The *Jobshop*Lean Advisor

Practical Solutions to Age-Old Problems in Make-To-Order Manufacturing

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Motivation for this Newsletter

There are a large number of manufacturers who should look beyond the Toyota Production System (aka Lean) if they feel that they have not achieved the results they expected from Lean. The majority of them are small and medium-size high-mix low-volume (HMLV) manufacturers who operate in a Make-To-Order (MTO) business environment. Their products are not made on assembly lines. Their on-time delivery performance is driven by due dates specified by different customers. They cannot afford to keep finished goods inventory for most of the products that they make. They continue to struggle with age-old operational problems because (a) they do not rationalize their high product variety, (b) they have a facility layout that encourages batch-and-queue production, and (c) they rely on an ERP system that lacks the analytics to produce valid production plans and daily operations schedules subject to finite capacity of resources (machines, labor, materials, etc.).

I read *Lean Thinking* in 1999 and immediately saw the synergy between Lean and Industrial Engineering (IE). From 2002-2012, while at The Ohio State University, I did the research to develop the concepts, methods, lecture notes, workshops, software tools, internship program, consulting seminars, etc. to adapt Lean for HMLV manufacturing. The result was *Jobshop*Lean! In 2012, I left the Ohio State University to work in industry. I got first-hand experience from succeeding (and failing too!) at implementing *Jobshop*Lean. I learned that:

(1) Executives really do not want to be involved in hands-on activities and do not wish to finance the changes if they do not see immediate returns.
(2) Executives and middle managers, especially those who run the Human Resources department, find it difficult to entrust their employees with the freedom (and authority!) to implement any CI (Continuous Improvement) ideas. Which is why they do not support training for employee development.
(3) Employees are the easiest to engage with if you want to implement Lean!
(4) There are few experts, books, tools, workshops, etc. that explain how to adopt and adapt Lean for HMLV manufacturing environments.

In 2014, I embarked on my current career as a full-time consultant.

Is This Newsletter for You?

Having transitioned from academia to industry, I have concluded that small and medium-size high-mix low-volume (HMLV) manufacturers are making a mistake by focusing **only** on management and operational practices implemented at/by Toyota. This newsletter will offer HMLV manufacturers guidance on the complete spectrum of operations improvement strategies that are appropriate to their non-repetitive high-mix variable-demand production systems. If

you answer "Yes" to some of the statements that appear below then you may want to read this newsletter:

Your Response	Statement
☐ Yes ☐ No	You have a chaotic material flow on the factory floor with significant material handling activity
☐ Yes ☐ No	The average stock-to-dock flow time for an order is high
☐ Yes ☐ No	Your product mix consists of a large number of products with dissimilar routings
☐ Yes ☐ No	Based on the aggregate demand, frequency of orders and certainty of demand for your different products, your product mix consists of 3 business segments – Runners, Repeaters and Strangers
☐ Yes ☐ No	The shop floor of your facility has a functional layout i.e. equipment with the same or similar processing capabilities are co-located together in departments (aka "process villages")
☐ Yes ☐ No	You rely on an ERP system to produce a daily schedule whereby orders are released without true knowledge of shop capacity and WIP
☐ Yes ☐ No	Visual LOS (Line Of Sight) between key work centers is lacking
☐ Yes ☐ No	Real-time order tracking capability is poor with much time being lost in "search and find" efforts
☐ Yes ☐ No	Large storage containers are being used to move material on the shop floor
☐ Yes ☐ No	Utilization of capacity on bottleneck machines is low

Examples of the Fundamental Differences between Lean vs. *Jobshop*Lean

(1) *JobshopLean does not focus on Waste Elimination alone.* Lean focuses on elimination of the Seven Types of Waste (Defects, Overproduction, Inventory, Unnecessary Motion of Employees, Over-processing, Waiting and Transportation). Click here to visit a website that has good information on the Seven Types of Waste. In contrast, *Jobshop*Lean is based on the science and practice of IE (Industrial Engineering). It looks beyond the Seven Types of Waste (the symptoms for a disease) and attacks the reason/s for those wastes (the actual disease). For example, in the case of a disorganized warehouse, the **first** step would be to investigate the Re-Order Points and Replenishment Quantities in the ERP system for the items stored in the warehouse. Next, the Min/Max Inventory Levels, Order Quantity, etc. would be determined for each item. **Later**, when it is time to design a new layout to streamline and design efficient workflow processes to execute warehouse operations, **then** the Lean tools such as 5S, Visual Management, Standard Work Instructions, etc. would be used.

