Chapter 26

Educational and Training Resources for JobshopLean

Background

FLean (Flexible+Lean) cells are the foundation for implementing JobshopLean in any complex high-mix low-volume (HMLV) facility. The core steps in the process for implementing JobshopLean in any high-mix low-volume facility requires its leadership to (i) identify the stable part families in their product mix, (ii) implement a FLean manufacturing cell to produce each part family that has a stable demand and (iii) utilize Finite Capacity Scheduling to schedule the daily operations in each cell. But, after they are done with the design and implementation of each FLean cell and its support systems, the real challenge of implementing the cell lies in educating and training cell employees and company managers to embrace a new way of working together. For example, if a cell is to operate as an ABU (Autonomous Business Unit), the cell's team must be given full responsibility for fulfilling all customer orders loaded on their cell. Is company management prepared to allow that? This chapter describes strategies and examples of the available resources that can be used to educate and train people (1) about Lean (in general) and (2) FLean cells (in particular).

Learning Lean from Other Manufacturers

Sometimes all that it takes to get the people in your own company fired up about Lean is for them to see how other companies have succeeded with Lean. Successful implementation of Lean does not always have to be a complete bolt-by-bolt re-arrangement of the entire facility! Even seeing the results of Continuous Improvement (CI) events done by employees in another company can get your own employees fired up.

Learning Lean from Videos

Some of the inspirational videos that create a basic awareness about Lean are:

- The Society of Manufacturing Engineers (www.SME.org) offers several videos such as *Introduction to Lean Manufacturing* (DV03PUB46), *Lean Manufacturing at Miller SQA* (DV03PUB47), *Lean Manufacturing at TAC* (DV03PUB48)
- The Greater Boston Manufacturing Partnership (GBMP, www.gbmp.org) has developed a mini-library of videos that feature some of their successful clients, such as Jotul, Madico, The Gem Group, VIBCO, AbioMed, etc.

Please do not rely solely only on videos to educate and train people in your company about Lean. At some point, you have to demonstrate that you, the in-house Lean expert, know a lot more than what is taught in those videos. So be prepared to frequently stop any video and explain details that are not displayed or verbalized in the video. For example, when a video shows a shadow board for tools, stop the video and explain that, for a shadow board to fulfil its purpose, every operator should commit to never return a broken tool on the board and walk away.

Learning Lean From Doing Facility Walkthroughs[1]

[1] If you are interested in free videos on how to do a facility walkthrough and conduct an effective morning meeting to report your observations, you may find helpful these YouTube videos with the following titles: (i) *Morning Improvement Walk* and (ii) *Lean, The Morning Meeting at FastCap*.

Nothing is better than seeing actual examples of the Seven Types of Waste[2] in your own facility. Just take along a video camera to record your entire facility walkthrough![3] However, it is important that you plan this walk based on the routing of a key component (or product), or better yet, an entire part family that you make. Figure 1a shows the manufacturing path followed by a forged part. The locations of the different machines that feature in that part's routing and the sequence in which they are used are shown on the Spaghetti Diagram that depicts the actual travel of the forging. ***To capture the wastes <u>between</u> all pairs of consecutive operations***, stand at the location of each operation, look in the direction of the location where the next operation will be done and take a photograph. For example, Figure 1b captures the distance of travel and the absence of Line Of Sight (LOS = 0) between the locations of Operation #1 (the partially-shown building on the right in the photo) and Operation #2 (the building on the left in the photo). How many of the Seven Types of Waste are caused by the transportation between these two consecutive operations to produce the forging?

