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Lean Management for Small Business

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LEAN MANAGEMENT FOR SMALL BUSINESS

By

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Abstract

Lean management can be utilized to grow small business by focusing on continuous improvement. Lean management and the tools associated with it will improve the efficiency of any business and that will lead to improved sales and overall growth. This innovative idea has become a significant form of performing every action as efficiently as possible in order to increase production and reduce waste throughout the world in many different types of industries. Lean management is synonymous with continuous improvement. This is the idea that no process can ever be entirely perfected so there is always room for improvement. By focusing on continuous improvement, any business, whether it is a large manufacturing company or a small retail shop, should be able to reduce waste and improve perpetually. This paper will discuss the tools that are associated with a well-designed Lean management program. Some of the more effective tools are “5S”, the Deming Wheel (PDCA), Root Cause Analysis, and Value Stream Mapping. These are just a few of the tools that can be used to promote continuous improvement.

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Introduction

Proper management is essential to any business's success. Without some form of management, most businesses would fail immediately. Most businesses fail even with a planned management strategy. In some cases, this is because they chose the wrong management style or just didn't know how to properly implement the plan. The trick is to find the management style that best suits the organization.

Lean Management (LM) is a management style that focuses on efficiency and waste reduction. Lean Management was developed in Japan, in the Toyota's plants, and then - copied by organizations from around the world (Parkes, 2015, p.106). While being developed in Japan's auto industry, the originators drew upon inspiration from the early works of Henry Ford, who is considered to be the pioneer of the assembly line method of manufacturing. According to the Lean Enterprise Institute, "he married consistently interchangeable parts with standard work and moving conveyance to create what he called flow production". However, it is believed, that the key to success of Ford's mass production was not the conveyor belt, but the interchangeability of the parts and the simplicity of assembly, as a result of which the introduction of conveyor belt was possible. Among other innovations, H. Ford introduced the reduction of activities required from the single worker, which led to a large cost reduction, as well (Parkes, 2015, p.109).

Some of the top executives at Toyota took notice of this and after visiting different manufacturing facilities and studying the methods of manufacturing that was being used, they came up with the Toyota Production System. According to Parkes (2015), some examples of these borrowings are presented below:

- Kiichiro Toyoda, after visiting America and Great Britain, used the acquired knowledge in terms of the production of cars and machinery (Liker & Ogden 2011, pp. 40-41) or Ford's flow production system (Jakonis 2012, Dennis 2002, pp. 3-6),

- Taichii Ohno borrowed the concept of production pull system, based on the American supermarkets' organization concept,

- and connected the above-mentioned with Sakichi Toyoda's invention of the motor – driven loom, which is considered to be the prototype of jidoka i automation (Jakonis 2012),

- as well as borrowing the concept of work standardization, etc. (Ohno 1988).

The thought process of lean was thoroughly described by Womack, Jones and Roos in the early 1990's in their book *The Machine That Changed the World* (1990). In a subsequent volume, *Lean Thinking* Womack and Jones (1996) distilled these lean principles even further to five:

- Specify the value desired by the customer
- Identify the value stream for each product providing that value and challenge all of the wasted steps (generally nine out of ten) currently necessary to provide it
- Make the product flow continuously through the remaining value-added steps
- Introduce pull between all steps where continuous flow is possible
- Manage toward perfection so that the number of steps and the amount of time and information needed to serve the customer continually falls (*A Brief History of Lean*, n.d).

Lean management is a combination of several different elements. The first being Total Quality Control (TQC). TQC is characterized as one of the Japanese manufacturing techniques, which is based on the assumption that quality has its origins at the beginning of

production process and requires “a habit of continuous improvement” (Schonberger 1982, p. 47). Quality should be the number one priority regardless of the type of business. The focus on quality is, in Japanese society, connected with the collective striving for perfection. According to Parkes (2015), Japanese society is characterized as homogeneous; nevertheless, it is “just the homogeneity which decides on searching for qualitative differences, producing incredible diversity of goods and allowing every participant of the production process to stand for a different vision of excellence, so that the finished product could be characterized by excellence in many respects”

The next element is Total Quality Management (TQM). Total Quality Management (TQM) relies on “continuous improvement of every action at every level of organization, with every employee’s involvement, so the quality improvement itself is going to be a purpose of the company’s activity” (Parkes, 2015, p.111-112). Everyone from the front-line production worker all the way to the upper management should be focused on quality and the continuous improvement of every process within the company. In the process of continuous improvement, the quality is a priority, more important than cost reduction or implementation of on time delivery system (Parkes, 2015, p. 112). This ideal should create a culture that is striving for improvement every day. The company’s culture impacts everything. If the company breeds an environment of improvement and everyone working towards a positive common goal, then the business should continue to grow in the right direction. Should a culture of negativity or apathy be allowed to set in, progress will stall or halt which could impact production, sales and the general morale of all the employees. That is why a positive culture with common goals between management and employees should always be emphasized. This culture subordinates the activities whose aim is to continuously improve the work effectiveness, flexibility and

effectiveness of the processes, which lead to increased competitiveness of the organization (Parkes, 2015, p.112).

There are a multitude of different types of tools that can be used for lean management to be more productive and discover and eliminate sources of waste. Waste and inefficiency are detractors from any size business. The implementation of Lean management in any business requires using some or all the tools that were created for this system to ensure continuous improvement. This paper will introduce the core concepts and ideas of each of those tools and discuss how each should be implemented to increase efficiency. The most common tools of a lean management program are as follows:

- Plan, Do, Check, Act (P.D.C.A).
- Kaizen events.
- Value Stream Mapping.
- 5S.
- Continuous flow.
- Mistake proofing (poka yoke).
- Root cause analysis.
- And Standardized work.

Each of these tools contribute to a well-designed lean management program. When combined with a positive culture focused on continuous improvement, these tools will promote growth and reduce waste.

Literature Review

Lizak (2016), summarizes the origins and purpose of Lean Management, what makes up the aspects of Lean Management, and how those aspects are measured and controlled.

Lizak begins with an exploration into the origins of Lean Management. Womack and Jones (as cited in Lizak, 2016), “Lean Management is formulated as a slender approach that shows the way of producing more volume using less - minimizing human labor, reducing the number of devices, as well as saving time and space – all at increased level of meeting the customers’ needs.” Lean Management has been used in companies around the world since it was created in the 1950s by Toyota. According to one of Lizak’s cited sources, it is defined as a set of concepts, principles, procedures, and tools adapted to improve of the production process by reducing waste.

Lizak (2016) states: Lean Management has instruments which by functioning improve implementation of modern management concepts. The first instrument mentioned is 5S, which is an abbreviation for sort, set, shine, standardize and sustain. Total Productive Maintenance (TPM), which purpose is to prevent errors of qualitative nature of the products, the occurrence of equipment failure and the condition required in terms of frequent adjustment (Lizak, 2016). The next instrument is Single Minute Exchange of Die or SMED for short. The author defines this as “retooling of machines and devices in less than 10 minutes”. Lizak (2016), defines the term retooling as the time measured from the last good product produced on the old machine setting to the first good product produced on a new setting of the machine, which should start a mass production. According to Lizak (2016):

The message of Lean is to avoid any kind of waste, reducing the internal functions of a company to what is necessary, and in relation to the manufacturing process, eliminating steps not

adding value to a product. Unnecessary actions lengthen production time and often are results of an organizational mess, causing an additional low-quality production. (p. 33)

The author also states that the financial results of the first two years almost always deteriorate and that the more beneficial metric to use is time. The author states that productivity is also often used to define the effects of lean management. Ulewicz and Mazur (as cited in Lizak, 2016), lists the following measurements of efficiency:

- inventory turnover ratio,
- reduction of shortages,
- reduction of retooling time,
- reduced manufacturing costs
- lead time,
- cycle time,
- reduction of overtime,
- reduction of waste,
- increasing the number of sales of products,
- increase the efficiency of use of the new fund crush-time work,
- increasing the efficiency of machinery and equipment,
- freeing resources - time, effort and materials
- stabilize and standardize processes (re-flow materials, line work, line balancing),
- levelling of production, the organization of the assembly workstation/production,
- improving health and safety.

