Chapter 18

Just-in-Time/Lean/The Theory of Constraints/Six Sigma

Just-in-Time is credited to the Japanese quality movement and the Toyota Production System. However, most of what is credited to Taiichi Ohno and others are derivatives of the teachings of W. Edwards Deming. The Theory of Constraints came to us from Israel (Dr. Eli Goldratt) about the same time that Six Sigma was arriving from Motorola. Lean is the "newest" continuous process methodology to come along but a deep dive into its origins show that when Ohno and crew originally wrote about what we call Just-in-Time, they called it lean.

Just-in-Time, Lean, the Theory of Constraints, and Six Sigma are all related methodologies. All four of these methodologies are continuous process improvement programs designed to improve a company's operations management chain and improve the quality of the outputs of the processes. A strong argument could be made that all four programs are basically the same program with a different name. This would not be unusual in the business world to change the names of programs just to make more money out of books and consulting fees. Although the four programs have similarities in their results, the approaches of these programs, except for JIT and Lean, are different. The goal of addressing these four programs in the same chapter is to provide the operations management student with alternatives for improving a process or system.

Regardless of the program used to bring about improvements to a process, **the first step is to walk the process**, map the process or document the process in order to establish what is being done and why. Then the process map or flow chart can be used to identify the non-value-

added activities or subprocesses as well as to identify those processes that are working well and may not necessarily need changing.

As mentioned before, it is important to remember two important points about improving operations. The first is that all processes add cost, but not all processes add value to an operation. Another key observation at this point in the discussion of continuous process improvement programs is that all improvements are changes but not all changes are improvements. Think about the times you have seen change for the sake of change rather than change for the sake of improvement. A promise of "change you can believe in" should really be "improvements you can believe in." The programs in this chapter will help the operations management student (and the future operations managers) identify those non-value-adding processes as candidates for improvement or elimination.

Just-in-Time (JIT)

This may very well be the most misunderstood and inappropriately implemented program in operations management. JIT has its roots in the rebuilding of the Japanese economy after the defeat of Japan in World War II. Taiichi Ohno and Shigeo Shingo get the credit for developing what became known as the Toyota Production System in the 1950s. This system grew out of the teachings of Dr. W. Edwards Deming, the American statistician who went to Japan after the war to help the Japanese businesses recover. The teachings of Deming trace their roots to Walter Shewhart, the father of statistical quality control and the designer of the Plan, Do, Check, Act Cycle that is the foundation for almost every continuous process improvement program.

JIT made its way to the United States and the rest of the world in the 1970s as a result of the growth of the quality of Japanese products in general and the Japanese automobiles in particular. In the 1950s and 1960s, the words "Made in Japan" on a product almost assured the

buyer that the quality was suspect at best. While everyone was making fun of Japanese quality, engineers in Japan were reverse engineering products to determine how to make them better and less costly. Then the quality revolution in Japan started the flow of high-quality products into the marketplace. By the mid-1970s, those same words, "Made in Japan," symbolized the highest levels of quality worldwide.

As this new wave of quality rolled across the globe, everyone wanted to know how the Japanese firms were achieving lower costs and higher quality products. The answer was JIT. The problem was that the applications of JIT got lost in translation. Instead of *Lean* as Ohno called it, the JIT program became zero inventories. This spawned a series of the "Zero Inventory Papers" published by what was at the time known as the American Production and Inventory Control Society (APICS). In 2018 APICS was renamed the Association for Supply Chain Management (ASCM). Just as the organization has evolved, so did their view of JIT. Now APICS/ASCM defines Just-in-Time as: "A philosophy of manufacturing based on planned elimination of all wastes and on continuous improvement of productivity" (John Blackstone, 2014). The concept of "zero inventories" was a narrow-minded focus on the JIT waste of stocks (we will discuss this shortly).