(2) *JobshopLean views the Seven Types of Waste mainly as performance metrics.* This helps to monitor and assess the progress of any CI (Continuous Improvement) project. The priority of JobshopLean is to do IE projects to improve the existing processes, systems, equipment, workforce skills, management practices, etc. If correctly planned and implemented successfully, these projects are guaranteed to eliminate the Seven Types of Waste.

(3) *JobshopLean looks for other less-obvious forms of waste.* In a jobshop, the waste of *Overproduction* is irrelevant because the jobshop typically purchases material specifically for an order. Then, as regards the waste of *Inventory*, there is waste when there is NO inventory i.e. there are shortages! Shortages lead to the wastes of (a) WIP due to an incomplete kit (or kits) of parts, (b) expediting costs to obtain the missing parts and (c) overtime to complete and ship the orders that had shortages! In fact, the website referenced earlier lists a few more

types of waste: (1) confusion caused by missing information or misinformation, such as conflicting goals and metrics set by management, (2) unsafe or un-ergonomic work conditions and (3) underutilizing the skills, talents and creativity of the employees. The Eight Waste is the "the failure to utilize the skills, talents and creativity of employees". In practice, I find that many small HMLV manufacturers release incomplete or inaccurate drawings to the floor because there is so much pressure to book new business! So they trust (and expect) their shop employees to find creative fixes on the fly when design errors or BOM inaccuracies force rework on the factory floor. And more often than not, those fixes produce a finished product that the customer buys. That is how small and medium HMLV manufacturers have done business over the years!

(4) *JobshopLean relies on data mining algorithms to analyze the data that resides in any ERP system to guide better business decisions and operations management.* Every job shop or MTO (Make To Order) custom fabricator uses an MRP-based[1] ERP system. That ERP system is often the reason why they lose money even before any order is released to the shop floor. Most ERP systems just store data. They lack data mining algorithms that could guide an HMLV manufacturer to (1) rationalize their product mix to eliminate the "cats and dogs", (2) determine when to decline some customers whose orders do not "fit" the capabilities of their shop and supplier base, (3) check that the parts list for every order (and drawings for each part) are complete, (4) flag wrong or missing data in BOMs and routings, (5) forecast demand, schedule operations and sequence jobs on machines.

(5) *JobshopLean solves the well-known problems that have plagued job shops and other HMLV manufacturers since time immemorial.* For example, job shops continue to prefer the process layout, where each group of identical or similar equipment is co-located in a single department. In theory, this layout gives them the flexibility to produce a large variety of parts with different routings. Unfortunately, **in practice**, the process layout forces batch-and-queue production (which causes the Seven Types of Waste). Even worse is the use of current ERP systems with their legacy MRP (or MRP II) engines for producing daily schedules. MRP does not work! Eliyahu Goldratt, who developed the *Theory Of Constraints*, was the first person to expose the shortcomings of MRP and offer the rudimentary DBR (Drum-Buffer-Rope) method for Finite Capacity Scheduling.

Why Lean is Unsuitable for *High*-Mix *Low*-Volume (HMLV) Manufacturers

The BIG problem in industry is that almost all implementations of Lean are done using tools developed for high-volume repetitive assembly! Lean may have a proven track record for helping any manufacturer **or** non-manufacturer to maintain high quality, free up wasted production capacity to absorb more business, cut costs, create a safe workplace, improve workforce morale, etc. But that is because Lean is derived from the revolutionary Toyota Production System (TPS) that has been universally adopted (and adapted) by thousands of manufacturing facilities, hospitals, warehouses, government offices, etc. **Please click here to hear the presentation *Overview of Lean Manufacturing*.** Still, the Toyota Production System (aka Lean) fails to address some of the fundamental needs of high-mix low-volume (HMLV) manufacturers. Why? Because the tools needed to design and operate an automotive assembly line are radically different from the tools needed to design and operate any job shop, such as a forge shop, machine shop, fabrication shop, tool & die shop, etc. Every assembly line is a **low-**

[1] MRP = Material Requirements Planning

mix **high**-volume repetitive production system and every job shop is a **high**-mix **low**-volume non-repetitive production system. So how can a carpenter get a job done if he is given the wrong tools to do that job? Table 1 provides my personal assessment whether the popular Lean tools would work in any HMLV facility, especially a job shop.

