Manufacturing Management & Technology Institute

Takt Times

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"Learning to See" and learning to see

by Michel Baudin

"Learning to See," by Mike Rother and John Shook, is a publication from Womack & Jones's Lean Enterprise Institute (LEI). What the book presents is a graphic method for material and information flow mapping. It is worth reading, but the content does not live up to the title. As an analytical framework, it is woefully incomplete: there is much more to understanding the dynamics of a factory than just mapping the flows of materials and information.

The graphic language it presents in the book is a useful abstract way to model the logic of lean production. I find it an improvement over what I have been using for the same purpose and I plan to adopt it.

Calling the book "Learning to See" was a stroke of marketing genius. A more descriptive title, like "Materials and information flow mapping" would have

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An ERP Mystery

A case study by Crispin Vincenti-Brown and Michel Baudin, based on a example from Jay Forrester.

"We know your shipping schedule," the supplier said. "You have been using 100 of our parts every month for the past six months, and you will be doing the same for the *next* six months. So why is it that this month you ordered 36 and next month 305?"

"I don't know," replied the buyer. "We've got this new ERP system that we spent $35M on, and that's what it tells us to do, and that's what you've got to deliver."

The customer's ERP system is producing some blatantly absurd numbers, but it cost so much money, time and effort to install that no one dares challenge its output.

Let us examine the logic behind its calculations. For each link in the supply chain, you have a starting inventory at the beginning of the month, which is depleted by sales and replenished by purchases to a target level set at the end of every month at 3-months' worth of that month's sales.

We introduce a small perturbation in the sales volume of the last link, and examin the response from the three preceding links. At the end of the 2nd period, the last link, the Customer, is unable to ship the 100th unit in time to credit 2nd period

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The "3C" alternative to MRP-II

By Jim Ayers

This article is an excerpt from Jim Ayers' forthcoming book, Handbook of Supply Chain Management to be published by St. Lucie Press. It includes a review of the "3C" alternative for managing inventory in supply chains.

Three managers from Lucent Technologies in Spain — M. Fernández-Rañada, X. Gurrola-Gal, and Enrique López-Tello — have devised and road tested a simplified tool for optimizing supply chain performance, which they called "3C" and describe as an alternative to MRP-II in a book they published, also with St. Lucie Press this year.

"3C" stands for Capacity, Commonality, and Consumption. The method is an alternative to the reliance on forecasts inherent in the MRP methodology, which they view as a flawed approach.

In the 3C method, supply chain *capacity*, the first C, is the governing parameter over the amount of inventory in the system. Under 3C control, the chain should have a sufficient number of any one part on hand to produce to the capacity of the chain. To the extent parts are *common*, then the overall inventory is less, since a single part will support

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several products. The "Gozinto" table below provides a simple example:

Product	X	Y	Z	Inventory Target
Part A	1	1	1	20
Part B	2		1	20
Part C	1		3	30
Part D		1		20
Capacity	10	20	10	

The simple system we describe only has four parts and three products. The capacity of the supply chain is the number of units of each that can be produced in a given period. This assumes that the system is producing nothing but that single product. The "target" inventory is determined by the maximum potential demand for the part during the period. For example, Part A's target inventory should be 20, since Product Y's capacity is 20, and it uses one unit of Part A for each unit of product. Part C's target is 30 due to potential demand from Product Z. There are three units of Part C in Product Z. A level of 30 will cover the needs of any potential demand scenario.

As parts are *consumed*, then they are replaced in sufficient amounts to maintain the target inventory. This concept is applied to all "points of consumption" through the supply chain. Thus, actual demand provides the signal for replenishment in the chain. No stock is reserved for any single forecast need. Only capacity, not lack of parts, restricts what can be delivered to the customer. Frequent updating of part requirements is abolished. Changes in the arrangement occur only at points when product or market changes make it necessary.

The authors have performed simulations demonstrating that 3C bests the MRP method in many cases. We believe 3C is a valuable addition to thinking about both supply chain systems and "rules of the road" among partners. The need for new approaches to supply chain management will call for simpler rule making with respect to inventory maintenance and restocking rules along the chain. 3C fulfills the simplicity criterion.

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sold 2,000 copies, where LEI reports having sold 100,000.