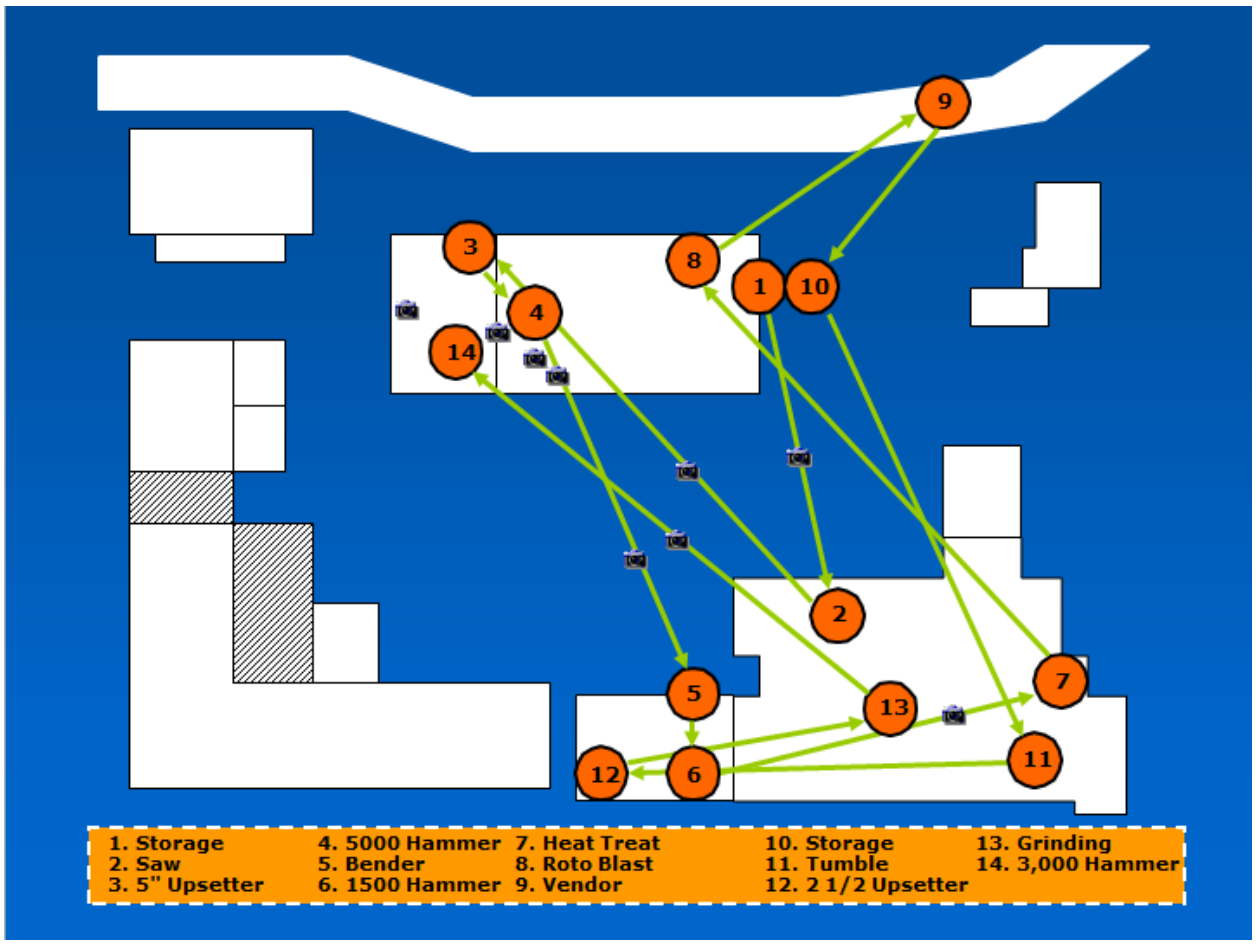

Figure 1a Spaghetti Diagram for a Single Forged Component

[2] There are numerous forms of waste but I have found that most of them can be reduced to the original Seven Types of Waste --- Overproduction, Transportation, Scrap/Rework, Operator Motion, Over-processing, Waiting and Inventory.

[3] A more advanced version of a facility walkthrough is the Gemba Walk.

Figure 1b Wastes due to Transportation between Consecutive Operations

Next, ***to capture the wastes <u>at</u> the location of every operation***, stand at the location of each operation and take a wide-angle photograph[4] of the machine and its vicinity. Figure 2a shows different locations in the facility where I took photographs related to the machines used to make the forging. For example, Figure 2b shows how bar stock delivered by the suppliers was stored outside the building that housed the presses. Which of the Seven Types of Waste are caused by the absence of any visual indicators to distinguish the different types of bar stock stored on the racks? The success of Lean easily depends on employee engagement and open communications.

[4] It would be preferable to also place a video camera that can record a continuous period of operation at key machines. Yes, the operators of these machines will feel that they are being spied upon. But, their concerns can be laid to rest by simply explaining to them the purpose of the video. Better yet, organize a pizza lunch during which time they can also watch the video and learn how the Seven Types of Waste could be reduced at the different machines.

