the literature review supports the approach and benchmarks other studies that address this type of problem. By researching external data, the study can understand customer needs in the current market, leverage data from other studies, and use tools other companies have found successful when facing similar challenges.

Chapter II: Literature Review

The parts service industry is highly competitive, and to be successful companies must differentiate themselves. By offering expedient service is one way for an organization to stand out from the competition. One way to offer expedient service is through lean methodologies, continuous improvement, and the elimination of waste. With these principles, a company can increase response times to the customer.

The failure of Company XYZ to successfully fill customer orders in a timely manner had resulted in lost revenue and poor customer service experiences. Applying and understanding customer expectations with order fulfillment, while leveraging lean methodology and implementing standard work, improved the ability of any company to meet customer expectations by filling orders faster.

This literature review focused on customer expectations and lean principles. The review began with studies to understand customer expectations for order fulfillment as it has changed in the modern era. Then moves on to understanding the history lean, the benefits of how lean methodology can be applied to banish waste and create wealth (Womack & Jones, 2003, p. 29), and the lean tools to use. The lean tools discussed include process maps, value add verses waste, time studies, gap analysis, and 5 Why's. This chapter also reviewed standard work and how it can create efficiencies, and the continuous improvement concept.

Customer Service Expectations

Customer service expectations have a major impact on how consumers choose to spend their money. In the next few sections, this paper covers how these expectations have changed over time and that Amazon is a key retailer that has been driving this change.

Poor customer service leads to lost sales. The assumption made before this review was that poor customer service experiences lead to lost sales for companies. The study revealed, “Research found that 76% of customers now report that it is easier than ever to take their business elsewhere – switching from brand to brand to find an experience that matches their expectations (Salesforce, 2018, p. 1).” This makes it even more critical than ever to not only understand what customers expect but being able to deliver on those expectations.

Hyken wrote about the loss of business due to poor customer service. According to the report, it is estimated that more than \$75 billion a year is lost due to poor customer service. Also, “CEOs of companies large and small are recognizing the importance of delivering a better customer service experience.... emphasizing customer service more than product quality and price (Hyken, 2018, p. 1).

Changes in customer service expectations over time. Also, Shulzhenko states (p. 1), “no doubt, customer service has a long-term impact on buying decisions, with customers continuing to avoid companies years after the initial negative interaction.” However, Schulzhenko goes even further to note that with the advent of social media and online reviews, bad service experiences can be shared openly with the public impacting other potential buyers. “63% of consumers read negative reviews on social media and 88% of customers trust online reviews as much as they trust friends” (Shulzhenko, 2017, p. 1). Furthermore, “It is estimated that a single negative online review can cost the average business an average loss of 30 customers (Shulzhenko, 2017, p. 1).

Amazon effect. As technology brings automation, people begin to expect instant gratification. One area this can be proven is with customer order fulfillment. Riter (2017) stated it best with, “who is setting the bar for consumer expectations? One word. Amazon.”

Recently the study reported on by Riter (2017) conducted a survey of over 500 retailers, suppliers, distributors, and logistics firms and the information was compiled through SPS Commerce commissioned from Retail Systems Research. The results revealed the second most important factor driving customer behavior of where to buy is product availability. This falls just behind best price available. If the product is available, the customer has a much higher likelihood to purchase. The assumption is then that this product will be available to the customer in the shortest possible time, allowing for the instant gratification.

Furthermore, the study goes on to discuss the importance of the speed of delivery and how it is changing the customer expectations. “Retailers are probably more keenly aware of Amazon as a competitor, and Amazon’s shipping options could be playing a big part in setting these speed and price-related consumer expectations” (Riter, 2017, p. 4).

Discussion of Lean Methodology

In addition to understanding customer expectations in the delivery of orders, it is important to understand the details of the lean methodology and when applied can ensure a company fills orders as fast as possible. This will deliver a positive customer experience, and ultimately attract consumers to when they need parts.

History of lean. As early as 1799 when Eli Whitney invented the cotton gin, people were looking to maximize the efficiencies of a manufacturing process (Strategos, 2016). Then Henry Ford came into the picture about 1910 with mass production of the automobiles (Strategos, 2016). But it was not until the 1980’s when Toyota production systems began changing the manufacturing environment into what it is today (Strategos, 2016).

Taiichi Ohno, was the Toyota executive who identified seven types of waste and how to eliminate waste to ensure all steps of the process are adding value. Toyota was a Japanese

company and therefore the roots of lean thinking started in Japan. “Toyota first caught the world’s attention in the 1980’s” (Liker, 2004, p. 16). The basic understanding of waste is the foundation for lean thinking. “It provides a way to specify value, line up value-creating actions in the best sequence, conduct these activities without interruption whenever someone requests them, and perform them more and more effectively” (Womack & Jones, 2003, p. 15).