Just-in-Time is both an inventory methodology as well as a continuous process improvement program. Much has been written about both. As a continuous process improvement program, JIT has a mantra to eliminate all waste. You may recall the discussions on positioning the firm when we stated that to be successful when competing on cost, the company must eliminate all waste. From a JIT perspective, waste is anything that does not add value.

As an inventory management philosophy, waste is defined as anything above what you need right now. JIT is interpreted to have just enough on the shelf to meet the needs of the

customer. Many companies have realized that JIT as a pure inventory methodology may not be the best method available. This places a greater onus on the suppliers to quickly resupply. The APICS/ASCM dictionary app defines the JIT supplier environment as "a company must supply components and subassemblies in exact quantities, delivery times, and quality. Shipments are made within narrow time windows that are rigidly enforced. Virtually every component must be delivered on time and be within specifications."[114]

he drawback of JIT as an inventory methodology is that it means someone must have the inventory in the supply chain or the ability to quickly produce the inventory to meet downstream needs in the supply chain. The pandemic panic buying of 2020 revealed some of these flaws in the JIT supply chain. When no one has the product, it will run out.

The US Military discovered this same issue at the start of the Second Gulf War (Operation Iraqi Freedom). The Military, in a cost cutting measure, went to a JIT-like supply system. The problem was that the flawed logic reduced inventory levels in the entire supply chain and the ramp up for deployments and combat operations left the units with severe shortages for some items and in 2003 revealed the same flaw that was relearned by the civilian world in 2020 – some one has to have the inventory somewhere in the supply chain.

Another example of this flaw in the JIT inventory methodology can be seen in the United States in 2001, all forms of transportation came to a halt after the attacks of September 11. Those companies that had moved to JIT inventories had problems meeting deliveries after

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[114] The APICS/ASCM dictionary app is available through the Apple Store and provides definitions of all major operations and supply chain terms. The APICS Dictionary is available for sale through the APICS/ASCM website at www.apics.org. The app is free and provides all the same information as the dictionary – go for the free app.

transportation started moving again. Hewlett-Packard missed deliveries as a result of going to a true JIT inventory methodology, while Dell was able to meet almost all of their deliveries.[115] The delays in transportation created stockouts and forced companies to reevaluate their JIT policies. Those companies that did not change after 9/11 got another wakeup call in 2002 when the dock workers went on strike on the West Coast. The strike delayed the shipment of items on approximately 300–500 ships depending on which report is most accurate. The 9/11 delays and the dock strike forced many companies to move from JIT to just in case inventories (refer back to the discussions of just in case inventory in the Inventory Management chapter).

As a process improvement program, JIT has great applications to all companies. Reducing waste is important to any company that wants to remain competitive. So, let's look at the goals of JIT. The primary goal is to eliminate waste. Here are the wastes as identified by the Toyota Production System that has become known as JIT.

- **Overproduction:** JIT seeks to eliminate the waste of producing too much. This includes too much of the right stuff and eliminating the production of items that do not sell at all.

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[115] Dell was reportedly a JIT company at the time of the September 11 attacks. However, Dell mandated that its suppliers keep 6–8 weeks of supply in the Dell Supplier Center across the street from their Texas assembly plant. This may be a case of semantics. Technically, the Dell Assembly Facility was using JIT with deliveries every 4 hours and the supplies in the Dell–owned Supplier Center were indeed owned by the suppliers—but, if Dell mandates the stockage levels of the Supplier Center, is that really pure JIT? It could also be viewed as a form of Vendor Managed Inventory and therefore not on the books of Dell until delivered into their assembly plant. The Opal Plant in Russelsheim, Germany also bills themselves as a JIT facility, but outside the back door of the plant is a yard full of inventory that belongs to the vendors that is stored in semi-trailers (an expensive form of storage) to ensure that the products are there when Opal needs them.

This is one area that causes conflicts between accountants and operations management managers. The age-old philosophy from the accounting side of the house is that a machine should operate at 100% utilization. However, if 100% utilization of an operation produces more product than the customers want then waste is the result.[116] JIT mandates only producing what is needed and nothing more.