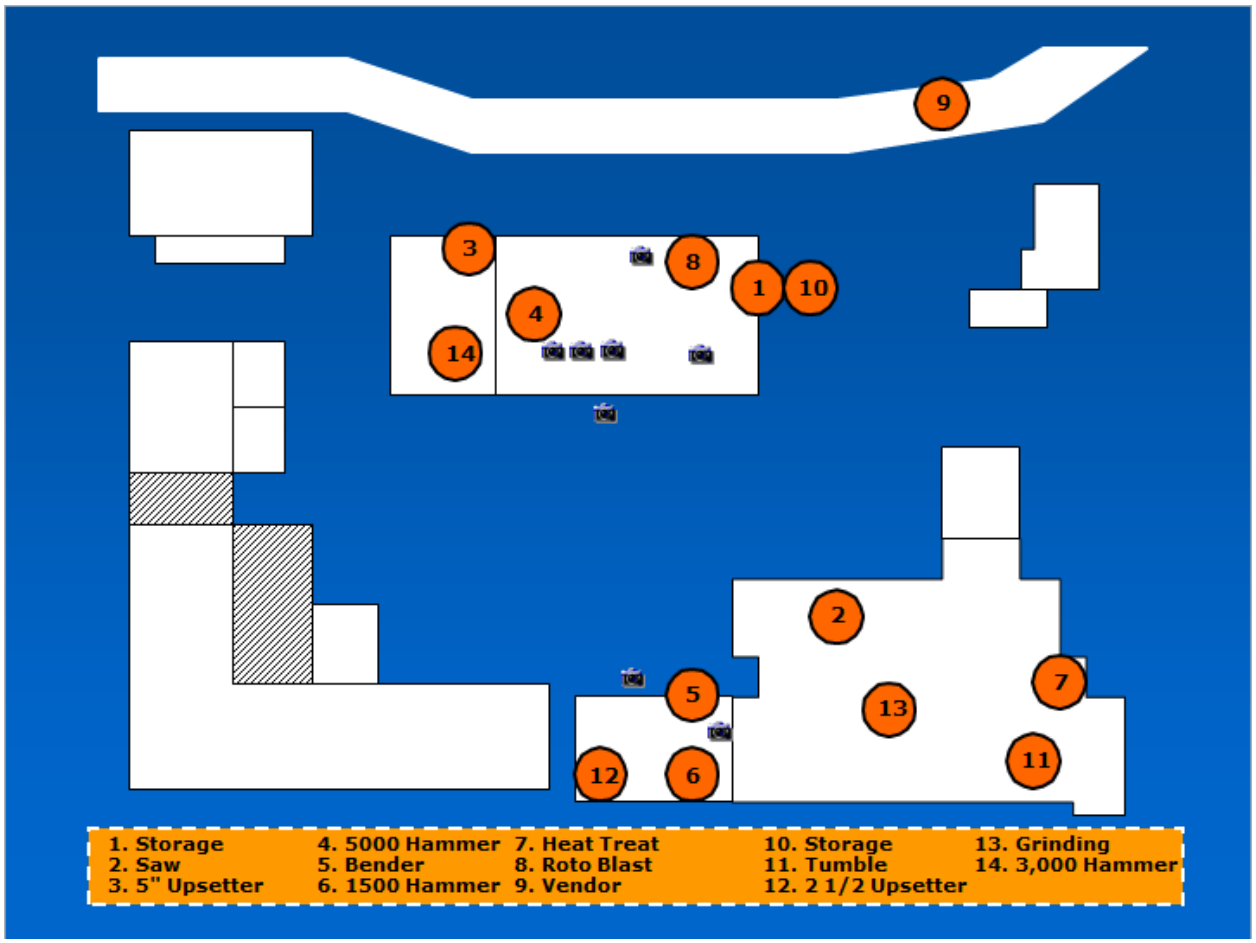

Figure 2a Locations At or Near Different Machines where Wastes were Photographed

Figure 2b Wastes due to Inefficient Storage of Raw Materials

Lean Assessment of an Operational Cell

There comes a time when it is important to demonstrate how to bring together all this education and training on Lean to design and operate an actual cell! Figures 3a-3g capture the Current State of an actual operational cell. In the case of this forging cell, the bar stock was stored in a different building (LOC #1 in Figure 3a) and transported in large tubs to the cell by a forklift ("MHE" = Material Handling Equipment in Figure 3a). Notice that the large tubs were put down a considerable distance away from the Oven by the forklift driver? From where the cell operator stood in front of the Drop Hammer, he would walk to the tubs, pick up and cradle several billets in his hands, walk back behind the Oven and place them one-by-one on the conveyor. Then he would walk around the Oven and wait for a heated billet to emerge from the Oven. As soon as a heated billet emerged from the oven, he would pick it up with a pair of tongs, load it into the Drop Hammer and forge the part.

Figure 3a presents a high-level visualization of the material flow of each forging produced in this cell. Figure 3b is a simplified Value Stream Map to display the operational parameters for all the activities performed in the cell. Figure 3c shows the location where tubs full of sawn billets are delivered from another facility. Do you think that the current inter-facility logistics is wasteful? Can you point out specific instances of the traditional Seven Types of Waste in Figure 3c? Figure 3d shows two tubs full of sawn billets that are delivered to the cell. Would you know how many billets are contained in each tub? And does that quantity relate to the daily demand that should pace

the production rate of the cell? And will it be easy for the operator to reach into the tub to pick the last few billets off the bottom? Figure 3e shows the relative locations of two key pieces of equipment in the forging cell. The Oven needs to be used first before the Drop Hammer. But aren't their positions opposite of what the material flow dictate (because the two tubs full of billets are dropped off to the right of the hammer)? Figure 3f shows the relative locations of in-process and finished forgings produced in the cell. Why do they put the forgings coming hot off the hammer to cool down on a table, and then expend labor to pick them off that table one-by-one and drop them into the wire mesh container. Later, they empty that wire mesh container into a sturdier tub that would be used to transport the entire batch of finished forgings to the facility that supplied the billets. **QUESTION:** Could a fixture be designed that would serve as the surface of the table but could be placed on top of the wire mesh container? That way, the operator would take hot forgings from the hammer and drop them on this surface. Then, with the palm of his hand he would sense if the hot forgings had cooled off. Once they had cooled down, he would simply tilt the fixture to drop the forgings into the container. Why unnecessarily accept the delays and costs of Waiting and Inventory wastes in the Current State? Figure 3g presents the improved layout that was designed for the cell to eliminate NVA (non-value added) activities. How does the circular layout of the cell eliminate Operator Motion waste?