Benefits of lean. “The benefits of lean extend far beyond project success” (Majewski, 2017, p. 1). There are many benefits of lean, but for the case of this analysis the most important three benefits include more efficient business processes, reduced lead times, and predictable delivery of customer value (Majewski, 2017).

The first benefit of improving business processes leads directly to improving service to the customer. The service to the customer is the outcome of the business process. Therefore, if the business process improves, the delivery to the customer will be improved as well. Secondly, lean tools reducing lead times. These reduced lead times can directly impact improved delivery of materials to customers. Third, when a process is repeated the same way repeatedly with positive results, the predictability of customer value improves (Majewski, 2017).

Tools of lean. This is a summary of the tools, but there are many books dedicated to the subject. One must really understand all the tools of lean, have a lean expert in the organization, and have the lean methodology engrained in the culture to see the full effects of its benefits. This research looked at five main lean topics including the process maps, value add verses waste, time studies, gap analysis, and 5 Why’s.

Process maps are a critical part of the lean thinking. The process map is a pictorial image of the actual flow of material through a process. It will show the value add steps with the

estimated time it takes to complete the step, along with the waste noted in time or inventory between the steps (Liker, 2004, p. 303).

Each step in a process can then be categorized into value add or waste. Value add is the part of the process that uses resources like money, materials, labor, time and information to complete the step (Taylor, 2018). As opposed to waste which is does not add value to a process. The seven types of wastes include defects, over production, transportation, waiting, inventory, motion and over processing. By knowing the seven wastes the team members know what to look for that is not adding value. These wastes are called out in the process map and need to be eliminated (Liker, 2004, p. 89).

Additionally, time studies can be conducted on steps defined in the process map. A time study is a direct observation technique used to assign an average amount of time a process step takes to complete. A team member is instructed to complete the task at a comfortable pace while the kaizen group measures and records the time it takes to complete the specific tasks. This observation is completed multiple times. Then an average is calculated to create a benchmark that can be compared to other times during the study. If the step is a few seconds or less, the time study approach is difficult to administer. The number of cycles that are required vary depending on the work and the level of accuracy required (Institute of management services, 2018).

The team can also conduct a gap analysis. A gap analysis is a tool to analyze the difference between the target and the anticipated results. The analysis reviews the tasks and the ways the gap might be overcome. It compares the present performance level with that of standard or desired levels (Business Jargons, n.d.)

The 5 Why's is another tool of the lean methodology. 5 Why's is a methodology which is part of the Toyota lean system. It was developed by Sakichi Toyoda, and the technique became an integral part of the lean philosophy (Lean Enterprise Institute, n.d.). This method helps get to the true root cause of a problem. When being applied, the team continues to ask why to a defined problem to get to the root cause. Often the first time the answer to the question of why there is another underlying issue that needs to be reviewed. The idea is the question of why could be asked up to five times before the true root cause has been identified. If the team does not dig deep enough, the solution that is implemented may not bring the desired results because the actual problem still exists (Liker, 2004, p. 46).

Kaizen events. The lean tools are all used in kaizen events. Kaizen is the term used in lean that means continuous improvement. The kaizen event therefore, is a scheduled meeting for a team to evaluate a problem and looking for possible solutions. The team consists of cross functional roles. This allows for expertise that can be brought in from outside the traditional department boundaries, and it allows for new ideas to form (Liker, 2004, p. 278).

Kaizen events identify activities in the process that are not adding value to the product. Effective management of gaps in the process can reduce inventory and operating costs while increasing capacity and profitability (King, 2011). Gaps are anything in the process that are slowing down productivity and adding waste. Many gaps can be solved by simply empowering employees to make minor decision in the immediate work areas.

Lean principles state that leadership should give their employees free rein in terms of minor decision making to avoid requiring manager approval on small changes that would not impact the company in a drastic way (Miksen, 2017). The kaizen team consists of member from the organization with all different types of backgrounds and positions. The diversity of these

combined backgrounds creates a cross functional group that that has both process expertise and a fresh perspective.

Standard work. Standard work is the foundation needed for lean thinking. Standard work is the process in which no matter who performs the task, or when the task is performed, it is performed the same exact way each time. It involves documenting the best practice (Lean Enterprise Institute, n.d.)

The benefits “include documentation of the process for all shifts, reductions in variability, easier training of new operators, reductions in injuries and strain, and a baseline for improvement activities...There is added discipline to the culture, supports audits, and promotes problem solving” (Lean Enterprise Institute, n.d., p. 1).

A control plan helps ensure the quality and speed of a process is repeated over a long period of time. It is a method of documenting the elements that are to be implemented in order to assure quality standards are met. The intent of the control plan is to formalize and document that will be utilized. Part of the control plan can include the standard work, and next steps needed to ensure a process remains in place, and the team does not revert to old practices and behaviors (Six Sigma Daily, 2012).

Improving on a standardized process is a continuous effort, as technology and markets evolve so do the needs of the processes. Many times, the easiest way to increase productivity is to invest in new technologies that make the work easier on employees (Lean Enterprise Institute, n.d., p. 1).