Table 1 Lean Tools that will (or will not) Work in Most Jobshops

Tools that *will* Work in Most Jobshops	Tools that *will not* Work in Most Jobshops
Strategic Planning (aka Hoshin Kanri)	Value Stream Mapping
Top-Down Leadership	Assembly Line Balancing
Employee Involvement	One-Piece Flow Cells
5S	Product-specific Kanbans
TPM (Total Productive Maintenance)	FIFO Sequencing at Workcenters
Setup Reduction (SMED)	Pacemaker Scheduling
Error-Proofing (Poka-Yoke)	Inventory Supermarkets
Quality At Source	Work Order Release based on Pitch
Visual Controls & Visual Management	Production based on Level Loading (Heijunka)
Product and Process Standardardization	Mixed Model Production with Takt Time
Right-sized Machines	
Jidoka	
Standard Work	

***Jobshop*Lean**

JobshopLean is a manufacturing strategy that conquers the complexity of HMLV (high-mix low-volume) manufacturing. JobshopLean integrates IE (Industrial Engineering) science with practical CI (Continuous Improvement) strategies such as Lean, Six Sigma and Theory Of Constraints. **Please click here to hear the presentation *Why the Toyota Production System is Unsuitable for Jobshops.*** Does this mean that Lean is completely irrelevant in high-mix low-volume facilities, especially job shops. No! Some Lean tools are universal. Even in a machine shop or forge shop, if they have a Long Term Contract with a customer, they would have to produce a single product in large quantities. Else, they may have to produce a family of products whose routings are identical. In both cases, a Lean tool like Value Stream Mapping would help to design a production cell to produce that product (or product family). **Please click here to hear the presentation *A Program to Initiate JobshopLean at Bula Forge & Machine Inc*.** JobshopLean focuses on improving the departments (and people) that perform the key IE functions in any manufacturing company listed in Table 2.

Table 2 IE Functions that are Equivalent to Lean Tools

Basic IE Functions	Advanced IE Functions
Time Studies	Variety Reduction with Group Technology
Cost Reduction	Product Mix Segmentation
Workplace Design	Inventory Control
Facility Layout	Design for Automation
Material Handling Analysis	Warehouse Management
Cellular Manufacturing	Production Planning
Process and Product Standardization	Finite Capacity Scheduling
Incentive Programs	Ergonomics
Communications	Shop Floor Control

What Aspects of JobshopLean Ought to be Discussed in the Newsletter?
Please give me feedback and let me know which, if any, of the following columns should appear in future editions of the newsletter:

- *Teaching Your Employees to be Problem Solvers:* In this column, I want to offer simple tips on what employees could be taught so that **their** complaints result in ideas that **they** submit to **their** immediate supervisor. Basically, no one complains unless they can offer a solution! How to do this? If an employee is interested and willing, teach him/her how to prepare a 5 Why's map for his/her complaint.
- *Implementing Lean in HMLV Facilities:* In this column, I will present examples of how I have implemented the standard Lean tools successfully in HMLV environments. **Please click here to hear the presentation *Setup Reduction on a Forging Press*.**
- *Implementing JobshopLean in HMLV Facilities:* In this column, I will present methods to implement JobshopLean in HMLV manufacturing environments. For example, I find that Value Stream Mapping is ill-suited for HMLV manufacturing environments. **Please click here to hear the presentation *Value Network Mapping*.**
- *Commercial Software and Technology to Design and Operate HMLV Facilities:* In this column, I will survey software and/or technology that can address the challenges of HMLV manufacturing ex. MES (Manufacturing Execution System) and FCS (Finite Capacity Scheduling). The Internet Of Things (IoT) is coming. Be ready to embrace it!
- *Do's and Don'ts for Executives and Middle Managers:* In this column, I will discuss what most executives and middle managers fail to do to ensure the success of their organization's Lean Transformation. Many do not understand why Lean will benefit them nor do they accept that they are primarily responsible for ensuring the success of Lean at their company. They are too busy with customers, demand forecasting, business meetings, etc. to have time to learn the WHAT's and HOW's of implementing Lean (let alone JobshopLean!). So they hire an (external) consultant to whom they abdicate their responsibility! One source claims that poor leadership is why "…around 70% of Lean Transformations fail to meet expectations and that circa 90% are in an equal of worse position within 5 years of starting…".