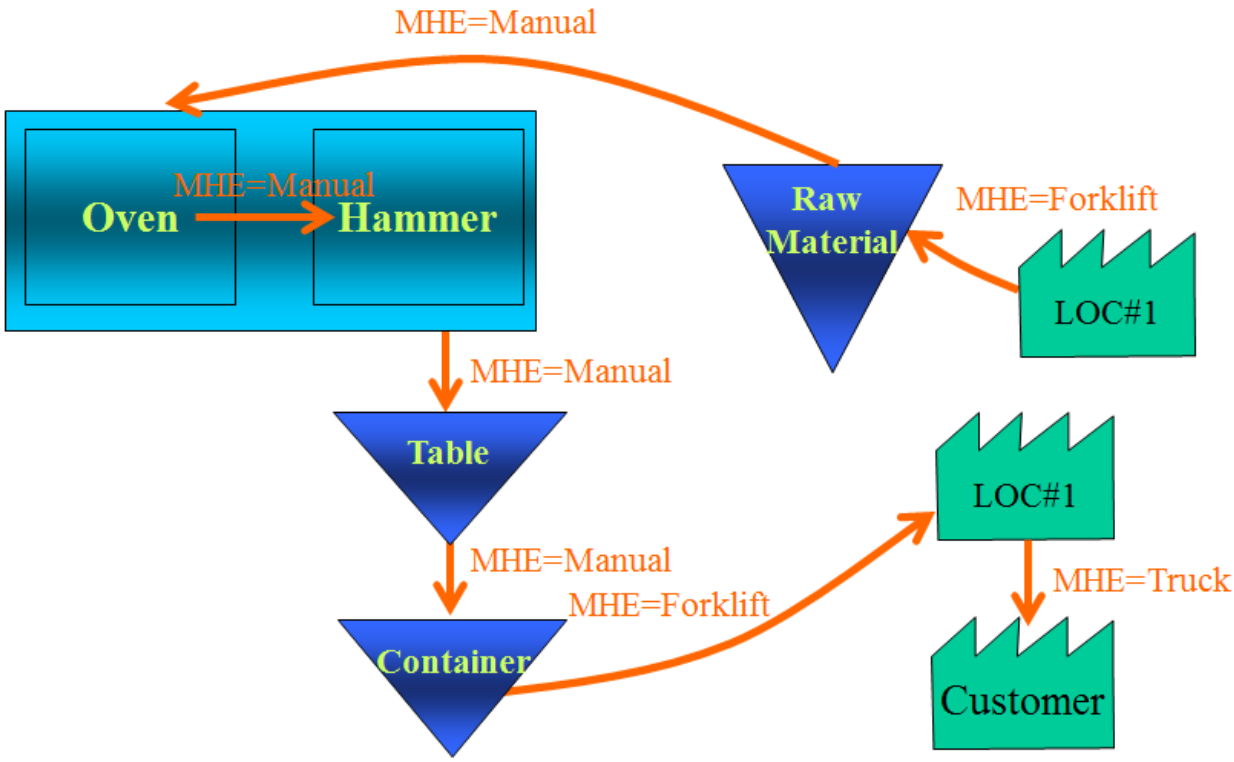

Figure 3a Factory-level Material Flow for the Cell

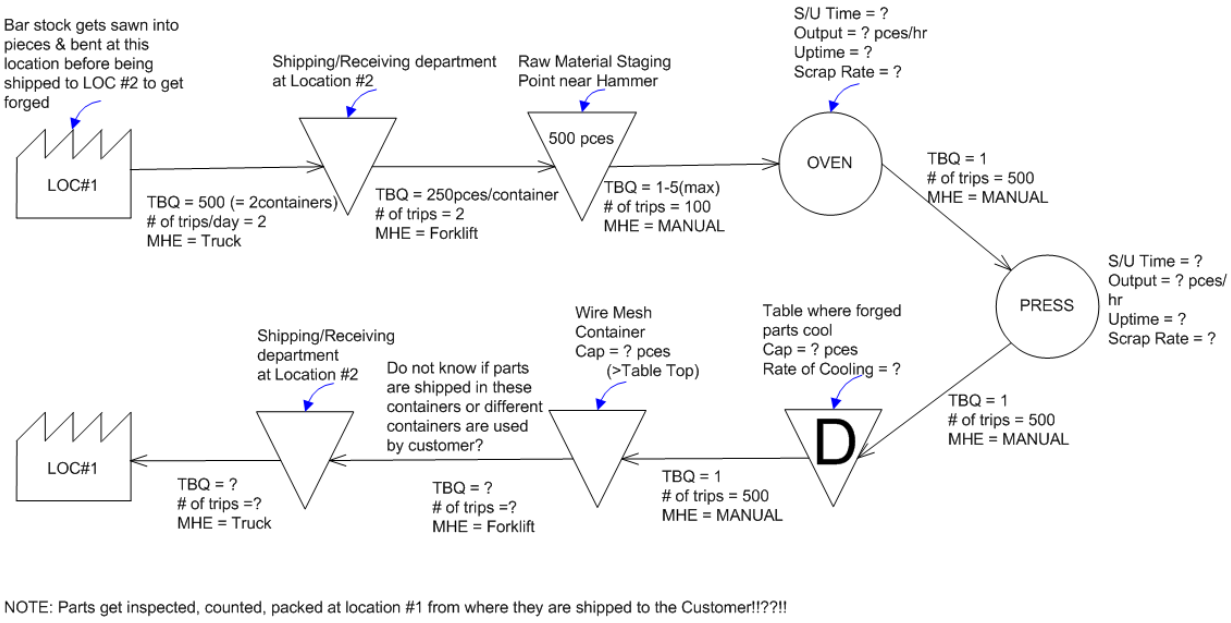

Figure 3b Shopfloor-level Value Stream Map for the Cell

Figure 3c Location where Tubs Full of Sawn Billets are Delivered from Another Facility