Summary

From the literature review detailed within this chapter, it was apparent how important it is to deliver orders on time to meet customer expectations, and how lean tools and standard work

can help ensure Company XYZ drive towards success. Every company in the service industry needs to differentiate itself to compete and grow. In today's market, it is more important than ever to ensure expedient processes and the fastest delivery to customers. Otherwise, the customers will go to the competitor who can deliver faster.

Many industries can implement lean manufacturing techniques with the intent of becoming more efficient. Lean manufacturing is not a new concept with its foundation built in the early assembly lines of Henry Ford. Then Toyota developed them further into the Toyota Production System which is a now a major standard in which other company's benchmark against (Strategos, 2016).

Utilizing lean manufacturing tools such as process maps, value add verses waste, time studies, gap analysis, and 5 Why's will allow Company XYZ to eliminate waste and improve speed of delivery to the customer. Then by adapting a standard work and continuous improvement approach, the organization can remain competitive and gain market share.

Chapter III: Methodology

This study focused on ways to improve the amount of time it takes to fill a customer order. The start time was at the point when a customer order was received for a service part, and the end time is when the order is shipped out the door of the company. The goal was to find steps in the process which could be modified to shorten the overall process time. The ultimate intention of this study was also to find ways to implement standard work to ensure the improved process steps would be repeatable, after the study was complete.

Chapter II identified two focus areas including customer service expectations and lean methodology which supported this study. These focus areas were researched to provide background information and develop a better understanding of the external reasons delays can no longer be acceptable, and describe the impact lean methodologies can have within an organization.

This chapter includes the data collection and analysis methodology that supported the purpose of the study. It described the lean principles used to gather data within the process, analyze the data to identify which steps needed to be improved, the tools used to document the study. This chapter contains the details of data collection to data analysis. It also describes the specifics of how the kaizen event, Gemba walk, the process map, time study, 5 Why's and gap analysis were conducted. This chapter clearly lays out a step by step guide to the methodology used for this study in such detail that it could be replicated by others as needed.

Data Collection and Analysis

Historical results were evaluated to determine if the order fulfillment process was in statistical control and what to expect if no action was taken to improve the system. A run chart was developed with data from 2018 for the entire company for time it took to fill customer

orders. The run chart was used to determine the average for 2018 by month. The run chart was developed from data stored in the company's data warehouse system. The data was displayed in a chart like Table 1. Since the purpose of the study was to reduce this number, past performance was useful in supporting the study. The actual data was entered in a spreadsheet and the results included in Chapter IV.

Table 1

Example of Time it Took to Fill Customer Orders

Month	Order count	Days
Jan-18	0	0
Feb-18	0	0
Mar-18	0	0
Apr-18	0	0
May-18	0	0
Jun-18	0	0
Jul-18	0	0

Kaizen Event

A kaizen event was created to last one business day. It started at 8:00 a.m. and ended by 5:00 p.m. with a fifteen minute break in the morning and in the afternoon, along with a hour break mid-day for lunch. The event included a cross functional group of employees from supply planning, material management, and shipping and receiving. Bringing together the diverse team helped to bring process experts for each step in the process.

The event started promptly at 8:00 a.m. Since the team had already been working together for quite some time, no introductions were needed for this event. The first thirty

minutes of the meeting was to share an overview of the problem statement and purpose of the event. The next thirty minutes were spent discussing what the team was going to achieve during the event.

The events of the day included creating a map of the current process, and collecting time studies of each step in the process to identify the steps which could be improved. Lean tools that were used included the Gemba walk, 5 Why's, gap analysis, and seven wastes. By the end of the day the team defined the improvements to be made, documented the actions to be taken, who will take them, and when they will be done. The timeline of these activities for the day were set as in Table 2.

Table 2

Example of Timeline of Activities for the Kaizen Event

Start Time	End Time	Activity
8:00	9:00	Overview & Set agenda
9:00	9:45	Create process map
9:45	10:00	-15 min break-
10:00	12:00	Time studies
12:00	1:00	-Lunch break-
1:00	1:30	Gemba walk
1:30	2:30	Gap analysis & 5 Why's
2:30	2:45	-15 min break-
2:45	4:30	Define improvements and next steps
4:30	5:00	Wrap up & Adjourn

Process Map

After the objective and overview of the kaizen event was discussed, the second task was to document the current state process map. The team started at the beginning of the process. The first step was established as the receipt of the customer order. The process steps were fully defined all the way to the end of the process when the order was shipped and left the building. Figure 1 shows an example process map.