According to Lizak (2016), “data for these indicators should come from automated records or forms filled by operators” (p. 33).

After having worked in companies that use the Lean Management style, I believe the author’s summation of this management style is very precise. The title of the article, “Methods of measuring the effectiveness of Lean Management”, describes exactly what the author is trying to inform the reader. Lean Management is all about efficiently performing tasks while reducing wasted movements. When done properly, it is extremely effective.

Lizak (2016) clearly defines the origins of Lean Management and briefly examines the main ideas associated with the process. The instruments used to measure the effectiveness of Lean Management are discussed but could have been a little more detailed. The 5S practice, for example, could have been expanded by outlining exactly what is entailed in this instrument. The five S’s stand for set, sort, shine, standardize, and sustain. Explanation of one of the main instruments of Lean Management could have greatly benefited this article.

The author cited most of his information in this article from publications that were only a few years old so most of the information is recent and up to date. The works cited are relevant to the study and there doesn’t appear to be any nonessential information.

Jagusiak-Kocik (2016) defines a continuous improvement process called PDCA or the Deming Wheel. PDCA is an acronym for Plan, Do, Check, Act.

Jagusiak-Kocik (2016) begins with defining the idea of continuous improvement. She states, “continuous improvement is a set of repetitive actions, which are designed to increase the capacity to meet the requirements”. The author then introduces William Edward Deming, the person who is recognized as the creator of the PDCA cycle. It is even referred to as the Deming Wheel. Deming was an American researcher and believed that management staff and all employees should be involved in the process of continuous improvement (2016). According to Jagusiak-Kocik (2016), the PDCA cycle is often designed to solve quality problems and implement new solutions. PDCA model is extremely versatile and it can be successfully used in any type of business. One of Jagusiak-Kocik’s (2016) cited sources states that PDCA cycles can be used in the following situations:

- In the process of continuous improvement.
- During the implementation of changes.
- During a downtime between one phase of a project and the next.
- During the implementation of a new solution.
- During the review of a process improvement (2007).

The first step of PDCA is Plan (P). It sets the objectives for improvement and designs an action plan which will enable this objective (Jagusiak-Kocik, 2016). The problem must first be identified then analyzed to determine the cause or causes affecting it. Then, solutions are generated which leads to development of how to implement the changes.

Step two is Do (D). According to Jagusiak-Kocik (2016), the developed plan in order to make changes in the process is implemented in a company (in order to raise its

productivity or quality and to eliminate the causes of problems). Tools such as an action scheme, benchmarking, flow diagram or check sheet can be used during this step.

Check (C), is the stage that all the changes and implementations are put to the test to see if they are working and sustainable. If the implementation of solutions proved to be appropriate, it is followed by the fourth PDCA cycle step, Act (A), if not, one shall return to step 1. (2016).

According to the author, the last step of the PDCA cycle Act (A) is connected with the application of the implemented solutions. When these solutions are proven, they are considered the norm and lead to standardization and monitoring of the activities. Jagusiak-Kocik (2016) states:

PDCA cycle is contained in a circle and never ends. The knowledge gained from the last stage becomes the basis for the next cycle; improvement is not seen as the end and does not bring satisfaction with the current situation. (p. 20)

The remaining portion of the journal covers the case of a small company that produces decorative elements made of plastics and how this company implemented the PDCA cycle to improve their daily production. This company was experiencing some defects in their products and used PDCA to reduce these defects. The company focused on identifying the source of the problems then collecting data to support their research. According to Jagusiak-Kocik (2016), after identifying the causes which might have affected the problems, the working group also began searching for potential solutions by means of brainstorming. This was part of the Planning step of the Deming Wheel.

Step two, Doing (D), which is connected with implementing the elaborated plan was associated with the removal of the causes of problems happening during the production of photo frames. The company made the necessary changes which resulted in less defective products.

Step three, Checking (C), illustrated that the previous actions had reduced the amount of defects by 60%. In the next step, Act (A), the company started their standardization and monitoring of their activities. In the production hall instructions for employees were displayed in a visible and comprehensible form.

According to Jagusiak-Kocik (2016):

PDCA is contained in a circle and endless which allows to consider all the implemented and applied solutions an indicator for further improvement activities. The company has achieved its objective, which reduced the number of discrepancies by more than 60%, but this should not lead to a halt in the improvement of the production process of photo frames. The next step should include development of a new action plan, or reusing Deming cycle as a cycle for improvement, by which the number of faulty photo frames is reduced compared to that achieved in the shown example. (p.22).

The author cited most of her work to recent publications, so I feel she used the best information available. The works cited are relevant to the study and there doesn't appear to be any nonessential information.

Kowalik (2018), focuses on the Six Sigma method for improving quality in the service process. There is an explanation of the Six Sigma method and an analysis of the measured improvement.

Antony and Banuelas (2001), states the following:

The six sigma, perceived not only as a statistical tool but also as a perspective of business strategy in literature is defined as a method of improving companies' profitability by driving out waste, reducing costs and increasing the efficiency and effectiveness to achieve the goal of meeting customers' expectations.

According to Kowalik (2018), the Six Sigma methodology is based on the DMAIC cycle which can be explained as follows:

- Define – identifying the goals depended on the VOC (voice of customer or their expectations) and the CTQ (service features that are critical to the customers' view of quality).
- Measure - measuring the actual performance of the process, data collection and determining key characteristics and parameters.
- Analyze – analyzing the collected data to determine the causes of the problem that most likely affect the lack of process stability.
- Improve – finding and implementing the solution of identified problems as a result of a selection and choice the one most valuable one to be applied to reduce the process variability.
- Control – guaranteeing continuous process monitoring; successful improvements should be standardized as a base for further actions.

One of the main myths about Six Sigma is that it is only for production or manufacturing and not services. The only shortfall of implementing Six Sigma into the service industries is that it may be difficult to obtain reliable data.

The second part of this article outlines the implementation of the Six Sigma method within a customer service process and analyzes the data gathered to find the amount of improvement that occurred. There is a theoretical algorithm used to calculate the initial sigma value of the customer service process. After the initial value was found, value stream mapping was used to determine what makes up the customer service process. According to the author:

For the purpose of the analysis the process was divided into four main stages: order placing, payment, order printing and delivery for which were indicated potential failures and their causes and effects. Then, occurrence, detection and severity indicators were pointed out for calculation of Risk Priority Number (p. 12).