Figure 3d Tubs Full of Sawn Billets Delivered to the Cell

Figure 3e Relative Positions of Oven and Hammer in the Cell

Figure 3f Relative Locations of WIP and Finished Forgings in the Cell

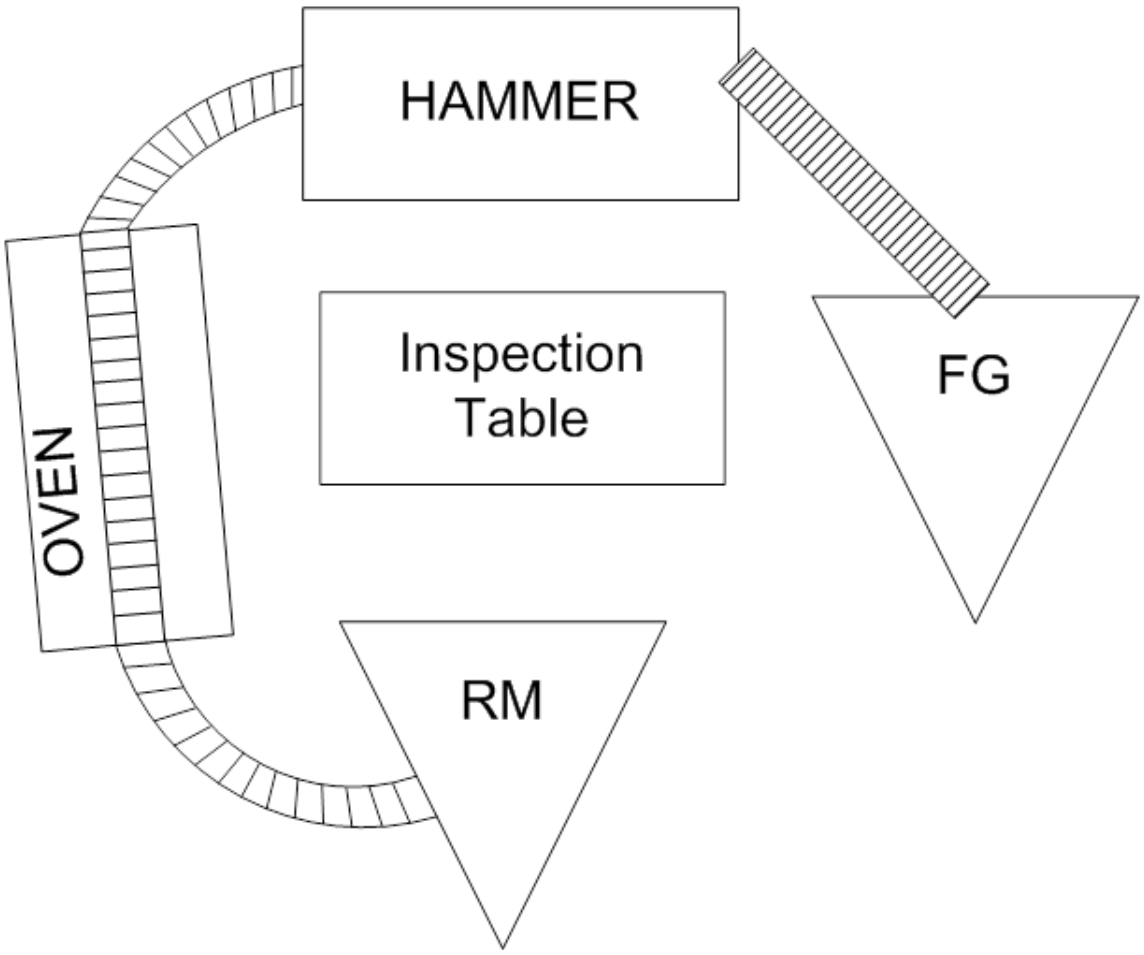

Figure 3g Improved Layout for the Cell

Figures 3a-3g should be the basis for discussion during meetings attended by all employees and managers who "touch" the cell. Indicate the "unLean" practices captures in each photo. Quantify the costs and delays due to the different wastes captured in each photo. Give everyone a chance to air their observations! Allow them to defend their actions but also encourage constructive argument to challenge those who take an "unLean" stance. If suggestions for improvement are voiced, note each idea on a Post It and assign each idea to a person who will follow through and implement it. Seeing is believing! Believing is doing! Doing is changing (for the better)!

Videos that Provide More In-Depth Training[5]

Having completed the preliminary Lean training, next you can teach specific Lean tools and best practices that are essential to make a cell operate like an Autonomous Business Unit (ABU). While there are numerous commercial videos on individual Lean tools such as 5S, Setup Reduction, Cross-Training, Visual Control, Continuous Flow, etc., I know of

[5] If you are interested in free videos on work cells, you may find helpful these videos posted on YouTube: (i) *Why Do You Use "U" Shape Cells at FastCap?*, (ii) *Manufacturing Work Cell Optimization* and (iii) *Subway is a Lean Work Cell – Be a Money Belt!*.

only the following videos that I have consistently used to discuss what it will take to implement a cell that can operate as an ABU (Autonomous Business Unit):

- *Customer Focused Manufacturing* (**Vendor:** www.sme.org, DV03PUB53): I use this video to emphasize that Continuous Improvement efforts must be made by everybody at all levels of the organizational hierarchy --- Business→Factory→Shop→Cell→Machine. For example, at the *Business* level, this video has segments that show top executives receiving training on strategic planning to help them decide that manufacturing cells were a key component of their strategy to be globally competitive. Similarly, at the *Machine* level, this video shows error-proofing (poka-yoke) devices for quickly checking product quality, tools hanging within easy reach of every operator, wheeled containers designed to hold a specific number of parts ("***cart***ban"), the ergonomically (and therefore safe) way to lift heavy containers from a cart onto a rack, etc.
- *Single Piece Flow* (**Vendor:** www.sme.org, DV06PUB13): I use this video in conjunction with notes I took to document every Lean best practice that is demonstrated in the video. For example, the digital counter on the assembly machine displays the Takt Time (TT) for the cell. Although TT may not be relevant in a high-mix machining or fabrication cell, it is far more important that (1) the LED display is clearly visible both to the cell operator and anyone outside the cell and (2) it displays a single metric to evaluate cell performance. I especially like the segment on the Water Strider in this video. This person is not just a material handler but also an expeditor who ensures that orders are on-time, that replenishments signaled by kanban cards are made in time, etc. **Please email me at ShahrukhIrani1023@yahoo.com if you are interested in the notes I have developed on this video.**

Once again, I will stress that you cannot just rely on videos to teach and train your employees and managers about Lean or JobshopLean. Either you or someone else has to become good enough to at least be the in-house expert who will repeatedly stop these videos to offer more details about a useful tool or a best practice or a behavior trait! Personally, I find it okay to put myself under this pressure because it forces me to keep learning. And that makes me a better teacher! To date, I have never hesitated to borrow every relevant concept, tool and system from the Lean body of knowledge and embed it into the JobshopLean body of knowledge. I have realized that Toyota has pioneered and continues to practice to this day an IE curriculum that we simply are not teaching in the 100+ IE departments in the US! Even though JobshopLean is built on IE science, I find the proven, simple, practical tools of Lean to be invaluable.

Do not Ignore *The Goal* Video!