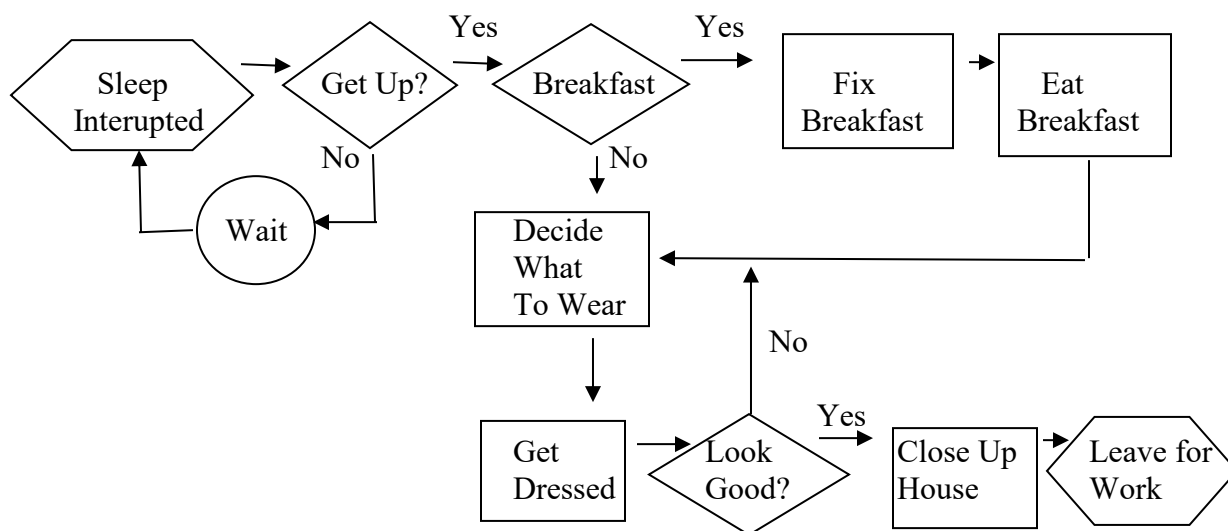


Figure 1. Example of a process map.

Time Study

After all the steps were defined in the process map, the team began the time study. During this phase, documentation was gathered to define how long each in the process took on average, over the past six months. If documentation was not able to be gathered, it was determined a sample time study would occur before the Gemba Walk. For each step in the process map, the step would need to be measured at least three times to gather an average. This would either be done by watching the operator perform the step while the observer is used a stop watch to track and document the time, or by reviewing dates in a report to calculate average days. An example of tracking documentation is shown in Table 3.

Table 3

Example of Tracking Documentation

Activity	Repetition	Total Time
a	1	0
	2	0
	3	0
b	1	0
	2	0
	3	0

Seven Wastes

The seven wastes were a focus of this study by the kaizen team. By identifying and eliminating waste, the company had the opportunity to increase customer order fill rates. Waste was identified early in the study by the amount of time an order was not being worked. Figure 2 shows the seven wastes and descriptions the team used during the event.

Types of Waste	Description of Waste
Defects	Unusable or reworked material
Over Production	Creating more material than the customer needs
Transportation	Movement of products or parts
Waiting	Delays in the process because material is not available or the next step is not ready
Inventory	Work in process, raw materials or finished good materials
Motion	Any movement that is not adding value
Over Processing	Adding more value than is needed for the customers' requirements

Figure 2. Example of seven wastes.**Gemba Walk**

After the process map and time study were complete, the team proceeded out to the shop floor. This is where the all service parts are stored, and the door for shipping and receiving is

located. The goal of the walk was to gain more insight by the team with real time, in-person observations. The team was instructed to walk the floor observing the flow of materials from receiving, storage, to order selection and fulfillment, to final shipment of the order. Each person took notes and documented opportunities observed on post-it pads. The notes had to be one thought per post-it and assigned to one of the following three categories: observation, opportunity, or potential solution. Each note had to list the individuals name who had the thought so follow up questions could be asked.

Following the Gemba walk, the team proceeded back into the conference room to share their learnings. The team was asked to place their sticky notes on a visual board for the rest of the team to see. An example of the Gemba walk visual board is pictured in Figure 3.



Figure 3. Example of visual board.

Gap Analysis and 5 Why's

The team was then instructed to focus on the gaps identified in the process and what could be done differently to improve the process. The observations were turned into gaps on the process map. The gaps were identified on the process map by stars with a number and short description of gap or failure mode.

During the sharing of the gap analysis, the team was encouraged to use the 5 Why's approach to truly define the root cause of the gap. This meant others on the team would ask each other why a step or event was happening the way it was today. If the team member felt there was more to uncover, the why question could be asked again, until the true root cause of the gap was identified. The root cause was determined when all team members felt there was no more to uncover by asking the question of why.

After the gaps were identified and added to the process map, the team went back to the visual board to review and discuss the possible solutions. The team tied each solution to a numbered gap. If there was a gap with no possible solution, the team discussed ideas together and added these to the visual board.

When all gaps had a solution the team then took a vote to identify the top solution combinations to prioritize first. Each team member received two votes, which were noted by a smiley face sticker. Each team member was asked to put their smiley face sticker on the gap/solution they felt needed to be prioritized first. The gap or solution with the most sticker votes was moved to the top of the priority list, and the solutions with the least number of votes moved to the bottom of the list.