After these four stages were assessed, survey sheets were given out to customers with 3 statements for which the respondents assigned ratings that indicated their agreement or disagreement and was based on the Likert scale which uses a five point scale with 1 meaning “strongly disagree” and 5 meaning “strongly agree” (Kowalik, 2018, p.12).

According to Kowalik (2018), the first statement was: the customer service staff’s information deficiencies bring down customer’s opinion about the service quality. The data shows that more than a large majority of the respondents strongly agree or agree with that statement.

The next statement referred to efficiency and faultlessness and their influence on service quality. Kowalik (2018) states, “the respondents’ view presents the lack of efficiency and faults occurring during customer service affects the customers’ opinion about quality” (p. 13). The third statement was about the importance of the last stage of customer service and whether it is an important phase and how much it defined the perceived service quality (Kowalik, 2018, p. 13). According to the author, the last phase of customer service should be perceived as an

important one but in comparison with showed previous two aspects its value in the service quality and its improvement is lower (Kowalik, 2018, p. 13).

The data obtained from the surveys showed that there were two main causes that made up nearly 80% of the problems. These are: information flow problems and insufficient training (Kowalik, 2018, p.13). Improving these two areas will greatly improve the customer service process. The article also uses a cause and effect diagram on the issues and an Impact and Effort Matrix to weigh the cost and the benefit of changing each process.

Kowalik's (2018) study found the following:

The results presented in the paper shows that six sigma based on the DMAIC methodology finds practical application in services improvement. Although the necessity of perception six sigma as a level of failures in the service process instead of process variations, six sigma tools are useful for raising level of service quality. (p.15)

The author explained to purpose of Six Sigma and how it can be utilized by a service-oriented business and not just production or manufacturing. Kowalik also demonstrated the tools necessary to validate the findings and provide a measured look into the process results.

Kaizen events are used to determine processes that can be improved on by implementing lean management tools. These can vary in duration from a few days or through several months, depending on the amount of change that is necessary to achieve full efficiency. Usually these events consist of different team members who are asked to contribute and focus on certain tasks. These usually begin with a proposed issue that management suspects is causing waste, either of time, material or capital. In previous events I have taken part in, several people from throughout the production process were asked to gather for a weeklong meeting. Involving people from outside the department that was being improved upon was valuable to bring “fresh eyes” to the situation. Many times, when doing the same task repeatedly, people begin to see that the way they are doing the task is the only way. Bringing in different people will expose these issues. Issues that may be focused on are time waste, movement waste, or any non-value-added procedure. After identifying the issues that may be causing the waste, the teams are usually divided into smaller groups to focus on different parts of the task. This way more work can be covered in the same amount of time.

In a manufacturing setting, the reduction of time of production can add to the reduction of costs associated with that production. A Kaizen event may focus on changes from minor to an overall change of the process. Changing the layout of the workspace can affect the amount of time it takes for a cycle of production. The sequence should be in as straight of a line as possible. Any wasted motion or movement can greatly affect the time cost of each cycle. A few seconds here and there may not sound like it amounts to much, but when considering some facilities work 24 hours a day, these few seconds can lead to minutes or hours of wasted time and lower production rates. These changes are not only for manufacturing but could also be implemented into a retail setting. I use this same continuous flow process in my own business.

I make customized hoses for farm and industrial equipment. The customer generally brings in an old hose that is no longer useable and I make them a new hose or hoses by crimping steel fittings to the same type of hose they brought in. As the customer enters the shop, I meet them at the counter and determine the type and size of the hose they need to replace the old one. Next, I locate the fittings needed to complete the job and then I select the proper hose. The next step is measuring their hose for the total overall length. Cutting the new hose to the appropriate length and temporarily attaching the new fittings to the hose are the last steps before permanently crimping the new fittings to the new hose with an industrial hydraulic crimping machine. Then it is back to the beginning of the cycle to close out the sale. All these steps are configured in a way so that there are no wasted motions. This way, I can provide fast and efficient service to my customers. This type of setup also simplifies the training process for new employees. If there is a single path to follow for learning a cycle of production, it will be easier to teach, and for the employees to learn, than if there were many ways to perform the actions needed complete the task.

Kaizen events are also a great way to create and implement standard operating procedures, or SOP, for each activity that is to be performed. Creating SOPs are an ideal way to make sure that the process is completed in the same efficient manner each time the cycle is performed, regardless of who is doing the task. Here is an example of the SOP that I have implemented in my shop:

Standard Operating Procedure (S.O.P.)

1. Greet the customer as they enter the building. If you are already with a customer, greet the incoming customer and inform them that you will be with them shortly.
2. If needed, put on gloves or other personal protective equipment (PPE).

3. Determine size and type of hose (2 wire, 4 wire, etc.).
4. Determine the size and style of fittings needed. Always double check by finding matching male or female. Always return unused fittings to the proper bin.
5. Write down fitting numbers to be billed out later.
6. Determine appropriate ferrules (AF2, AF4, etc.).
7. Use table, tape measure or the old hose to determine the overall length of hose. (Straight fittings measure from end to end. Any hose with a 90° fitting measures to the center of the bend).
8. Put ferrule and fitting on one end then measure to the appropriate length. Use a marker to indicate the location to cut.
9. Adjust pins in saw to the correct size hose (small hose=pins in close, larger hoses=pins further apart).
10. Use saw to cut on the marked line. (Use eye protection).
11. Put other ferrule and fitting on the open end of the hose. Make sure both fittings are seated correctly.
12. Turn on crimper.
13. Check for the corresponding crimp specs for the size and type of hose being used. Change die and crimp settings when needed.
14. Place hose with fittings through the rear of the crimper and leave @1/4" from the front of die to the top of ferrule. While keeping hands safely away, use the foot pedal to crimp fittings. Once the crimp is complete, use calipers to measure crimp to ensure proper size.
15. Turn off crimper.
16. Bring all hoses to counter to begin checkout.

17. Ask the customer if they have an account. If it is a charge sale, use create invoice function. For cash, check or credit card sale, use create sales receipt. Never invoice to an account that does not have a billing address.

18. Use notes to properly fill out sales or invoices with part numbers and lengths of hose used (Quantities of fittings, ferrules, and length of hose =inches/12). Make sure to tab down to the empty line on sales receipts to get the final total. Always double-check your work.

19. Take payment (cash, check or credit card) and give back change if needed.

20. Print receipt. Add check numbers to sales receipts if needed or purchase order numbers to invoices if needed.

21. Thank the customer.

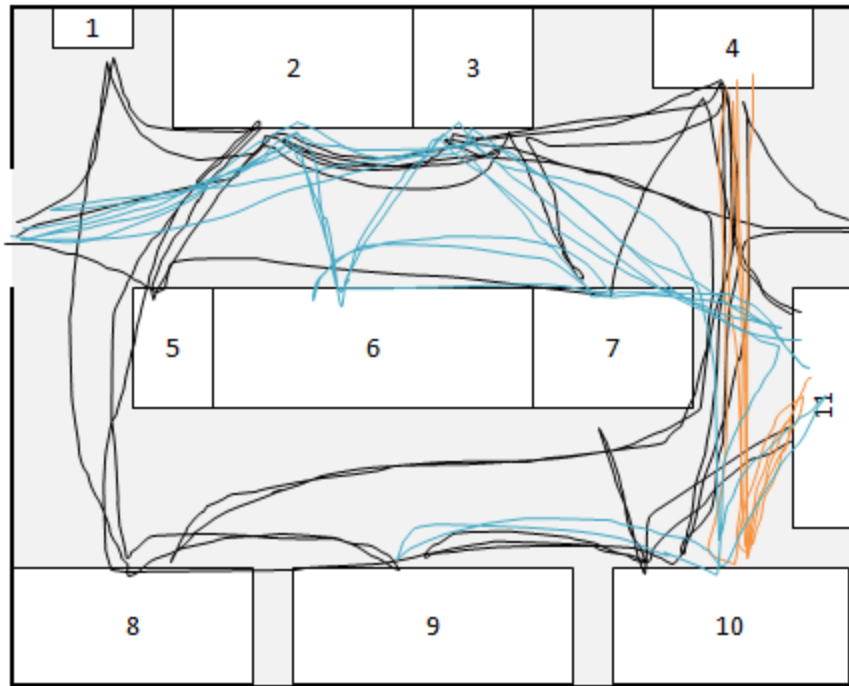
22. Clean up the work area and replace any fittings or hose not used.