Coauthor John Shook is a Toyota veteran and concedes that, at Toyota, this method was never thought of as important in its own right but instead as a convenient means of presenting implementation plans. Elevating it to the level of a strategic tool, much higher than Toyota's own people ever thought, is a stretch.

As Womack and Jones see it in their introduction, this tool should be used to map the entire product flow through the factory before implementing anything. In 1953, they probably would have told Taiichi Ohno to back off making any changes in the machine shop until he had made a complete "value stream map" of Toyota's activities, from stamping to final assembly and shipping.

Since Eli Goldratt used the anecdote of unneeded robots in "The Goal," many managers have latched on to the idea that local improvements never lead to overall

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An ERP Mystery

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sales for it, but catches up the following morning.

As we can see in Table 1, as we go up the chain in the following columns, this small perturbation in sales is amplified at each link by the planning logic, resulting in the *plant* ordering 36 units one period and 305 the next. When we get to the *supplier*, the fluctuations are so wild that it ends up not ordering at all in period 5 and creating a shortage in period 6.

While this example is contrived, the above discussion between buyer and supplier actually occurred. And it is not an isolated incident. The phenomenon of perturbations being amplified up the supply chain was observed by J. Forrester of MIT in the 50's, and in the 90's by Stanford's Hau Lee in the case of diapers, where a steady consumption by babies eventually results in an alternation of feast and famine for the makers of the adhesive strips on these diapers.

What the example shows is how a seemingly reasonable planning logic can generate this undesirable result. But exactly what is wrong with this logic? What should we replace it with to make sure that perturbations are dampened rather than amplified?

We would like to know *your* answers to these questions. Please post them on the Lean Production discussion group at *http://www.mmt-inst.com/discussiongroup* or e-mail to *webmaster@mmt-inst.com*. We will discuss them next month.

Supply Chain Link	Customer			Dist. center			Plant			Supplier		
Period	1	2	3	2	3	4	3	4	5	4	5	6
Starting inventory	300	300	297	300	300	288	300	300	252	300	300	264
Sales	100	**99**	**101**	100	**96**	**107**	100	**84**	**140**	100	**36**	**264**
Ending inventory	200	201	196	200	204	181	200	216	112	200	264	0
Target inventory	300	297	303	300	288	321	300	252	420	300	108	792
Quantity ordered	100	*96*	*107*	100	*84*	*140*	100	*36*	*308*	100	0	792

Table 1. Supply chain response to a small perturbation

improvements unless a global strategy has been worked out first. In their foreword to "Learning to See," Womack and Jones restate the same point.

This view is mistaken is several respects. First, if a global strategy were needed to get started, it could only be elaborated by people with no implementation experience! The knowhow to analyze material and information flows can only come from having carried out local projects on the shop floor.

Second, at a very high level, a global strategy already exists. We know that the *ideal* material flow pattern is one-piece flow at every operation of every line throughout the supply chain, with instant transfers between operations like clockwork at every takt (See Figure 1). This ideal is not actually realized anywhere, but every departure from it adds WIP, waiting time, handling, and quality problem detection delays. The leanness of a plant can be measured by how closely it approximates this ideal.

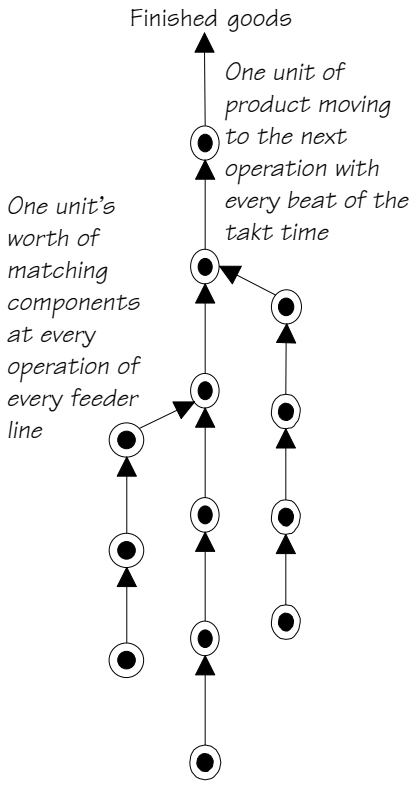

Figure 1. The ideal: one-piece flow on takt time from raw materials to finished goods.