The list was then converted to an excel spreadsheet and put in order of priority. The team then added an owner to each solution, and estimated timing of completion. If additional resources would be needed, that was noted as well and the kaizen leader would take the action to request those resources to support.

The kaizen leader wrapped up the event by summarizing the problem the team addressed, the activities the team went through, and solution steps which will be taken forward. The notes were shared via email as documentation and the kaizen leader planned to set a follow up meeting

in a month to review the progress of each solution. Monthly meetings continued until the fixes were completely in place and part of the standard work.

Tracking Results

To ensure progress was being achieved, the leader had to track the results. To track the results, the data collection was to be continued monthly for all of 2019. The run chart used at the beginning of the study to determine the average for 2018 by month, was also used in 2019 as the study was being conducted and following changes that were implemented. The new data of was then compared the earlier data collected. The run chart was developed from the same data stored in the company's data warehouse system. The data was displayed in a chart like Table 1. The actual data was entered in a spreadsheet and the results included in Chapter IV.

Summary

In Summary, this chapter explains the methodology used while conducting the study at Company XYZ to improve the time it takes to fill a customer order for service parts. The study focused on utilizing the lean principles. The order fulfillment process was analyzed by a cross functional kaizen team made up of employees from different areas of the organization. The baseline data was collected and the kaizen event was planned. Tasked with finding waste in the process the kaizen team mapped out the current process and completed time studies. They then identified gaps and ideas on the Gemba walk, while using the seven wastes and 5 Why's. Following the walk and gap identification, the team then brainstormed solutions to solve the gaps. These solutions were then ranked in order of priority to fix, assigned owners, and deadlines. Through continued data gathering the leader could track the results against the baseline data gathered earlier in the study.

Chapter IV: Results

This study focused on ways to improve the amount of time it takes to fill a customer order. The start time was at the point when a customer order was received for a service part, and the end time is when the order is shipped out the door of the company. The goal was to find steps in the process which could be modified to shorten the overall process time. The ultimate intention of this study was also to find ways to implement standard work, to ensure the improved process steps would be repeatable, after the study was complete.

Chapter II identified two focus areas including customer service expectations and lean methodology which supported this study. These focus areas were researched to provide background information and develop a better understanding of the external reasons delays can no longer be acceptable, and describe the impact lean methodologies can have within an organization.

Chapter III described the data collection and analysis methodology which supported the purpose of the study. It described the lean principles used to gather data within the process, analyze the data to identify which steps needed to be improved, and the tools used to document the study.

This chapter will review the results of the data collection, kaizen event, Gemba walk, process map, time study, 5 Why's and gap analysis. These results were gathered using the same methodology described in Chapter III.

Data Collection and Analysis

Historical results were evaluated to determine if the order fulfillment process was in statistical control and what to expect if no action was taken to improve the system. A run chart was developed with past data from 2018 for the entire company for time it took, to fill customer

orders. The run chart was developed from data stored in the company's data warehouse system. The data is displayed in Table 4. Since the purpose of the study was to reduce this number, past performance was useful in supporting the study.

Table 4

Time it Took to Fill Customer Orders

Month	Order Count	Average Days
Jan-18	3280	8.81
Feb-18	3120	5.76
Mar-18	2610	3.11
Apr-18	3970	3.14
May-18	3190	2.35
Jun-18	3300	2.45
Jul-18	2750	3.01
Aug-18	4120	3.54
Sept-18	2900	1.68
Oct-18	3670	1.61
Nov-18	4280	1.50
Dec-18	3600	1.69

Kaizen Event

A kaizen event was created to last one business day. It started at 8:00 a.m. and ended by 5:00 p.m. with a fifteen minute break in the morning and in the afternoon, along with a hour break mid-day for lunch. The event included a cross functional group of employees from supply planning, material management, and shipping and receiving. Bringing together the diverse team helped to bring process experts for each step in the process.

The event started promptly at 8:00 a.m. Since the team had already been working together for quite some time, no introductions were needed for this event. The first thirty minutes of the meeting were used to share an overview of the problem statement and purpose of the event. The next thirty minutes were spent discussing what the team was going to achieve during the event.

The events of the day included creating a map of the current process, and collecting time studies, of each step in the process to identify the steps which could be improved. Lean tools which were used included the Gemba walk, 5 Why's, gap analysis, and seven wastes. By the end of the day the team defined the improvements to be made, documented the actions to be taken, who will take them, and when they will be done. The timeline of these activities for the day were set as in Table 5.