I also have a standard operating procedure to use when there aren't any hoses to be made. This details the duties that need to be performed on a daily, weekly and monthly basis.

DAILY	COMPLETED	WEEKLY (SATURDAYS)	INITIAL AND DATE	MONTHLY (last Saturday of the month)	INITIAL AND DATE
SWEEP		CLEAN BATHROOMS.		MOP FLOORS.	
TAKE OUT TRASH (hoses, trash can behind counter, bathroom, and trash can by fittings).		CLEAN BEHIND AND UNDER WORKBENCH.		CLEAN WINDOWS.	
CLEAN COUNTER (front counter, fittings counter).		DUST SHELVES.			
CLEAN WORKBENCHES (saw workbench, crimper table, and metal workbench).		PICK UP TRASH FROM PARKING LOTS(cigarette butts, paper and anything else that doesn't belong).			
STRAIGHTEN UP SHELVES AND BINS(put away any fittings or adapters).					
	DO NOT CHECK OFF UNLESS YOU HAVE COMPLETED THE TASK.				

By having a standard that is clear and concise, no matter the employees experience level, a company can save time and money.

Another tool to use during a Kaizen event is a spaghetti diagram. A spaghetti diagram is a visual representation using a continuous flow line tracing the path of an activity through a process. The continuous flow line enables process team to identify redundancies in the workflow and opportunities to expedite process flow (Kattimani, et al., 2015). For this, the employee will perform the cycle of work in the current manner that they have been doing the task. A member of the Kaizen team will then map out the steps and movements of each movement performed by the employee. This drawing ends up looking like overlapping lines showing the movement pattern of the task cycle. The intent is to identify ways to shorten the walking time from one activity to another for frequently performed tasks. Another benefit is to know areas where many walking paths overlap and are the cause of delay. Waiting is one of the wastes of organization as is unnecessary motion (Kattimani, et al., 2015). Using a stopwatch to time and record length of each line demonstrates the cycle time of each step. The time from the beginning of the process until the end is the cycle time. This will be the time used to gauge the impact of proposed changes at the end of the Kaizen event. Towards the end of the Kaizen, a new spaghetti diagram will be drawn based on the new movement patterns to illustrate the improved path of the work cycle. Removing wasted motions throughout the work cycle should decrease the time allotted to perform the job which will improve the efficiency of the task and allow more total cycles per day. Below is an example of a spaghetti diagram:



One of the best tools to use when the goal is to streamline any process is 5S. According to Omogbai and Salonitis (2017), 5S helps to reduce non-value adding time, increase productivity and improve quality. It has been used in the design of efficient facilities. 5S techniques have been integrated with other lean tools to reduce changeover time. The 5S lean technique can be summarized as follows:

1. Sort- To organize things in order, for ease of storing and retrieval.
2. Set- To designate and clearly label where everything should be stored. Everything should be kept in its rightful place to eliminate the need for searching.
3. Shine- To keep everything clean and neat.
4. Standardize- To document the work methods and make the 5s part of the culture of the organization.
5. Sustain- To form a habit of continuous improvement procedures.

The first “S”, or sort, is basically going through the workstation and removing all items not required to perform the job. Excess clutter can cause downtime and could possibly cause a safety issue, both of which can impact efficiency. The only items left should be the ones that are required to perform the work. These items should also be sorted into order of how they are to be used during the process. This will help to eliminate wasted movements. Sorting is a continual process that needs to be done often to avoid excess materials or items in the work area.

The second “S”, set, is to label every item within the workstation. Items need to perform the work need to be clearly labeled with part numbers or any other references needed. A shadow board can be used for any tools used. Shadow boards are boards that use a different background color in the shape of whatever tool or item belong there. This makes it easy to see when there is an item that is not in its proper place. Labeling and storing items in the proper place each time eliminates downtime by always have the necessary items in the right place each time they are needed. This is a good practice when working with more than one shift so that incoming employees can see if there is anything out of place or missing that they may need during the work process.

Shine is the third “S”. This step is very straightforward. Work areas should always be cleaned to prevent safety issues and to avoid any related downtime. Clutter can impact a worker’s productivity by taking up space and by creating an environment that leads to inefficiency.

The fourth “S” is standardizing. After the first 3 steps are completed, standardizing the process is the best way to have accountability to the process. If there are more than one workstation performing the same type of job, they should all be set up in the same manner with the same flow, items, and tools required to complete the work. This standardization can also be

coupled with the standard operating procedure so that each employee doing the work is doing the work in the same manner. This will lead to more efficiently produced results across all employees and shifts.

The final “S” is to sustain the changes. Once the changes have been made to the process, there shouldn’t be a return to the previous way of doing things. This will ensure that the new process is given all the effort it should and will keep the work moving towards continuous improvement.

5S has been demonstrated to be a simple and non-costly way to achieve tangible benefits of LM. Much effort has been dedicated towards listing ways of how to implement it, even to the extent of detailing the shop floor day-to-day activities (Omogbai & Salonitis, 2017). This is a process that can be repeated as many times as necessary and basically adds no costs to the production, but by implementing this tool properly, overall costs should go down while productivity should go up. 5S audits are used on regular basis to ensure that the changes are being implemented and to monitor and record the results on a graded scale. These audits should be performed by someone other than the employee that works in the area so that the audit is unbiased. The auditor should look for excess clutter, tools or parts out of place, misplaced labels, empty shadow boards and general cleanliness. This is an effective method of maintaining the changes and continuing the effort for improvement.