Furthermore, the ideal flow is the conjunction of ideal flows around each operation. Any *local* project that brings a segment of the process closer to the ideal improves this segment without harming anything else. This is why it is possible to *start* with local cell or setup time reduction pilot projects before worrying about mapping the entire flow.

These projects not only save money for the company but also build the competency needed in the organization to envision how close to the ideal the plant can actually be brought over time. It is then that material and information flow mapping tools at the level of abstraction used by Rother and Shook come in handy.

We understand learning to see at the outset of lean conversion as what you need to make plant data talk and to read the shop floor's body language.

In the initial condition of the plant, there are production plans, dispatch lists, process specs, and other documents that are used to trigger actions, and from which we must be able to glean information we can use to drive the lean conversion. Then we must also be able to walk down the aisles on the shop floor and understand what is going on by observing people, machines, conveyors, fixtures, parts, etc..

One dimension that I see missing in the Rother & Shook's book is the analysis of the *demand* structure. Lines are designed to a takt time, which is a function of the demand. From sales data, we need to analyze the demand in at least three ways:

- *Overall trend.* Whether demand is growing, stable or declining has far reaching implications for lean conversion.
- *Pareto analysis of volume by product.* The resulting ABC categorization is then used to decide which products deserve dedicated lines, which ones lines by family, and which ones are odds and ends to be made with generic equipment.
- *Seasonal variations.* Diapers are consumed year-round at the same rate, but cosmetics sell around Mother's Day and Christmas. We need to take this into consideration when deciding the design takt times for production lines.

Regarding shop floor observations the real problem is that it is quite possible to walk through the aisles and not notice that the plant is anything but a tight ship.

The key to actually seeing is to not just watch but instead act. For example, you can emulate Sesame Street's "The Count" and start counting people, machines, parts or fixtures.

That's how you may notice that 20% of the people are walking in the aisles rather than tending to their machines. You ask a few questions and find out that half of those 20% are going to or returning from the tool crib. You have not only discovered that the plant uses a wasteful method for distributing tools, but you also have a ballpark estimate of the productivity improvements at stake in setting up tool pickup and delivery milk runs.

Thus the simple act of counting people has led you to discover a *pattern* of wasteful operation, which you will then recognize immediately elsewhere. In other words, you have learned to see it.

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Likewise, counting WIP not only lets you know how much there is but also makes you see inaccuracies in inventory management and the lack of visibility.

Measuring times with a stopwatch also makes you notice process and motion waste that you would otherwise miss.

My mentor Kei Abe also came up with the "bug hunt" as a means of making managers aware of common small problems that are easily overlooked. A group of 10 to 20 managers get each a stack of 10 red tags and 20 minutes to attach them to frayed cables, broken gauges or switches, puddles of oil, lubricant on the floor, devices held in place by duct tape, or any other detail that is clearly wrong.

Wherever I have seen this method used, all managers used up their stack of tags, and came away stunned by the sheer number of small maintenance problems they found. Once they had learned to see them, they understood the value of TPM.

Those are a few of the topics that I would expect to see covered in a book called "Learning to See." This being said, if you are interested in mapping material and information flows and you can get past the title, the exaggerated claims, and the hifalutin vocabulary, it is a pretty good book.

Schedule of events for Dec. 1999 to June, 2000

- *Lean supply chain management*, a one-day seminar with David Held, Jim Ayers, and Michel Baudin, Dec. 9, Irvine, CA

For enrollment information, please call us at **(650)856-8928** or register on line through **http://www.mmt-inst.com.**

In addition, the following courses are offered in partnership with the University of Dayton:

- *The details of lean production: Where the devil is. (Two* days)

2/23-24	Orlando, FL
4/5-6	Tucson, AZ
4/18-19	Charlotte, NC
6/13-14	Dayton, OH

- *Lean production implementation: Avoiding the bumps in the road. (One* day)

2/25	Orlando, FL
4/7	Tucson, AZ
4/20	Charlotte, NC
6/15	Dayton, OH

- *The journey to perfect quality through poka-yoke and ZQC*

5/3-4	Dayton, OH

For enrollment information, please call the University of Dayton's Center for Competitive Change at **(937)229-4632**.

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