Table 5

Timeline of Activities for the Kaizen Event

Start Time	End Time	Activity
8:00	9:00	Overview & Set agenda
9:00	9:45	Create process map
9:45	10:00	-15 min break-
10:00	12:00	Time studies
12:00	1:00	-Lunch break-
1:00	1:30	Gemba walk
1:30	2:30	Gap analysis & 5 Why's
2:30	2:45	-15 min break-
2:45	4:30	Define improvements and next steps
4:30	5:00	Wrap up & Adjourn

Process Map

After the objective and overview of the kaizen event was discussed, the second task was to document the current state process map. The team started at the beginning of the process. The first step was established as the receipt of the customer order. The process steps were fully defined all the way to the end of the process, when the order was shipped, and left the building. Figure 4 shows an example process map.

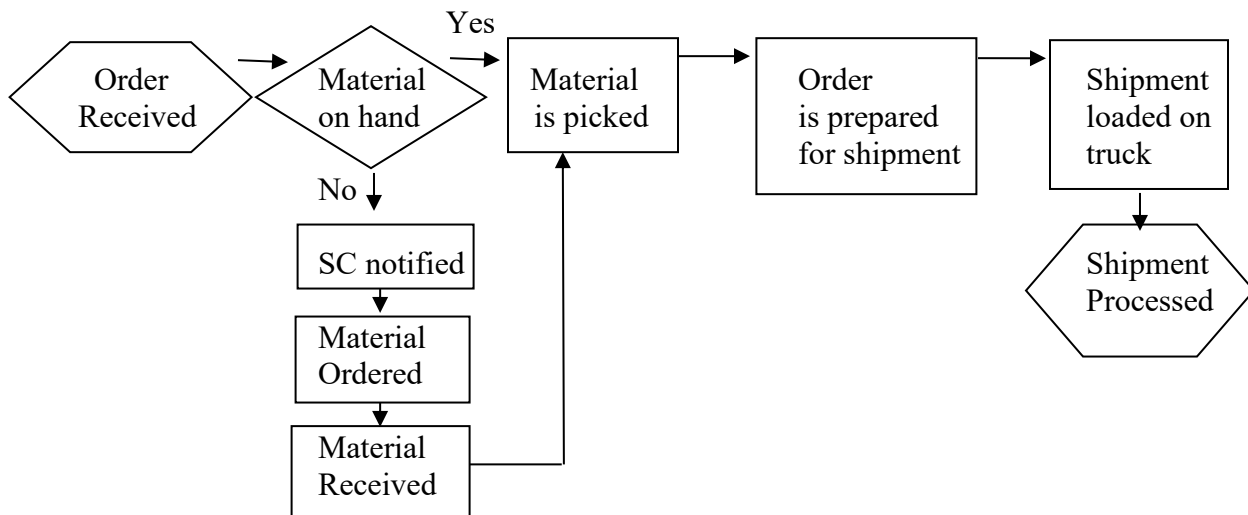


Figure 4. Process map.

Time Study

After all the steps were defined in the process map, the team began the time study. During this phase, documentation was gathered to define how long each step in the process took on average, over the past six months. If documentation was not able to be gathered, it was determined a sample time study would occur before the Gemba Walk. For each step in the process map, the step would need to be measured at least three times to gather an average. This would either be done by watching the operator perform the step while the observer is used a stop

watch to track and document the time, or by reviewing dates in a report to calculate average days. An example of tracking documentation is shown in Table 6.

Table 6

Tracking Documentation

Activity	Repetition	Total Time
SC Notified when material is unavailable	1	8.5 hours
	2	2 hours
	3	6 hours
Material Ordered & Received	1	11 days
	2	12 days
	3	18 days
Material Picked & Shipped	1	30 minutes
	2	27 minutes
	3	31 minutes

Seven Wastes

The seven wastes were a focus of this study by the kaizen team. By identifying and eliminating waste, the company had the opportunity to increase customer order fill rates. Waste was identified early in the study by the amount of time an order was not being worked. Figure 5 shows the seven wastes and descriptions the team used during the event.

Types of Waste	Description of Waste
Defects	Unusable or reworked material
Over Production	Creating more material than the customer needs
Transportation	Movement of products or parts
Waiting	Delays in the process because material is not available or the next step is not ready
Inventory	Work in process, raw materials or finished good materials
Motion	Any movement that is not adding value
Over Processing	Adding more value than is needed for the customers' requirements

Figure 5. Seven wastes.

Gemba Walk

After the process map and time study were complete, the team proceeded out to the shop floor. This is where all the service parts are stored, and the door for shipping and receiving is located. The goal of the walk was to gain more insight by the team with real time, in-person observations. The team was instructed to walk the floor observing the flow of materials from receiving, storage, to order selection and fulfillment, to final shipment of the order. Each person took notes and documented opportunities observed on post-it pads. The notes had to be one thought per post-it and assigned to one of the following three categories: observation, opportunity, or potential solution. Each note had to list the individuals name who had the thought so follow up questions could be asked.

Following the Gemba walk, the team proceeded back into the conference room to share their learnings. The team was asked to place their sticky notes on a visual board for the rest of the team to see. An example of the Gemba walk visual board is pictured in Figure 6.