An example of a 5S audit sheet:

5S AUDIT WORKSHEET

5S Audit Sheet (for workshops)		Workshop name: Score:		Completed by: Previous Score:		Date:			
1S	No	Check item	Description	Score					
				0	1	2	3	4	
SORT	1	Materials or parts	Does the inventory or in-process inventory include and unneeded materials or parts?						
	2	Machines or equipment	Are there any unused machines or other equipment around?						
	3	Jigs, tools, or dies	Are there any unused jigs, tools, dies or similar items around?						
	4	Visual control	Is it obvious which items have been marked as unnecessary?						
	5	Written standards	Has establishing the 5S's left behind any useless standard?						
Sub Total									



0=Very Bad 1=Bad 2= Average 3=Good 4=Very Good



5S Audit Sheet (for workshops)		Workshop name: Score:		Completed by: Previous Score:		Date:			
2S	No	Check item	Description	Score					
				0	1	2	3	4	
SET IN ORDER	6	Location Indicators	Are shelves and other storage areas marked with location indicators and addresses?						
	7	Item Indicators	Do the shelves have signboards showing which items go where?						
	8	Quantity Indicators	Are the maximum and minimum allowable quantities indicated?						
	9	Demarcation of walkways and in-process inventory areas	Are white lines or other markers used to clearly indicate walkways and storage areas?						
	10	Jigs and tools	Are jigs and tools arranged more rationally to facilitate picking them up and returning them?						
Sub Total									



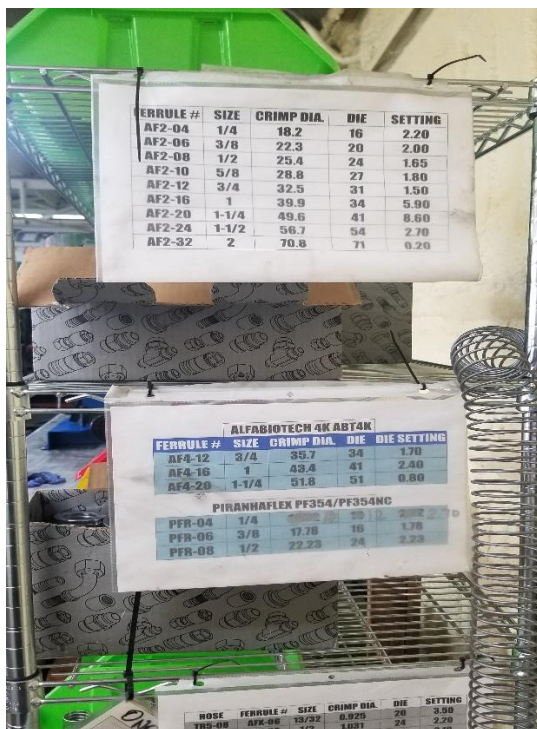
0=Very Bad 1=Bad 2= Average 3=Good 4=Very Good



I implement the 5S process throughout my shop. Removing clutter or non-essential items is done on a regular basis. This frees up valuable space and allows for better control of the shop. Every item in my shop has a label detailing the part number and sometimes a description of the item. Tools are stored properly and readily available for use. This saves time by eliminating the

need to look for tools when they are needed. By keeping my shop clean, it allows for a safer work environment and gives the business a more respectable appearance.

Standardizing my process means having all the pertinent information needed to complete the process of producing hoses for my customers. Each hose is different based on size and type of hose, so it is necessary to have charts that list crimping specifications, ferrules, and finished measurements to ensure that each hose is made to perfection. Without these standards, the hoses made may not work properly and could be returned. This could impact my customer service and could affect my credibility. As a small business that thrives on the ability to provide excellent service and quality, this is the last thing I want.



Pictured above are the crimping specification charts that I have made and have posted next to the crimper. These contain all the information needed to produce a hose to the manufacturer's specifications. This reduces the build time for each hose by having the necessary information available as each hose is made.

Sustaining this process is just a matter of following the steps and performing each action the same each time. Using a 5S audit form each month enables me to see what is working and what may need to be changed. This is also good for my employees so that they are aware of the expectations of how the work should be completed.

During the Kaizen process, finding ways to prevent defects in the products being assembled should be a priority. Defects in the product can result in wasted material and time. If the defective product makes it to the end user, this could result in returned products, lost sales, unsatisfied customers, and in some cases, like with hydraulic hoses that have thousands of pounds of pressure and high temperature fluids flowing through them, could cause accidents or death. Poka yokes can prevent some of these mistakes. Poka-Yoke is a quality tool developed by Japanese engineer Shigeo Shingo in the 1960s, which helps to prevent systematic errors and defects. The word poka-yoke has the following meaning: poka - avoidance, yoke - error. Poka-Yoke technique can be used to prevent the root cause of errors. A poka-yoke device allows the operator to concentrate without further action to prevent an error in his workplace (Balan and Janta, 2019). A good example of an everyday poka yoke are gas pumps. When a person pulls up to the gas pump to fill up their car, there are usually two handles to choose from. One is for diesel fuel and the other is for gasoline. Putting diesel into a gas burning engine will cause serious damage to the engine so the diesel fuel pump nozzle is designed to be bigger and will not fit into most gasoline tanks. This is a simple but effective method of preventing mistakes. That is how all poka yokes should be designed. They don't have to be elaborate or expensive to implement. Creativity over capital should always be at the forefront of any improvement process.

The objectives of implementing poka yokes are as follows:

Using Poka-Yoke devices involves:

- continuous improvement of processes and products, this being a constant concern for every person in the organization.
- periodic evaluation of established criteria of excellence to identify areas requiring improvement.
- educating each employee so that they can use the techniques and methods of continuous improvement.
- setting objectives for improvement and the measures needed to achieve them.
- promoting prevention-based activities.
- recognizing the results of the organization's staff in terms of continuous improvement of the process (Balan & Janta, 2019).

Poka yokes are implemented into my shop in a couple of ways. Each hose takes certain parts to make the finished product. These are size related and, therefore, cannot be used on a hose that it does not fit. Another poka yoke is built into the saw that is used to cut the hoses. There are pins that allow the hose to only be cut in certain places as needed. These prevent uneven cuts and serves as a safety precaution.

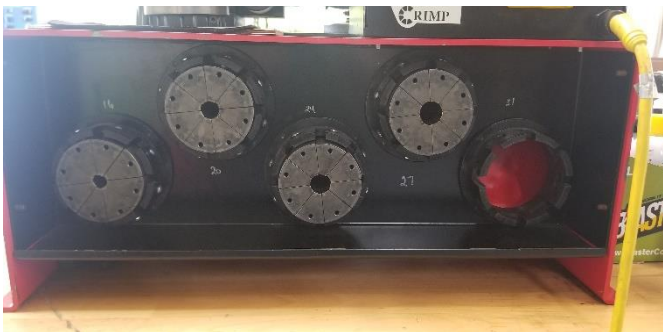
These picture shows the different pin positions on the saw for different sizes of hose.





The crimping machine that makes the finished hose has different size dies that are used for each size and type of hose. If the incorrect die is in place for that hose, the crimper will not crimp the hose. These poka yokes are not complicated ideas, nor do they increase costs, but they do help to eliminate errors, assist with productivity and prevent accidents.

The picture below shows the different sizes of dies that are needed for different size of hoses. These are numbered on the dies and on the storage rack. This is an easy way to eliminate any mistakes when selecting the appropriate die.