While it never mentions Lean and despite its intimidating price tag, a video that I highly recommend to every Lean trainer, is *The Goal* (**Vendor:** www.goldratt.com). It introduced the world to Eliyahu Goldratt's Theory Of Constraints (TOC). The trouble I have with Lean's over-emphasis on waste elimination pursued with employee-led kaizens is that it is very easy to unleash a frenzy of factory-wide waste elimination efforts with no overarching goal. Instead, I favor integrating TOC and Lean as follows: (a) select a key Value Stream (or part family) and (b) focus on eliminating waste first and foremost on the bottleneck in the Value Stream (or Value Network for the part family). Every time that I show *The Goal*, I stop the video and challenge the group to answer a question that I pick from a comprehensive list of questions that I have prepared about the video. Over

the years, I have continued to check the original answer that I had written for each question in my question bank. It amazes me that others have helped me to improve almost every answer! In addition, I have added a question every time I found a new nugget of knowledge to be gained from this classic educational video. **Please email me at ShahrukhIrani1023@yahoo.com if you are interested in the list of questions on the video.**

Advanced Workshops on Lean/JobshopLean

I find that games and simulations on JobshopLean are entertaining and effective for explaining concepts and strategies. But, they are incapable of teaching the methods and tools that actually ***solve*** the operational issues that plague HMLV manufacturers! This is why I have developed the following workshops to teach JobshopLean and IE enhancements of Lean tools:

- (5-day workshop) *Fundamental Methods and Tools of Lean Manufacturing*
- (1-day workshop) *IE Software to Extend the Lean Tools*
- (3-day workshop) *Fundamentals of Finite Capacity Scheduling*
- (1-day workshop) *Practical Cell Scheduling using Scheduling Algorithms, Lean and TOC*
- (5-day workshop) *Building a High-Mix Low-Volume Manufacturing Facility using Production Flow Analysis*

If you are interested in the subject matter that is taught in any of these workshops, please email me at ShahrukhIrani1023@yahoo.com.

In Conclusion

Nobody taught Toyota how to develop the revolutionary Toyota Production System on the pillars of *Just In Time* and *Respect for People*. They did it on their own! They had the confidence and internal experts who were courageous enough to learn novel problem-solving tools via a try-and-try-again process. And that is what should drive you to implement, improve and enhance the implementation of JobshopLean in your ***high***-mix ***low***-volume manufacturing facility. Yes, it is not easy to implement JobshopLean. If Lean takes years to embed into a large company's culture, it takes a similar amount of time, if not more time, to truly convince the owner of a small or medium manufacturer to invest time and money, especially their own, to implement JobshopLean.

Supplementary Reading

How a Jobshop Developed their In-House Training Video on Waste Elimination:

One of the ways to instill desire and motivation among your employees could be to try and develop an internal video on waste elimination based on your own operations. Find an interested employee in your company and let him/her loose on this video project to kick-start your company's Lean training curriculum! The CD contains a folder that carries the video and related training materials that we developed for PR Machine Works (www.prmachineworks.com). All the content in the folder is based entirely on the video recording of a facility walkthrough that was led by their President, Mark Romanchuk, himself. The step-by-step tutorial on waste identification and elimination that was later taught to the manager team at PRMachineWorks is based entirely on this video. **Now**, what if you do not find any takers for this challenge within your employee ranks? No problem! Hire an IE intern from a local university with the necessary skills. I cannot say

enough about one of my all-time favorite videos titled *A Program to Initiate JobshopLean at Bula Forge & Machine Inc.* that was made by Bryan Wang, a former IE graduate student at The Ohio State University. They had hired him to do a pilot project to implement Jobshoplean in their facility. He single-handedly produced the video that documented his 3-month summer internship in a custom forge shop. Please click on this link https://vimeo.com/91520874 to see the video online.

Toast Kaizen: The *Toast Kaizen* video (**Vendor:** www.gbmp.org) is one of the best educational videos ever made on Lean. I use this video to teach the Seven Types of Waste at the start of every client engagement. In addition, I have developed a complete teaching package on problem-solving tools and production system design methodology based on this video. This teaching package shows how to utilize a variety of CI (Continuous Improvement) tools, such as Flow Process Chart, Spaghetti Diagram, 5 Why's, Ishikawa (Cause and Effect) Diagram, Constraint-driven Thinking, Tree Diagram and Gantt Chart to improve the ToPS (Toast Production System). And now a cautionary note about this video! It is easy to conclude that the toaster is the bottleneck. But, in reality, the butter could very well be the bottleneck. That is why the teaching package includes several Gantt Charts that were produced using MS Project. The reason for doing so is because the toast-making process is a parallel process and **not** a linear process! Therefore, it is important to teach the fundamentals of Project Activity Scheduling to emphasize that waste elimination involves fundamental IE skills such as: (1) reduction of the time it takes to setup and execute certain tasks, (2) determining the best sequence in which to perform the steps in a process and (3) investigating the possibility of executing tasks in parallel to the extent possible.

The *Single Piece Flow*© Simulation: One of the key reasons for implementing cells is to reduce the tendency for batch production. It may not be possible to have one-piece flow between machines in each and every cell that is implemented. But surely an Order Batch could be split into at least two (smaller) Transfer Batches in many cases? That is the primary goal of this simulation! Prior to developing this simulation, I went on YouTube and found a video titled *One Piece Flow versus Batch Production – Lean Manufacturing*. Please set aside some time to watch this video! Maybe you will not need to use my simulation thereafter. ☺ The complete details of the game are described in the overview that I have written for this game. Figure 4 provides a template for the part's route sheet that you could use for this game. Be sure to make each square a large 1" by 1" square so it takes time to X each square out!