<p>Opportunities</p> <ul style="list-style-type: none"> *Faster pick time *Better storage methods *Improved clerk efficiencies *Improved alert to SC when material is not available 	<p>Solutions</p> <ul style="list-style-type: none"> *Tracker of orders processed per shift *Automated system to show what bin stores what material *Automated alert to SC when material is not found
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Figure 6. Visual board.

Gap Analysis and 5 Why's

The team was then instructed to focus on the gaps identified in the process and what could be done differently to improve the process. The observations were turned into gaps on the process map. The gaps were identified on the process map by stars with a number and short description of gap or failure mode.

During the sharing of the gap analysis, the team was encouraged to use the 5 Why's approach to truly define the root cause of the gap. This meant others on the team would ask each other why a step or event was happening the way it was today. If the team member felt there was more to uncover, the why question could be asked again, until the true root cause of the gap was identified. The root cause was determined when all team members felt there was no more to uncover by asking the question of why.

After the gaps were identified and added to the process map, the team went back to the visual board to review and discuss the possible solutions. The team tied each solution to a numbered gap. When all gaps had a solution the team then took a vote to identify the top

solution combinations to prioritize first. Each team member received two votes, which were noted by a smiley face sticker. Each team member was asked to put their smiley face sticker on the solution they felt needed to be prioritized first. The solution with the most sticker votes was moved to the top of the priority list, and the solutions with the least number of votes moved to the bottom of the list.

The list was then converted to an excel spreadsheet and put in order of priority. The top item was automated alert to supply chain when material was not found. The second solution was to create a tracker of orders processed per shift. Lastly the team voted to have an automated system to show what bin stores what material. The team then added an owner to each solution, and estimated timing of completion. Additional information technology resources were noted for all three items.

The kaizen leader wrapped up the event by summarizing the problem the team addressed, the activities the team went through, and solution steps which will be taken forward. The notes were shared via email as documentation and the kaizen leader planned to set a follow up meeting in a month to review the progress of each solution. Monthly meetings continued until the fixes were completely in place and part of the standard work.

Tracking Results

To ensure progress was being achieved, the leader tracked the results. To track the results, the data collection was to be continued monthly for all of 2019. The run chart used at the beginning of the study to determine the average for 2018, was also used in 2019 as the study was being conducted and following changes that were implemented. The new data was then compared the earlier data collected, and is shown in Table 7. The data was pulled from the same data stored in the company's data warehouse system.

The data shows continuous improvement from January 2018 at almost 9 days, to February 2019 of less than 1 day to fill customer orders. The largest variable which impacted the longer fill time was caused by not having the inventory on hand when the customer ordered the product. When the improvements were implemented the results showed the success of the team's efforts.

Table 7

Time it Took to Fill Customer Orders

Month	Order Count	Average Days
Jan-18	3280	8.81
Feb-18	3120	5.76
Mar-18	2610	3.11
Apr-18	3970	3.14
May-18	3190	2.35
Jun-18	3300	2.45
Jul-18	2750	3.01
Aug-18	4120	3.54
Sept-18	2900	1.68
Oct-18	3670	1.61
Nov-18	4280	1.50
Dec-18	3600	1.69
Jan-19	4280	1.50
Feb-19	3010	0.56

Summary

In Summary, this chapter explained the methodology used and actual results of the study at Company XYZ to improve the time it takes to fill a customer order for service parts. The

study focused on utilizing the lean principles. The order fulfillment process was analyzed by a cross functional kaizen team made up of employees from different areas of the organization. The baseline data was collected and the kaizen event was planned. Tasked with finding waste in the process the kaizen team mapped out the current process and completed time studies. They then identified gaps and ideas on the Gemba walk, while using the seven wastes and 5 Why's. Following the walk and gap identification, the team then brainstormed solutions to solve the gaps.

The top item was automated alert to SC when material was not found. The second solution was to create a tracker of orders processed per shift. Lastly the team voted to have an automated system to show what bin stores what material. These solutions were then ranked in order of priority to fix, assigned owners, and deadlines. Through continued data gathering the leader could track the results against the baseline data gathered earlier in the study.

Chapter V: Discussion

Company XYZ was struggling to meet customer expectations when filling orders for service parts, in the United States. It was taking more than eight days to fill and ship an order once the customer order was received. The purpose of this study was to identify what was happening in each step of the order fulfillment process, benchmark external research, collect internal data, and analyze all the data to find the root cause of the delays. The main objective was to propose possible solutions of what needed to be done next at Company XYZ to fill customer orders in two days or less.

Chapter I discussed the business background of Company XYZ including the organizations demographics, structure, and focus. As a 25 year old company, with \$2 billion dollars in annual revenue, the organization could not afford to overlook this growing problem with delays in shipping service parts to the United States customers. The market was driving customers to expect product to ship within one to two days, but Company XYZ was taking longer than eight days. Also, this chapter shared the purpose of the study, the assumptions, terms, methodology and limitations of the study.