Problems can arise throughout the production process. These problems can be recurring problems with defects or a problem with wastes. During a Kaizen event, finding the reason these problems are occurring may require asking more than one question about the cause. The best way to find the issue is by using root cause analysis. Root cause analysis (RCA) is a process designed for use in investigating and categorizing the root causes of events with safety, health, environmental, quality, reliability and production impacts. The term “event” is used to generically identify occurrences that produce or have the potential to produce these types of

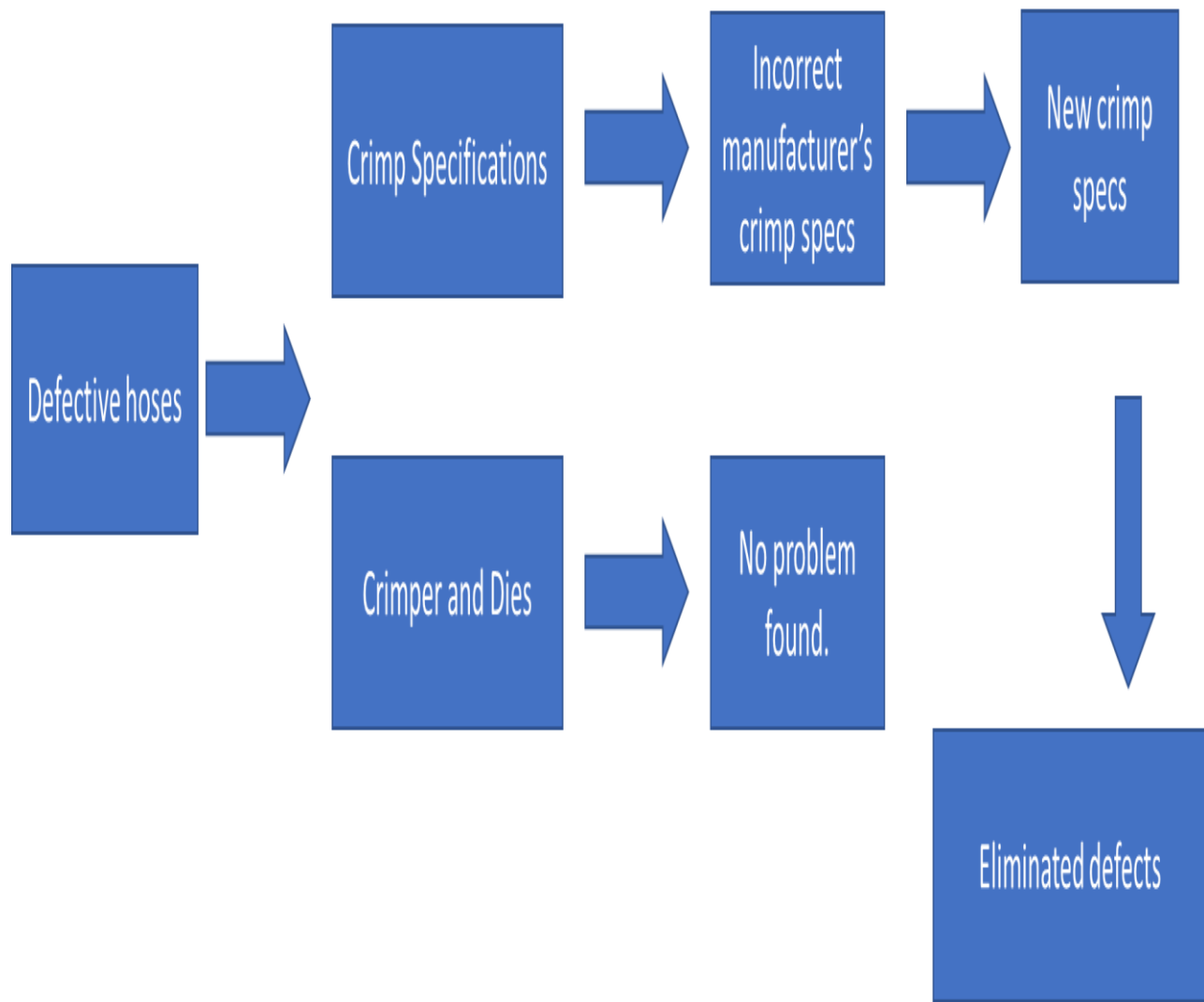
consequences (Heuvel & Rooney, 2004). By investigating the issues and their causes, one can understand and deduce what is the main source of the problem. Working backwards through the issues can lead to the main source of the problems whether they be defects, improper use of materials or time wastes. RCA is a tool designed to help identify not only what and how an event occurred, but also why it happened. Only when investigators are able to determine why an event or failure occurred will they be able to specify workable corrective measures that prevent future events of the type observed (Heuvel & Rooney, 2004).

When investigating a problem, sometimes it is not always the immediate process that causes the flaw. The problem could be further downstream in the process, so it is necessary to conduct a thorough search into the root issue. It may be that the first issue determined is the cause of the malfunction, however, if the analysts stop here, they have not probed deeply enough to understand the reasons for the mistake. Therefore, they do not know what to do to prevent it from occurring again (Heuvel & Rooney, 2004). Some problems may have multiple issues that are causing the problems to arise. It is necessary to find solutions to all these issues before finally reaching the root cause of the problems.

I have used root cause analysis when trying to understand what was causing some issues with my hose productions. I was having an issue with some of the crimped-on fittings leaking fluids or blowing off entirely from the hose. One could be considered a coincidence but after a couple more, I considered the possibility that there was an issue somewhere in my production process. After following the process that was in place to crimp the fittings, I decided to measure the finished product. Each size and type of fitting has its own finished crimp specifications. The measurements for each of the defective hose fittings were incorrect according to the specifications. After checking the machine and die to make sure they were functioning properly,

I moved on to the crimp specifications themselves. According to the manufacturer's specifications, I was using the proper die and crimping specifications, but the finished crimp diameter of the fitting was not correct. This led to using new calculations about the crimping specifications to obtain the proper finished crimp diameter. After a few trial and error runs, I was able to get the correct finished crimp specifications and have not had a defective hose since. Had it not been for following the root cause analysis to determine the main cause, I may have continued to have issues of defective hoses and returns.

Below is an example of the root cause diagram I used to fix my issue:



Another useful tool is the Kanban system. Kanban is an inventory tool that keeps costs down by only keeping inventory that is needed at that time. According to Rahman, Sharif and Esa, (2013):

Kanban system is one of the tools under lean manufacturing system that can achieve minimum inventory at any one time. Kanban system provides many advantages in managing operations and business in the organization. Using Kanban system is a strategic operational decision to be used in the production lines. It helps to improve the company's productivity and at the same time minimize waste in production (p.175).

As the products are ordered by the customer, this is recorded in some way, either cards identifying the product, barcodes or any number of ways of identifying the part. The customer of the part can be an actual consumer of a finished product (external) or the production personnel at the succeeding station in a manufacturing facility (internal). Likewise, the supplier could be the person at the preceding station in a manufacturing facility (Rahman, et al., 2013). As these cards are used, it signals the need for a replacement to production. This means that the product would need to be replaced to its previous levels without producing more than is necessary. The number produced would be based on average sales and lead times of producing a new product. This type of system ensures that there is never a surplus supply of goods. In certain systems, a surplus supply can be useful, but within a lean model, they just add up to more waste. One problem with having too much inventory, is that of obsolescence. The product being produced now may not be useable or saleable at a future date, so it would not be beneficial to have more than is necessary on hand. The costs associated with such an abundance of inventory can be widespread. Storing the excess inventory can lead to limited space in warehouse or stores that could be used for another useable inventory. The time and human capital used to track and move this inventory

would increase costs and reduce profits. Most Japanese companies implement the Kanban system because it saves costs by eliminating over production, developing flexible work stations, reducing waste and scrap, minimizing the waiting times and logistics costs; thus reducing the inventory stock levels and overhead costs (Rahman, Sharif & Esa, 2013).