- **Waiting:** There is no value in waiting. Remember our apple sauce example from our discussions of process design. Or think back to your last visit to an amusement park – what was the value in waiting for an hour for a 3-minute ride? That is the very reason that Disney went to the fast pass concept to reduce waiting times and allow you to spend more time doing other things in the parks. This is also the reason that Disney has revamped the queueing process at many rides to provide interactive games and videos to help reduce the feeling of wasted time while standing in line.

In manufacturing, the waste of waiting comes from not balancing the manufacturing line and having machines in the line that produce faster than other machines in the line. If the line is not balanced, there will be waiting at some machines and overproduction at other machines in the line. Balancing the manufacturing line will eliminate the waste of waiting. This ties back to our facility layout discussion and balancing the production line to prevent work in process building up.

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[116][116] Think back to the discussions of utilization when we discussed capacity planning. In that discussion we stated that utilization rate should match sales rate – this is a direct link between JIT implementation and capacity planning. Hopefully, through the course of this instruction you will start to see that many of the operations management terms and concepts are linked and dependent on each other for success.

This could also be the waste of watching a machine run. If the machine works well without any human intervention, there is no need to have someone standing there watching the machine just in case it breaks down. The old American Tobacco Company used to have a person standing in front of every machine to fix it in case it broke down, however, according to one worker there the machines never broke down.[117]

- **Unnecessary handling:** Every time an item is handled there is a chance of damaging, misrouting, or misplacing the item. Eliminating the waste of unnecessary handling prevents this damage or loss of the product. A good facility layout will eliminate unnecessary handling of the product.

- **Non-value-adding processing:** This has been discussed earlier in the text. Every process adds cost, but not every process adds value to an operation. Walking the process, documenting each activity, and then preparing a process map will help companies identify non-value-adding processes. Eliminating non-value-adding processes helps companies reduce costs and thereby makes the company more competitive and profitable.

  Non-value-added processing also includes preforming processes that do not need to be done. This waste is a contributor to work in process by tying up resources that may not need to be used.

- **Inventory in excess of immediate needs:** This waste is very close in nature to the first waste of overproduction. This is also the waste that led to the original focus on "zero

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[117] The American Tobacco Company had a preventive maintenance shift on the weekends to work on the machines in the cigarette manufacturing facility to ensure that they were operational. They also had mechanics on each shift to fix the machines if the person watching the machine ever reported that they had stopped working.

inventories." Careful and accurate forecasting coupled with knowing what the customers need and want will help the company eliminate this waste. Managing this waste does not mean zero inventories, but it does mean reducing nonproductive inventory. As you recall from our discussions of inventory management, non-productive inventory is stuff that no one is buying. If no one is buying it, then why is it being held in inventory?

- **Inessential motion:** Moving for the sake of moving or moving products to multiple intermediate locations is the waste of movement. In some distribution centers there is the process of re-warehousing monthly or quarterly. This results in products moving from one location to another. Like the waste of unnecessary handling, this produces lost, damaged, or misplaced items. One of the beauties of RFID tags is the ability to see stuff move around a storage yard for the sake of movement. Sometimes the use of RFID tags helps to identify this unnecessary or wasted movements.

One facility that I worked with several years ago had a large quantity of shipping boxes prepped for shipment out of the facility for disposal. Instead of loading the boxes for outbound shipment, when the managers were notified of the boxes, the boxes were moved to another location in the yard that was out of sight. Unbeknownst to the managers, I had put my initials and date on the boxes while inspecting their yard. A month later the boxes were discovered again during a walk through the yard. This time the manager tried to tell me that this was a new set of boxes being prepped for outbound shipment. However, the manager was a bit embarrassed when I showed him the dates and initials. This was not only a breach of honesty but a classic example of movement for the sake of movement.