Chapter II reviewed the related literature in the study. From the literature review detailed within this chapter, it was apparent how important it was to deliver orders on time to meet customer expectations, and how lean tools and standard work can help ensure Company XYZ drive towards success. Every company in the service industry needs to differentiate itself, to compete and grow. In today's market, it is more important than ever to ensure expedient processes and the fastest delivery to customers. Otherwise, the customers will go to the competitor who can deliver faster.

Chapter III detailed the different methodologies used to achieve the desired results of the study. The study focused on utilizing the lean principles. The order fulfillment process was analyzed by a cross functional kaizen team made up of employees from different areas of the organization. The baseline data was collected and the kaizen event was planned. Tasked with finding waste in the process the kaizen team mapped out the current process and completed time studies. They then identified gaps and ideas on the Gemba walk, while using the seven wastes and 5 Why's. Following the walk and gap identification, the team then brainstormed solutions to solve the gaps. These solutions were then ranked in order of priority to fix, assigned owners, and deadlines. Through continued data gathering the leader could track the results against the baseline data gathered earlier in the study. The analysis of the current state was determined as a baseline for measuring the improvement of the future state.

Chapter IV presented the results of the study. In Summary, this chapter explained the methodology used and actual results of the study at Company XYZ to improve the time it takes to fill a customer order for service parts. It highlighted details of the current practices, and the solutions to make improvements to be able to ship customer service parts within two days. By using tables, process maps, time studies, seven wastes, Gemba walk, and gap analysis it was evident the team needed to improve the alert process to supply chain, when material for an order could not be found, track orders processed per shift, and improve the system to track inventory storage locations. Over the course of a year, the organization moved from an average of over eight days to less than one day.

Limitations

Only data from Company XYZ was used in this study. Also, this study was limited to only data collected from the location in Minnesota for domestic shipments to the main 48 states

in the United States. It was limited to the current process, and was also limited to orders received from 2018 and later. The study was also limited to only orders received for parts stocked at the facility. It did not include customer orders received for parts the location did not stock. Furthermore, the study focused only on improving the metrics for customer orders for parts, not for repair. These limitations helped to define the scope of the study, and had no negative impacts on the study.

Conclusion

The kaizen team at Company XYZ identified three main opportunities to improve the time it takes to fill customer orders. Tasked with finding waste in the process the kaizen team mapped out the current process and completed time studies. They then identified gaps and ideas on the Gemba walk, while using the seven wastes and 5 Why's. Following the walk and gap identification, the team then brainstormed solutions to solve the gaps.

The three main opportunities identified in the study which needed to be improved included the alert process to supply chain when material for an order could not be found, track orders processed per shift, and improve the system to track inventory storage locations. Of the three areas, the main delay was caused by the failure to alert supply chain when material for an order could not be found. This added days or weeks to the time it took, to fill a customer order, because if the inventory was not on hand, supply chain needed to be alerted, place the order, and have the vendor fill the order. By ensuring material was on hand of all parts and signaling to supply chain when material was getting low before material was completely out, these orders were no longer delayed to the customer. Over the course of a year, the organization moved from an average of over eight days to less than one day.

The other two improvement areas, tracking orders per shift and improved tracking of inventory storage locations via a visual management system, also added value to the process. Tracking orders per shift allowed the operators to hold themselves accountable for the work they could get done per shift. The improved tracking of inventory storage locations allowed the operators to pull parts more efficiently. It also allowed supply chain to monitor stocking levels and place orders for more parts when stock was getting low, to avoid stock out situations. The two tracking system improvements were added to the companies standard operating procedures to ensure a strong control plan and sustained improvements in the future. Overall the three improvements have improved the order fulfillment process and customer satisfaction.

Recommendations

The customer service industry is very competitive. Company XYZ should continue to use kaizen teams to study the processes, benchmark other companies, and continuously improve the operations. They should keep the customer as the focus of all future studies. This will ensure the company continues to meet or exceed customer expectations to have them come back as repeat customers.

Going forward, Company XYZ should continue to follow the new standard operating procedures. They should also plan to conduct kaizen events at least annually. The findings from this study can be used as a foundation for showing the team how the lean tools can allow for the teams to continuously improve the operations to meet and exceed customer expectations.

Company XYZ needs to adapt and drive a culture focusing on lean manufacturing and company growth. Continuously studying the existing processes and testing new ways to improve efficiencies would help drive growth and gain market share. Employee acceptance will be a major hurdle to this new culture. Through the kaizen event there were some employees which

were resistant to the new thought process. Management should continue to drive and reward the lean initiative. They should celebrate the success of this project, and share the best practice across the company to motivate employees. The kaizen event should be duplicated across all the functional areas in the company. Small rewards along with company recognition should be given to all employees which submit ideas, to enhance the continuous improvement culture at Company XYZ.

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