This idea is usually associated with production of goods, but it can even be used to keep inventory levels down for retail businesses. In my store, I implement a Kanban system by tracking my average sales per month and basing my inventory levels on those numbers. As in most every business, there are certain months that are busier than others. I try to accommodate for that by calculating total annual sales and then finding the average throughout the twelve months. This will enable me to keep enough during my busy times but also to keep my inventory levels lower during my slow time. The good thing about my products, hose and fittings, is that they don't have an expiration date. Should I experience lower sales than predicted, I just roll the numbers over and adjust my orders to allow for this overage. Using a minimum/maximum inventory system is useful in this instance. By adhering to these minimum and maximum allowable inventory levels, I can have inventory turnover on a regular basis all while keeping my costs down. This eliminates the guesswork about how much on-hand inventory is needed and allows me to not have any lost sales.

Each part in my store has a part number that is entered into my computer software system. I use this for inventory tracking, recording costs, and billing. My next step in implementing this system is to set up barcodes associated with each part number. This will simplify my inventory tracking and should eliminate costly mistakes like entering incorrect numbers while billing out invoices or when placing orders to my vendors. This low-cost solution should help to reduce mistakes and increase profits.

Implementing the tools listed previously should have an effect on the reduction of waste and an increase in production or sales, but if these tools are used incorrectly, the yields will not be as great if they are used without some planning and foresight into why they are being implemented. Value-stream mapping is necessary to identify the appropriate path of production. According to Chen and Meng (2010):

The fundamental of lean production is to identify and eliminate wastes, all work of an enterprise can be classified into three parts, the first is value-added work includes essential activities that add value to a project in a way the customer is willing to pay for. The second is incidental work includes the auxiliary activities that don't necessarily add value but must be done to support value-added work. The third is non value-added work or waste includes non-essential activities that add time, effort, cost, but no value, which we are familiar in production site that has not implemented lean production including superfluous inventory, unnecessary transportation, waiting, excess processing, wasted motion and products with defects (p.204).

In the example of my business, the value-added work is producing the hoses when and how the customer needs them. This is where it is very important to have the right kind of inventory. Since I am a specialty shop, I need to have fittings and hose that every other store probably won't have. Having the right type of inventory with the appropriate amount of the necessary fittings will ensure that when a customer needs a hose or fitting, they know that I will have it in stock. When a customer brings a hose that needs replaced into my store, I make it immediately. They do not have to wait for more than a few minutes, so this adds value by allowing the customer to get what they need and get back to their work without wasting time. This goes back to the spaghetti diagram previously mentioned and with the production process as streamlined as possible, there is not much lead time between cycles, or in this case, sales.

Another piece of value-added work I offer is that I am available to my customers 24 hours a day and 7 days a week. Many of my customers are farmers, loggers and manufacturing facilities so when they have a breakdown, they don't have the time to wait for normal business hours. This service has helped to set my business apart from others in that I am willing to assist my customers whenever needed and that adds value to my products and my service. This can be an inconvenience to me sometimes, but the amount of business it has gained me is well worth it, and the only thing it really costs is the time spent coming back to the store to help the customer.

The second part of value-added work are the things that, while they do increase value, do not necessarily make the difference in the customer wanting to buy the item or not. On every hose that is made in my shop, I create labels identifying the different parts that make up each hose. After each hose is produced, a label is attached that lists the type, size and length in inches of the hose and the part numbers for each fitting as well. The thought behind this is that once this hose is reinstalled on the equipment or machine, should this hose ever need to be replaced, the customer just has to look at the label and they will have all of the pertinent information needed, including my phone number and company name, to have the replacement hose made. This is a simple solution that can save the customer and myself valuable time. Most of the hose failures that occur are usually while the customers are in the field or needing to keep production running. With the information obtained from the labels on each hose, the customer can call ahead and by the time they arrive at my shop, the hose will be ready, and they can get back to work. This reduces waste for the customer and is another value-added step that doesn't increase costs but could help to produce more sales later.

Value stream mapping should represent the system as a whole and identify any weaknesses in the system that could jeopardize productivity, and in return, profits.

Chen and Meng (2010), state:

Value stream mapping helps us understand where we are (Current State), where we want to go (Future State) and map a route to get there (Implementation Plan), which can create a high-level look at total efficiency, not the independent efficiencies of individual works or departments, visually show three flows - material flow, product flow and information flow to identify improvement opportunities, and help identify applicable lean improvement tools and plan for deployment (p. 204).

The current state of my business is a brick and mortar store that meets the needs of the customers when they come into the shop. Over the four years since opening, I have made many improvements that have helped to increase customer service satisfaction and sales. By adding new products to the inventory in increments instead of purchasing a huge variety of products that may or may not sell, I have been able to keep costs down and avoid unnecessary inventory overhead. In lean management, inventory turnover is the goal.

The future state of the business is to offer even more products and services. The next phase will involve a mobile hose fabrication truck that will allow me to go out to the customer to do repairs in the field or other working environments. In my area, there is no other service like this available and this would set me apart from every other business that may offer hose and fittings. This would be an expensive process to set up, so it will need to be undertaken with the same lean management mentality that I use throughout my store. It would need to be outfitted with just the right amount of inventory to be able to cover any issue that may arise on the job because the last thing needed is to get out to the customer and not have the items needed to fix the problem. This would create too much waste and would cut into profits.

The next option for the future state of the business is to open more locations. There are industries all over that rely on businesses like mine to keep their machines and equipment running and not all those areas have a specialty hose and fitting shop. If I could be in closer proximity to other areas that need hoses and offer the same level of customer service that I currently offer to my customers, I would be helping these people and increasing my sales. Another benefit to having multiple locations is that it could help me to increase my efficiency in placing orders for inventory. Having a second location would mean that I could order higher quantities and divide them between the two locations. This would lead to quantity discounts from my suppliers as well as reduced shipping costs by taking advantage of vendor-paid freight that is offered when an order meets a minimum dollar amount. These types of advantages would increase my purchasing power and would increase the value of the service and products I offer.

Another option for the future state of the business could be moving into e-commerce. Selling online to customers from all over the world would greatly increase my presence in the market and would, hopefully, lead to more sales and profits. This could turn my small business into something more and could possibly create more jobs for other people.

All these options listed could add value to my business which in turn could mean the difference in a customer buying from me or giving their business to a competitor. Quality, value and service should always be the priority. By using value stream mapping, I can determine the best course to take in providing these items.

Benchmarking is yet another tool in the toolbox of any company practicing lean management. Bogetoft (2012) states:

In the business world, benchmarking is traditionally thought of as a managerial tool that improves performance by identifying and applying best documented practices. Managers

compare the performance of their respective organizations, products and processes externally with competitors and best-in-class companies and internally with other operations within their own firms that perform similar activities (p. 1).

Benchmarking can eliminate unnecessary trial and error work by using standards set forth by other companies. Finding what works best for other companies could reduce costs by saving time and money involved with achieving a certain level of operating.

According to Bogetoft (2012):

The first task in a benchmarking exercise is, therefore, to select a product, service or process to benchmark and to consider what may be appropriate key performance metrics. Next, one must choose companies or units to benchmark against and collect data on the performance and practices of these. Once data are available, they must be analyzed to understand the firm's relative cost position and possible strategic advantages to identify opportunities for improvement and to increase organization learning by bringing new ideas to the firm or facilitating experience sharing (p. 2).