In Just-in-Time, the movement of one inch is still considered a movement. If it does not need to be moved, why move it? This ties to our discussion of facility layout and the goal to minimize moving or touching an item.

- **Rework of defects:** This is a serious waste of assets, time, and money. As discussed in Chapter 4, quality initiatives will reduce the amount of rework required to fix defects before shipping to customers or fixing warranty work necessitated by allowing defective products to get in the hands of the customer. The discussion of reverse logistics in Chapter 16 will look at some of the additional costs companies incur from the waste of reworking defects. The bottom line is design a quality product, design the process to build a quality product, then train the employees to build a quality product.

- There is another waste that is not a part of the seven wastes of the Toyota Production System. This waste is the waste of meetings. Too many companies have meetings for the sake of meeting with nothing decided in the meeting but to have another meeting. How many times have you sat through a meeting only to wonder what the meeting was about when it was finished and feel like you just wasted a couple of hours of your life? Only have meetings when it is necessary. The goal of software like Microsoft Office is to improve productivity by being able to share information electronically rather than have to sit in a meeting to have someone read slides to you. If a face to face meeting is not needed, why have it? How much money is spent annually in companies on meetings that are not necessary.

JIT Elements

In addition to the wastes of JIT, there are some basic elements associated with JIT. Some of these basic elements of JIT are also just plain common sense.

- Flexible resources. This was the basis for the cellular structure previously discussed. This is also what drives the layouts of fast food restaurants. In a hamburger fast food restaurant there is one "cell" where the burger is microwaved, another "cell" where the burger is assembled, still another "cell" taking the order, and still another "cell" operating the fry cooker. There are no specialists in this arrangement. Each of the workers is trained to work in all of the "cells." The key with flexible resources from my perspective is: if I give you additional training and additional skills, I should also give you additional pay for those skills.

- Pull production system. As discussed earlier, the pull system only produces a product when there is a demand for it. This concept helps to eliminate the waste of overproduction and excess inventory.

- Kanban production control. Kanban literally translates as "card." A Kanban card alerts the producer to make more of the product. A Kanban could be a signal such as a light to alert the previous operation to make more products or a square on the floor that when emptied alerts the previous operation to make more products. As mentioned in the previous chapter, this concept is derived from the two-bin inventory reorder point concept. Here are some common examples of Kanbans:

    - **Bin Kanban—**When the bin is empty it is the signal to replenish the bin (much like the two-bin system).

- **Kanban Square**—This is a marked area on the floor or assembly line that is designed to hold a certain quantity of material. When the square is empty it is time to replenish.

- **Signal Kanban—**This may be as simple as an andon light to signal the previous operation to move more products forward or a triangular sign or a flag that is raised to alert the previous operation to move product forward.

- **Calculating the number of Kanbans needed—**If a company is going to use the Kanban methodology, it is necessary to calculate the number of Kanbans necessary to support the operations. When using the formula shown in Formula 18-1, if a company wants to force more efficiency in the system, the calculation is rounded down and if the company wants to allow a little slack in the system, the company will round the calculation up (see Example 18-1).

$$\text{\# of Kanbans} = \frac{\text{average demand during lead time + safety stock}}{\text{container size}}$$

Formula 18-1: Kanban Calculation

a. demand = 300 widgets per hour
b. lead time= 1 hour
c. safety stock is set at 10% of the demand during the lead time
d. container size = 75 widgets

$$K = \frac{(300)(1) + 30}{75}$$

$$= 4.4 \text{ Containers}$$

Example 18-1: Kanban Calculation

In Example 18-1, if the company wants to force efficiency in the system, the company will round the number of containers in the system to 4. However, if the company wants a little slack in the system, it can round the number of containers to 5. This is the only calculation that we look at in this course that we have an option of rounding up or rounding down. Being a strong believer in never running out of product, I always recommended to my clients to round up.