Part XXX	Lot Size: 6	Part # of 6	
Operation #	Machine Used	Operation Time	
1	M1	5	☐☐☐☐☐
2	M2	5	☐☐☐☐☐
3	M3	5	☐☐☐☐☐
4	M4	5	☐☐☐☐☐
5	M5	5	☐☐☐☐☐

Figure 4 Route Sheet for the Part

Now let me share with you a little history about what happened when I first ran this simulation to train a group of employees at the Milby, TX, facility of Hoerbiger Corporation of America. One of the employees in that group was Luong D. He worked in the MPC Cell where an IE graduate intern was working with me to completely re-design that cell. The three of us discussed (and argued a lot too!) why one-piece flow ought to be implemented between the Haas Mill and the group of three Cincinnati Mills that Luong D. operated. The intern and I maintained that it was unacceptable that operators at two machines which were a few steps apart continued to use a batch-and-queue policy instead of using transfer batches! A few days after this training, Luong D. gestured to us and showed us what he had implemented. Figure 5 shows his idea to start pulling just enough pieces off the Haas Mill that he could pack on the arbor used on each of his three mills. Thereby, the same order could be split up and each batch run in parallel on all three machines. This is just one instance of the economic benefits of (1) implementing cells **and** (2) giving Lean education to the cell operators **and** (3) empowering the cell operators to exercise their creativity!

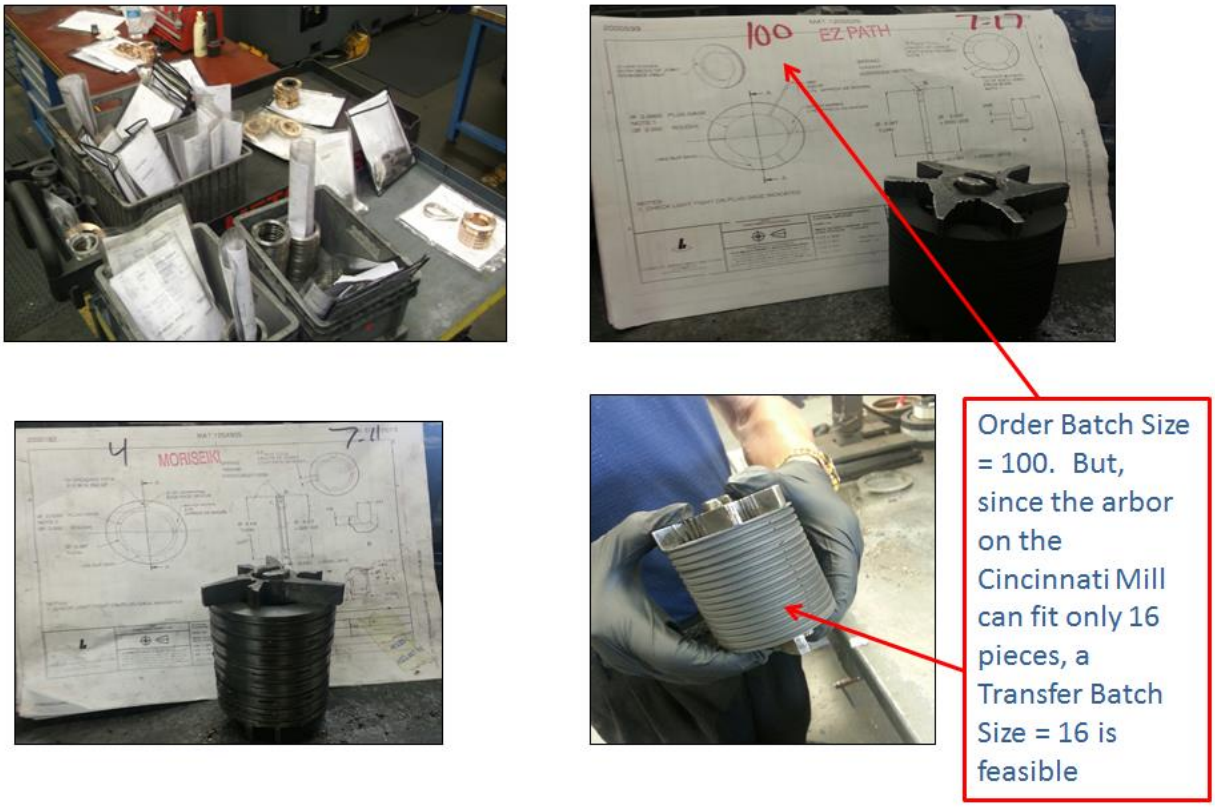

Figure 5 Transfer Batch determined by the Fixture used on the Mill

The *Stamping Out Chaos*© Simulation: This simulation teaches the layout and day-to-day operations of a cell. The cell needs to produce a number of different license plates. The group is asked to design a cell that must be (i) flexible, (ii) fast and (iii) cost-effective to operate. The cell consists of six stamping presses and a location "R/S". The

location "R/S" is the combination of two departments: "R" = Receiving (for receipt and storage of raw materials) and "S" = Shipping (for receipt and shipping of finished products). Six volunteers are chosen to role play as the "stamping presses". They each receive an inkpad and a stamp with one of the six letters – W, E, T, A, H, C. They would stamp their letter on each license plate that has a word with that letter in it. The set of license plates that must be produced is as follows:

Wheat	**Thaw**	**Etch**
Cheat	**What**	**Whet**
Teach	**Chew**	**Each**
Chat	**Hate**	**Ache**
Watch	**Heat**	

Each license plate is assigned to a different person in the group. Each license plate will start at the location "R/S", visit the appropriate sequence of presses one-by-one, get the sequence of letters stamped on it at the different presses and, after all the needed letters have been stamped on their plate, they return to the location "R/S". When a license plate reaches a particular press to get their next letter stamped, they wait their turn in the queue to get stamped before they can move to the next press to collect the next letter stamp, and so on. The person carrying a license plate must keep a count of the total number of steps that he/she walked on their route, beginning and ending at the location "R/S". On completion of his/her manufacturing route, each person reports the total number of steps that they walked to the person acting as the R/S clerk sitting near the cell.