- *Case Studies:* In this column, I will discuss case studies about HMLV manufacturers that have implemented Lean. **Please click here to access a case study on JobshopLean implementation in a machine shop**.
- *Non-Traditional Applications of JobshopLean:* In this column, I will bring to your attention specific examples of Lean implemented in non-manufacturing HMLV environments that exhibit the operational characteristics of a job shop. **Please click here to hear the presentation *Patient Flow Analysis to Design a Lean Hospital***.
- *Book Reviews:* In this column, I will bring to your attention books that are "off the beaten track". They offer sound advice for HMLV manufacturers despite the fact that their authors have little, if any, affiliation with Toyota. Examples of these books are: (1) Ton, Z. (2014). *The good jobs strategy: How the smartest companies invest in employees to lower costs and boost profits.* Houghton Mifflin Harcourt Publishing Company **and** (2) Gawande, A. (2010). *The checklist manifesto: How to get things right.* Picador.
- *Q&A:* In this column, I will post my responses to readers' questions on JobshopLean. While I will answer each question to the best of my abilities, I will not hesitate to suggest a book or some other valid source of information, maybe the name/s of other experts.
- *Community Service:* In this column, I will describe a situation (possibly include a photo or two) that is crying out for improvement and invite ideas from readers. I will post the ideas I got from readers in the next issue. For example, at the local YMCA that I go to there is no "circulation" in the usage of the floor mats for workouts. Why? Since the mats are hung on hooks on the wall, there is a Last In First Out pattern of usage. Can a workable and affordable idea be implemented so the mats are used on a First In First Out basis?
- *Columns contributed by Readers:* I would hope that this newsletter encourages readers to become contributors. If you are interested in contributing to this newsletter, please email me at ShahrukhIrani1023@yahoo.com or call me at 832-475-4447.

SAMPLE COLUMN: Do's and Don'ts for Executives and Middle Managers

Are the executives at your company going to be involved and get their hands dirty working with their employees during the Lean Transformation? A colleague of mine, who is a Lean implementer at his facility, had this to say about the executives there … "We no longer have COMPLETE buy-in and daily gemba walks by middle and senior management with enforcement. We've lost all that here since Ed[2] left. Ed would walk the shop 3 times a day. He called it washing his hands and seeing the real work that he was expected to manage. (Our) executives need to get out of their offices and stop managing by Powerpoint! They all want to be executives and isolate themselves from the daily dirt on the shop floor. We don't have a chance now since Ed left." Click here to visit a website that has good information on Gemba Walks.

Click here to read this article *Lean Manufacturing Transforms Wisconsin Maker of U.S. Navy Warships*. Quoting from that article, "Jan Allman, who took over as President of Marinette Marine last year after nearly three decades in the automotive and truck business, walks the 550,000-square-foot (51,097-square-meter)shipyard every day, gathering tips from workers about how to improve production." As the CEO, or COO, or VP Operations, or Director of Operations, or Plant Manager of your company, would you take a daily gemba walk, either through the factory or the offices?

[2] **Ed was the previous Plant Manager at this facility.**

Click here to read this article *Lean Doesn't Work! (And What To Do About It)*. The author lists the following reasons why executives and middle managers fail to lead their company's Lean Transformation:

(1) They lack the discipline and focus.
(2) They do not see what is in it for them to do this new, extra work.
(3) They do not really understand where these specific changes are headed and what they can do for them and the company.
(4) They have not learned deeply enough to believe in all this "Lean stuff".
(5) Nobody they respect and trust has been teaching and coaching as they have gone through the change.

Now for my two cents! I spend 1-2 days every week working full-time at a client site, either as a project team leader, project team member or observer (as when the team gets called away to fight a fire so I have the time to go to the floor and observe the Current State). This hands-on involvement helps me to build relationships with the employees and managers I work with. It helps me to identify the anchor-draggers and naysayers who would like the Lean Transformation to fail. Sadly, I consistently find that it is usually the executives and managers who are the least involved and supportive of Lean. And they work full-time at their company! The little things that an executive can do for each employee they meet on their daily gemba walk ("How's the day been so far?", "Thank you for working for us!", "What gets in the way of your work every day?", etc.) would go a long way. If only they would get out of their offices!

Pro Bono JobshopLean Assessment

If you are located in Texas and are within driving distance, I am willing to do a pro bono ½ day visit to your company. During this visit, I will:

(i) make a brief presentation on JobshopLean,
(ii) complete a 2-part questionnaire *Is JobshopLean Right For You?* with you,
(iii) take a tour of your facility,
(iv) share with you my observations during the plant tour,
(v) provide ideas for potential improvement projects after the plant tour,
(vi) conclude the visit with a Q&A.

Even if you are not within driving distance, you are still welcome to complete and return the 2-part questionnaire to me. I will follow up with a call to discuss your responses and provide you a pro bono assessment over the phone.

A "Starter List" of Books

- Byrne, A. *The Lean turnaround: How business leaders use Lean principles to create value and transform their business*. McGraw-Hill.
- Conner, C. *Lean manufacturing for the small shop*. Society of Manufacturing Engineers.
- Fisher, K. *Leading self-directed work teams: A guide to developing new team leadership skills*. McGraw-Hill.
- Jacob, D., Bergland, C. & Cox, J. *Combining Lean, Six Sigma and the Theory Of Constraints to achieve breakthrough performance*. Free Press.
- Lane, G. *Made-To-Order Lean: Excelling in a high-mix low-volume environment*. Productivity Press.