- Quick setups. Anything that can be done to reduce the setup times falls under this concept. For example, NASCAR teams use guides to make the pit stop tire changing go faster. There is a notch and a mark for the jack man to hit to speed up the setup for the tire changing as shown in Figures 18.1 and 18.2. Figure 18.3 shows another example of quick setups in NASCAR. In order to reduce setup time for the tire changers, each lug nut is glued to the tire and then the tires are arranged in the proper order of use and marked to prevent placing the wrong tires on the car.

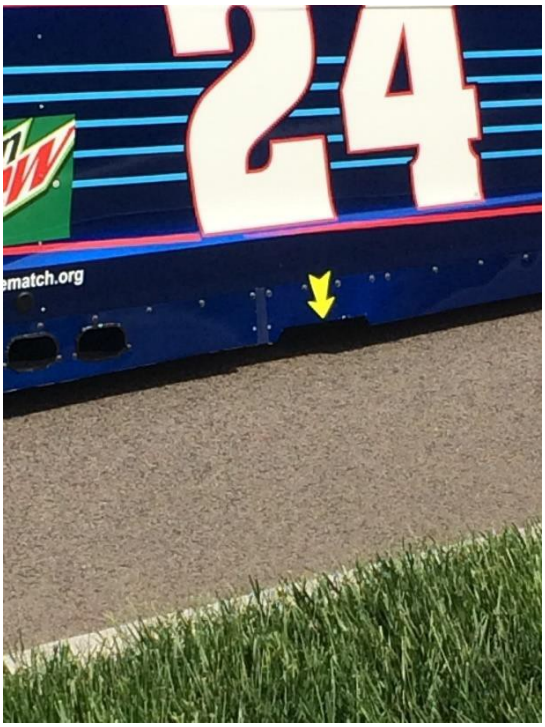

Figure 18.1: Tire Jack Mark for NASCAR Pit Crews for Quicker Set Up Times

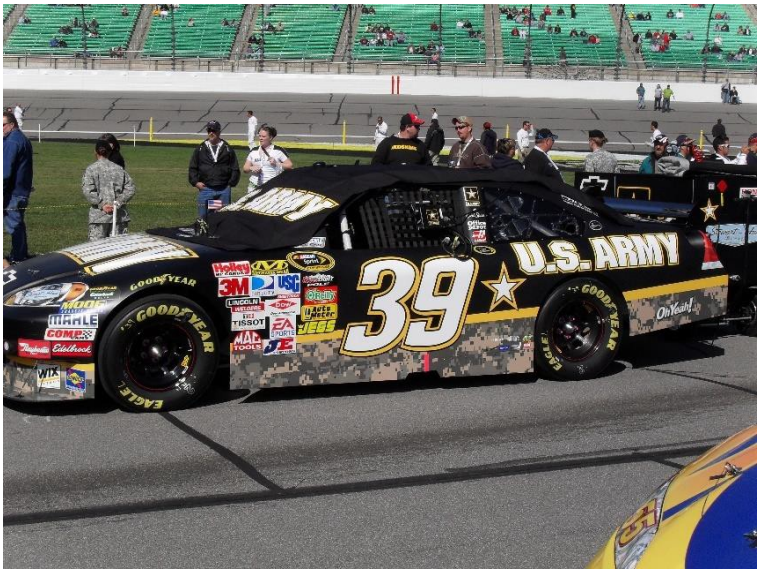

Figure 18.2: Another View of the Jack Set Up Mark on the US Army NASCAR Car

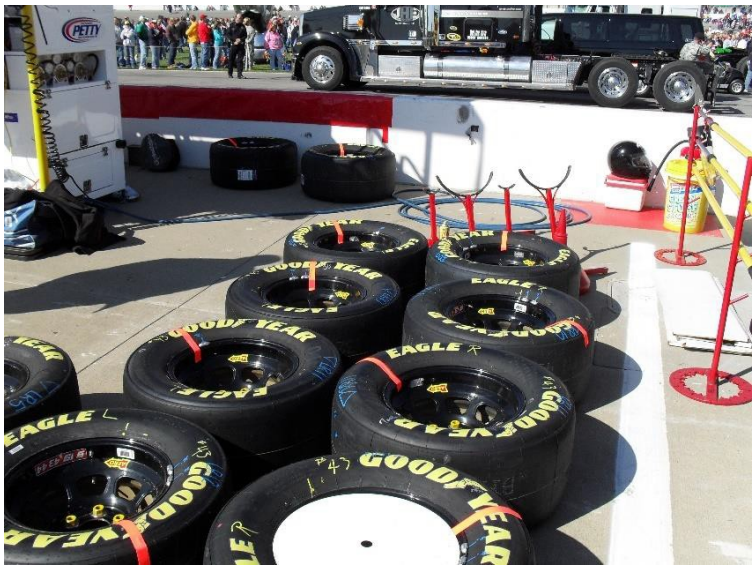

Figure 18.3: Tires Readied for Use on a NASCAR Cup Series Car

The JIT concept of reducing set up times is often referred to as Single Minute Exchange of Dies (SMED). This concept forces a company to take a look at their operations and determine if a quicker set up is possible. In the automobile industry, it used to take weeks to retool a plant to produce a new line or model of an automobile. This is lost productivity time and lost revenue. If an operation can be analyzed and the steps and set ups reduced to internal and external operations, the process can be streamlined and improved. This concept is the driver for setting up the tires and lug nuts prior to use as shown in Figure 18.3. This analysis may actually eliminate some set up steps altogether or at least allow for some steps to be accomplished simultaneously external to the operation.

Other examples of quick set ups include the use of:

- Preset buttons or settings such as the quick set buttons on the car stereos. I know it is hard to believe, but there was a time when finding a radio station on

the car radio (there were no stereos then) involved the use of the tuning knob for every station. This was time consuming and distracting to the driver.

- Locator pins or guides provide quicker set ups. The Indy Racing League uses a set up pin/guide to assist in getting the tires properly set on the cars prior to fastening the one "lug" nut.

- Using standardized operations helps to reduce setup times and remove wasted time from operations.