My goal is to provide the attendees insights into some of the key differentiators between JobshopLean and Lean. Here are some of the challenging questions that I ask the group after we are done playing this seemingly simple game are:

- Which of the 720 possible layouts for the cell would minimize the total distance travelled by all the license plates?
- Where should the R/S station be located with respect to the six presses in the cell?
- What is the sequence in which the plates should be released to the cell to minimize the total time it takes the cell to complete all the license plates?[6]
- Would they release all the plates for production at the same time? If not, would they release similar plates such as WHEAT, WHAT and HEAT one after the other? Or would they prefer to release dissimilar plates such as WATCH, HEAT and CHAT one after the other?

A Step-By-Step Approach for Implementing JobshopLean: I developed this case study while I was at the University of Minnesota to teach total facility re-organization into cells, and appropriate support systems and operational strategies to manage the individual cells as well as interactions between them.. It was originally published as Chapter 20 (A Classroom Tutorial on the Design of a Cellular Manufacturing System) in the *Handbook of Cellular Manufacturing Systems* (John Wiley, 1999, ISBN 0-471-12139-8). It has been reproduced in this book with the permission of the publishers, John

[6] If you wish to answer this question, you may want to learn about Job Shop Scheduling and download the free *LEKIN Academic Scheduling Software*. Please visit http://community.stern.nyu.edu/om/software/lekin/ to download the software.

Wiley & Sons, Inc. Special thanks are due to Bob Argentieri for facilitating the permissions process that allows me to disseminate this one chapter from the handbook. At the time, he was with John Wiley and managed the handbook project.

This case study uses data for a hypothetical machine shop to illustrate how the PFAST software can perform some of the basic analyses for the design of Cellular Layouts (or Hybrid Cellular Layouts) such as product mix segmentation, material flow mapping, part family formation and block layout design. However, these are ***just*** the preliminary analyses to design a detailed facility layout. PFAST ***does not*** perform many of the subsequent steps to re-layout a jobshop. Therefore, this case study explains *in full detail* the following activities that are essential for implementing a FLean (Flexible and Lean) facility layout:

- Product-Process Matrix Analysis to form part families
- Capacity Requirements Analysis to determine how many machines of each type are required in a particular cell (Machine Loading)
- Distribution of shared machines among competing cells (Machine Allocation Analysis)
- Strategies for limiting inter-cell flows ex. elimination of Exception Operations
- Design of the layout of each cell (Intra-Cell Layout)
- Design of the overall layout of the entire facility (Inter-Cell Layout)
- Scheduling operations inside each cell (Intra-Cell Scheduling)
- Synchronizing cell schedules with the inter-cell flows to complete operations on parts that visit (1) other cells, (2) Monument/s (if any) and (3) Remainder Cell/s (if any) that are external to the cells (Inter-Cell Scheduling)[7]

I urge you to work through these steps as that will help you to understand what data you will need to extract from your ERP system if you decide to implement JobshopLean using the methods described in this book! **Please email me at ShahrukhIrani1023@yahoo.com if you have questions.**

The *JobshopLean*© Simulation: This low-cost interactive simulation is based on the *Classroom Tutorial on the Design of a Cellular Manufacturing System*. While the classroom tutorial may be better suited to IE students, I realized that industry practitioners needed something more dynamic and hands-on without sacrificing the learning content. This simulation teaches the following JobshopLean practices:

- Segment the parts into multiple segments based on Volume, Value and Complexity *(and not just Volume using the 80-20 Pareto Rule!)*
- Identify part families in the product mix
- Implement manufacturing cells but also consider other layout options, such as Hybrid Cellular Layouts or Virtual Cells
- Plan the equipment allocations to the cells based on Workload vs. Available Capacity
- Cull the low-value low-volume products from the existing product mix
- Try to re-engineer certain routings to eliminate "misfit routings" and "exception routings"
- Train material handlers to become "Water Striders" who have complete "situational awareness" on the shop floor

[7] This coordination of cell schedules is to be done jointly by Production Control and the Water Strider/s on the factory floor.

- Cross-train employees to attend to multiple machines within a cell (or even if they were distributed across the facility in Virtual Cells)
- Introduce multi-function flexible automation to compact the facility
- Schedule with finite capacity constraints in order to manage work releases into the shop so as to maintain sufficient WIP in Time (***not*** Inventory) Buffers
- Use appropriate sequencing/dispatching rules to prioritize jobs at different machines, especially the bottleneck/s
- Use performance measures, such as Cash Flow Velocity, instead of Cost Reduction (aka Seven Types of Waste)
- Encourage feedback and ideas from the employees
- Implement a visual queue management system to facilitate Pull scheduling

In addition, you can incorporate into this simulation **some** of the standard Lean tools as follows:

- *Quality At Source:* You can issue help cards that show how the squares on the route sheets should be X'ed out else rework will be called for.
- *5S:* You can have the players who represent the different machines go to a central tool storage rack to get the particular colored pencil they must use to mark up the route sheets.
- *Visual Management:* You can mount a white board on which the specific sequence in which jobs must be done at certain work centers is announced.

The first run of the simulation demonstrates the Current State of a hypothetical machine shop with 12 different machines making approx. 15 parts with routings that use different combinations of those machines. Please click on this link https://vimeo.com/5425379 to see the online video titled *JobshopLean Simulation – Current State of the Jobshop*. The second run of the simulation demonstrates the Future State of the same machine shop after implementing some of the JobshopLean strategies listed earlier. Please click on this link https://vimeo.com/5537406 to see the online video titled *JobshopLean Simulation – Future State of the Jobshop*. In both videos, I play the role of the Water Strider moving jobs between different machines. This allows me to have fun while I entertain and instruct the class.