Once the process is chosen to compare against the benchmark, one can eliminate any parts of the process that do not contribute to the overall efficiency of the process. In benchmarking, we therefore need to collect data to describe actual behavior, approximate the ideal relationship between inputs and outputs and combine actual performance with ideal performance to evaluate efficiency (Bogetoft, 2012). In other words, find what is working for other companies and try to replicate their success within your own products or process.

I have used benchmarking strategies in my shop in a couple of different ways. I have used past experiences with other businesses I have worked in, not only for making hoses, but how to handle ordering, inventory accuracy, billing and other essential office functions. I have

also visited specialty hose shops in other cities and states to see how they operate. Most are welcoming enough and have shown me around their stores to see if there are any different strategies to pick up. This also helps them because they in turn can ask me about how my operation works. This type of interaction may not work for every business as some people or companies may not be willing to share information on what makes them successful, but if even a small amount of good advice or a better idea of how to perform a process is learned then it is all worth it.

Lean management is for all sizes and types of businesses. I have worked for Fortune 500 companies that utilize lean and now I have implemented the ideas into my own small business. I would recommend finding areas that you would like to improve efficiency and reduce waste. This doesn't have to be some grand or elaborate idea. It could be one of the smallest, most basic functions involved in a process, but by improving this one area, it could lead to major changes in how the business or process runs. With these changes will come the need for change management.

According to Furman and Kuczyńska-Chałada (2016):

Change management in this case refers to an entirely different management of processes, where a significant role is played by the human factor, i.e. the employees of the enterprise. Without their involvement and cooperation, it is impossible to achieve the desired results of the implementation of the concept (p. 23).

Change is difficult to accept by most people. Even if it is a change for the better, most people will find some sort of issue with the changes. All the continuous improvement won't make a difference if everyone involved does not give it the priority it needs. In larger organizations, when dealing with dozens or hundreds of employees, managing this change can be

extremely difficult. This goes back to the previous idea of cultivating a culture that is positive and accepting of the changes and getting everyone on board with the new ideas.

Furman and Kuczyńska-Chałada (2016) state:

Overcoming resistance towards the change is also very significant and can be done through frequent communication with the employees, removal of change blocking barriers, rewarding of positive attitudes of employees towards the changes, trainings, encouraging employees to cooperate in introduction of changes in the enterprise (p. 26).

By using these techniques, it may be easier to develop the changes necessary to move forward with the continuous improvement efforts. These same principles can be applied to small enterprises as well. For example, with my business, there is only myself and two part-time employees. Once I have decided on what type of change needs to be made, I must communicate these changes to the employees and get them in the mindset that this is how we will be doing these functions until the next improvement. If I implement a change and don't have their full support to carry out these changes, then the idea will fail.

Furman and Kuczyńska-Chałada (2016) list the follow stages of change management:

- diagnosis phase, covering determination and definition of the problem through diagnosis,
- search phase – proposals of various solution variants,
- decision phase, i.e. evaluation of solutions according to the assumed criteria (selection of an optimal solution), enterprise design, introduction of changes through author supervision,
- evaluation phase – assessment of effects of the change introduced in the enterprise (p. 26).

Following these stages should help to achieve the desired results of continuous improvement while ensuring that everyone involved will contribute to their full capabilities.

Recommendations

Although lean management is usually looked at from the viewpoint of manufacturing and production, I believe these same ideas can be implemented to all businesses to run more efficiently. The reduction of waste and more ways to increase efficiency can be, and should be, used in all industries. I recommend trying this in small steps before jumping into big changes. Even small changes made over long periods of time can result in big results.

Having been involved on many continuous improvement teams, I have used some of the tools and techniques discussed in these articles. Continuous improvement is valuable to any type of industry because no matter how well a system operates, there can always be improvements. While parts of a process may be perfected, the never-ending cycle of the Deming Wheel could help improve other aspects of the process until the whole is operating at its full potential. The more people you can engage in these activities, the better the overall outcome. Having more people involved on these projects should yield more ideas. Not all these ideas will be implementable, but if only a few ideas get picked up, these will still help improve the business. Even with small enterprises that don't have the option of having a multitude of people working on creating new ideas, these companies should reach out to colleagues, comparable businesses or research what other companies have done in the past, both successfully and non-successfully.

By using tools such as customer surveys and the Impact and Effort Matrix, businesses should strive to become more efficient in serving their customers. Using the Six Sigma method and the tools involved in the method, could help managers to identify any issues that may require a change to how their customer service process works.

Lean management can be utilized to grow small business by focusing on continuous improvement. Lean management and the tools utilized will improve the efficiency of any

business and that will lead to improved sales and overall growth. Certain aspects of each tool may not be a perfect fit for every type of business, but there is always something to be gained from each tool.

This paper has covered just a handful of tools that can be used but there are dozens of lean management tools available. Creativity over capital is a good idea to keep in mind when implementing any of these tools. Throwing money at a problem is usually not the best solution. Research the type of improvements that need to be made and find out what has worked for other people. Look outside of your own industry to see if there are different or better ways of doing a process. Maybe the other company produces or sells a completely different type of product, but they perform a process like yours and have figured out the best way to do it efficiently and without waste. Use past experiences from other jobs where you had to perform a process a certain way, but now you know that that way was either the best way to perform the process or that it was not efficient enough to accomplish your goals. It is a cliché but try to think outside of the box when it comes to implementing new ideas.

Standardize the process as much as possible. This will ensure that the work is completed in as efficient a way as it should be. Repetition is the best way to get a movement correct. It goes the same for processes performed. Every time a customer places an order or comes into your business, try to follow the planned process the same each time. This should increase efficiency and reduce wastes in time and money.

There is never a perfect process. That is what is so great about lean management and continuous improvement. There are never-ending possibilities for improving all parts of a process. Even when the process is close to 100%, things can always change that could take it one step forward. New technologies and advancements can change the process for the better or

for the worse if continuous improvement is not implemented. Continuous improvement eliminates stagnation and helps to create an environment of always moving forward. Any company that practices continuous improvement should never be caught off guard by new advancements because they will have been constantly changing and adapting their ways to better produce their products or service their customers.

Conclusion

Sometimes, it is the small changes that add up to substantial increases in productivity and profits. Some of these tools used for lean management and continuous improvement are more detail oriented and help to focus on the important aspects of what is necessary to add value to your products or service. This means that most processes can be improved upon without spending large amount of money or human capital.

By continually reassessing the process, there will always be parts that can be changed to reduce wastes. The old saying about “if it isn’t broke, don’t fix it” is an outdated method and could be the downfall of many businesses if they do not adapt and improve how the business operates.

Continuous improvement is perpetual and should be at the forethought of any owner or manager to reduce the chance of obsolescence and stagnation. If a process is working at a high capacity, that is not the time to be content. Look at the process from a different point of view or have other people look at it with fresh eyes to see if maybe there is something that can be improved.

This does not mean that one should go looking for issues that don’t exist just to say they are involved in continuous improvement. Only make the changes or attempt the changes once all the necessary tools have been utilized and the data shows that this will positively impact the production or move the process towards higher efficiency. This is a mistake I have seen in my experience with some other companies that I have worked for and have seen the negative outcomes. Change what is necessary but try to keep the main goals in mind so that the changes don’t affect the overall process in a negative way.

Be mindful of new technologies and updated data or information that could assist in improving the process. These new changes and information could be the next step in reaching the goals that you and your company are striving to attain.

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