- Uniform production levels. This is the goal of every production facility regardless of whether or not JIT is adopted. If a facility can produce at a constant level, there will be less turbulence in the workforce and more predictability.

  Uniform production helps to smooth the manufacturing operations while improving the quality of the information being shared by supply chain partners and adds some level of predictability to the supply chain. One method of achieving uniform production is through the use of mix model assembly operations or being able to make more than one product or model on the same assembly line. When the Harley-Davidson Plant was operational in Kansas City, Missouri, although each of the three main lines was dedicated to a particular line of motorcycles, each line is in fact a mixed model assembly line. On the same line the company makes V-Rods for the United States, Japan, Australia, and Europe. Each of these "models" requires different braking systems, safety features, and emission systems. Having a mixed model assembly line allows the company to balance production while meeting the

needs of the customer and keeping the employees working. However, they could not make a Sportster on the Dyna line thus reducing some flexibility in the plant.

- Supplier networks with fewer suppliers. JIT emphasizes fewer suppliers and more long-term relationships with suppliers. Long-term relationships with suppliers are usually a good practice as this leads to better cooperation and the sharing of information between customers and suppliers. This is an adaptation of the single sourcing concept discussed earlier. There is an upside to using fewer suppliers. This fosters a better understanding of what customers need. The downside of fewer suppliers is the loss of supply if one of your suppliers has financial problems or goes out of business.

- Quality at the Source. This is important regardless of whether a company uses JIT or not. Some of the Japanese terms and ideas have migrated to other countries as part of this aspect of JIT. One of these concepts is the idea of Jidoka. This is simply empowering the employee to stop the assembly line if the employee discovers a quality issue with the parts or the assembly itself. Another concept that has found its way into both JIT and Six Sigma is the concept of "poka-yoke." This is simply idiot proofing the operation so a mistake cannot be made.

Kaizen

The 14th edition of the APICS Dictionary defines Kaizen as: "The Japanese term for improvement; continuing improvement involving everyone—managers and workers. In manufacturing, kaizen relates to finding and eliminating waste in machinery, labor, or production methods" (John Blackstone, 2014). Kaizen is a continuous process improvement program; however, it sounds so much sexier and important to call it a Kaizen rather than a common

continuous process improvement program. Kaizen is literally for the greater good of everyone. A good continuous process improvement program is for the good of everyone in the program. Just because JIT came from Japan and Kaizen sounds so much more impressive, do not get wrapped around doing a Kaizen program and waste time developing a Kaizen when everyone understands continuous process improvement.

JIT Summary

As a continuous process improvement program JIT can be used by anyone, as an inventory management program, it may not be applicable to your operations. Eliminating waste is important even if your company is not positioned on competing on cost. Getting rid of non-value-adding operations or processes can make a company more competitive and more profitable. Getting rid of inventory for the sake of JIT may make a company go out of business because of the inability to support customers. If the demand remains constant in the supply chain, someone has to have the product somewhere to meet customer needs.

The Theory of Constraints

"Focusing on everything is synonymous with not focusing on anything. Can we condense all of TOC into one single sentence? I think it is possible to condense it to a single word – focus."

—Dr. Eli Goldratt[118]

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[118] *The Theory of Constraints Handbook*, edited by James Cox, III, and John G. Schleier, Jr., McGraw-Hill, New York, 2010, p. 3.

The Theory of Constraints (TOC) grew from the business novel, *The Goal*,[119] by Eli Goldratt, a physicist from Israel. According to the APICS Dictionary, the Theory of Constraints is "A holistic management philosophy developed by Dr. Eliyahu M. Goldratt that is based on the principle that complex systems exhibit inherent simplicity."[120] In spite of this inherent simplicity, every system has at least one variable or constraint that limits the throughput of the system. Any increase in the capacity of the system anywhere except the constraint does not increase the capacity of the system. A constraint is a bottleneck that restricts the flow of materials in the system much like the bottleneck of a Coke bottle that limits the amount of Coke that can flow out of the mouth of the bottle. This is exactly why Mickey's went with the wide-mouth bottle—more liquid can pass through the wider mouth and the bottleneck is changed. It is important to remember that just because a process is not the constraint that does not mean that the process is not important.

TOC, like JIT, is a continuous process improvement program that seeks to produce a process of ongoing process improvement or POOGI. The TOC improvement process has a series of five focusing steps. The first step is to simply indentify the constraint in the system. In TOC terminology, an hour lost at a bottleneck or constraint is an hour lost in the entire system. This bottleneck must be modified or eliminated.

Once the constraint is identified, a decision is necessary on how to modify or exploit the constraint. The third step is to subordinate all of the non-constraint operations to the bottleneck. The fourth step is to remove the constraint or modify the operation to increase flow through the

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[119] *The Goal* was released in 1984; the term theory of constraints did not appear until 1987.

[120] APICS Dictionary, 14th edition, 2010, p. 142.

constraint. The fifth step is the continuous process improvement step—go back to step one and look for a new constraint and repeat the process while not allowing inertia or short-term satisfaction to prevent the process of ongoing process improvement.

TOC works on a system known as Drum-Buffer-Rope to make an operation work. The Drum is the constraint. The constraint provides the drum beat that the rest of the operation should be moving to. Just as the drumbeat sets the cadence for a marching unit, the constraint provides the cadence for the operation. The Buffer is the amount of product positioned in front of an operation to prevent work stoppage. The Rope is the flow of material that links the Drum to the rest of the operation or the release of materials to the consumption at the bottleneck.

Six Sigma

We looked at Six Sigma during the discussions on quality as a methodology of reducing variability through the use of the Define-Measure-Analyze-Improve-Control (DMAIC) methodology developed by Motorola.

- **Define** – define who the customer is; what the customer wants; and how our company can do it better than the competition. Define the process – what are we doing? In order to define the process, you have to physically walk the process. This is akin to the concept put forth in the Harvard Business Review called "Staple yourself to an order."
- **Measure –** in this step the process as the process is walked and documented, a detailed process map with every activity, the time allocated to the activity and how long each activity takes is produced.
- **Analyze –** look at the data from the measure activity and determine how the process can be performed better with less variability and develop this new process.
- **Improve –** put the new process into place and test it to make sure it works.

- **Control –** put controls in place to institutionalize the process and ensure that it works as designed.

Just like JIT and TOC, Six Sigma is a continuous process improvement program. The key to the success of Six Sigma is the continuous aspect. Too many companies complete the DMAIC steps and then find that Six Sigma did not work for them because they did not go back to the Define step and make sure the new process actually worked and worked better than the original process.

Six Sigma originated as a manufacturing process control but has applications to other aspects of the operations management chain. Six Sigma can be applied to warehousing and distribution operations as well as service industry. Granted, in service industries a company may not have one million opportunities but the ability to apply the Six Sigma methodology to reduce variation and improve the quality of the service is available to all companies in the operations management chain.

Lean

When Ohno and Shingo wrote about the Toyota Production System, they actually called what we now call Just-in-Time "lean." Something got lost in translation for many years. In 1995, James Womack wrote *Lean Thinking*. It was a follow on to his book, *The Machine that Changed the World.* His first book was about the Toyota Production System not really a machine itself. While researching the for the book, Womack became very interested in the foundations of the Toyota Production System. His follow-on book, *Lean Thinking,* turned out to be a literal translation of Ohno and Shingo.

This literal translation became the foundation of the lean movement. This foundation of lean includes the following similarities with JIT:

- The mandate of lean is to eliminate waste, improve quality and reduce costs. The same mandate and goals of JIT.
- There are seven wastes in lean – in fact they are the same seven wastes of JIT since it is simply a literal translation from Japanese into English of Ohno/Shingo.

Lean has taken on a life of its own since the release of Womack's book. In the quality world, half of the "experts" believe that lean is a tool of JIT and half of the "experts" believe that JIT is a tool of lean. In actuality, they are the same thing. They have the same wastes, the same goals and the same mandate. And they both come from the original works of Ohno and Shingo.

Summary

Just-in-Time, the Theory of Constraints, and Six Sigma provide tools for operations managers to improve their operations. Although each of these approaches is different, the success from them comes from the continuous process improvement aspects of the programs.

Discussion Questions

1. Is Just-in-Time an inventory management technique or a continuous process improvement program? Justify your answer.
2. Does every system have a constraint? If so, describe the methodology to improve the constraint or eliminate the constraint.
3. How do JIT, Six Sigma, and the Theory of Constraints compare and contrast?
4. Are JIT, Six Sigma, and TOC the same?
5. What is the goal of Six Sigma?
6. What are the seven wastes of the Toyota Production System? Give examples of each.
7. If a company increases the capacity of their system at a non-bottleneck process, what is the impact on the system?
8. Does non-constraint also mean non-important? Explain.
9. What is “Zero Inventory” and how does it relate to JIT?
10. Describe the concept of the Drum-Buffer-Rope.
11. Can Six Sigma be applied to services?
12. What is Kaizen? How does it apply to JIT?
13. The JY Company wants to move to Kanbans to move its supplies forward in the supply chain. If the lead time is 2 days; the demand during the lead time is 400; and the company is using a container that holds 50 items, how many Kanbans will the company need?
14. The JY Company wants to improve the efficiency of the company and its Kanbans, what will that do to the calculation in question 14?
15. How can quick set ups improve operations?