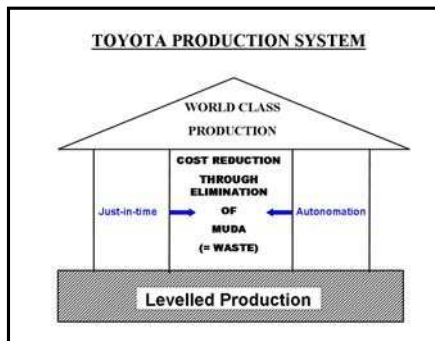


MOVING TO FLOW

by Ian Glenday

Background

What is lean? The majority of people when asked this question reply “waste elimination”. This is true. However Taiichi Ohno’s original definition of lean was “the complete and thorough elimination of waste to reduce the timeline from receipt of customer order to delivery”. To



achieve this more complete definition necessitates the creation of product flow achieved through the implementation of levelled production. This is the foundation of the Toyota Production System, the origin of lean. Levelled production is an essential enabler for moving to flow and to becoming truly lean.

The Paradox

Why do so many companies focus on the waste elimination aspect of lean, while ignoring flow and levelled production? One reason is that when people come across terms like “every product every interval” and “one piece flow” they seem to be impossible to apply in their business. In addition they think levelled production can only be achieved when there is stable demand – and who has that? Levelled production seems ridiculous for their business so it receives little further thought. On the other hand people easily understand eliminating waste; it is something they have been doing for years. Now value stream maps show them lots of new waste to work on, which enables them to say they are doing lean.

There is another reason, which is a lack of awareness and therefore understanding of how Toyota originated and progressively developed the implementation of production levelling. This helped them to achieve the final goal of one piece flow matched to market pull through Takt time.

Establishing Production Levelling

One way to begin the journey of levelling is to create a *fixed production schedule that is **rigidly** followed*. This means making the same products, in the same sequence, in the same volume, on the same equipment, at the

same time, with the same sequence, every cycle. Which is where people start to say “But that’s impossible for our business!” Actually it’s not as difficult as people think, if you start with just the products that drive the majority of the volume and put those into a fixed cycle first.

As this fixed cycle schedule is repeated, a phenomenon I call “Economies of Repetition” soon starts to emerge. Essentially it’s about going down the learning curve and establishing routines so that you can create standard work and continuous improvement. Quite simply, the more you do the same things in the same sequence, the better and more consistent you will naturally become. Economies of repetition is the magic that comes from fixed sequence schedules, which delivers above expected improvements in quality and productivity with less overheads and stocks. These gains in capability and capacity are significant enough to enable more products to be progressively introduced into the sequence, and to make the cycles faster, shorter and more flexible in order to progressively match volumes to actual market demands. The logical conclusion of this progression of levelling is “one piece flow matched to market pull through Takt time”.

A Tool to Help

A useful tool I have come to call the “Glenday Sieve” separates products (SKU’s) into four groups based on sales volume (or value if this is more appropriate). The results shown are typical. Many people insist that it is impossible for such a small percent of the product range to account for 50% of the sales volume in their business. Yet when the analysis is done, it is invariably found to be the case. These results are intuitive for some and genuinely shocking for others. Either way the power is in the indisputable information it provides.

Figure 1: Glenday Sieve Analysis

Cumulative % of Volume	Cumulative % of SKU's	Colour code
50%	6%	green
95%	50%	yellow
99%	70%	blue
Last 1%	30%	red

It is not difficult to develop a fixed sequenced cycle for just 6% of the products, and then value stream mapping these items to help unravel the “spaghetti” pathways one usually finds through the plant. The end result

is a “green stream” for these few high volume products, with shorter throughput times and continuous flow.

The “yellow” SKU’s are where to direct your capability improvement efforts, with exercises such as change over reduction and smaller batch sizes so making it easier to introduce these products into the cycle. This typically results in a staggering 95% of the total volume yet only 50% of the product range now running in a fixed sequence “every product every cycle” schedule.

The “blue” SKU’s are typically 20% of the product range, but just 4% of sales. What opportunities are there here for the harmonisation of raw materials and packaging so the final product appears different to customers but makes these SKU’s easier to include in the cycle? For instance, differently coloured bottles with the same shape, or labelled rather than printed cartons. These may sound like simple things but they can make a big difference in getting these products into the cycle and making them flow.

The “red” SKU’s will need to be carefully reviewed to determine their real business cost versus their benefit. The impact of these products to the total supply chain and overall company costs, including overheads, must be understood to be certain that the benefits of retailing them genuinely outweigh the costs. It is not uncommon for companies to recognise through this analysis that they actually have two distinct businesses. One is high volume with the same products, for which the plant, business processes and performance measurement systems were designed. The other is a low volume customised job shop operation, which is being managed through the same equipment, processes and systems for both “green” and “red” SKU’s, to the detriment of customer responsiveness and profit margins.

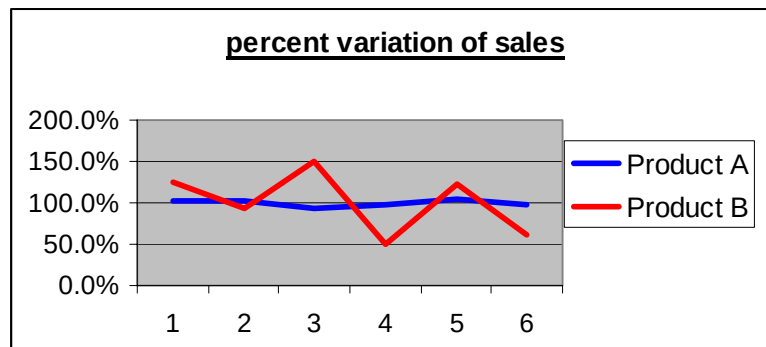
A further factor to consider

An understanding of the Central Limit Theory is also helpful in creating levelled production and flow, especially the impact on demand variability. Put simply, bigger sellers usually have less **percentage** variability than smaller sellers. This is because, in general, the sales of the bigger volume items are coming from a larger number of customers, so the variability in demand from individual customers is balanced out at the aggregate level. Correspondingly smaller sellers come from fewer customers so don’t have as much of this balancing out, resulting in higher **percentage** variability.

Ironically because people generally measure production and sales at the unit level, not percentage, many consider the bigger sellers to have the greatest variability because the volume changes are large – see table below. Whereas it is typically the smaller sellers that trigger short term plan changes and fire fighting, which then affects the production efficiency of the larger volume items. The figures shown are for actual sales over a six week period for a well known brand of yogurt, comparing two products with very different sales volumes.

	PRODUCT A			PRODUCT B		
	actual sales	volume variation	percent variation	actual sales	volume variation	percent variation
Week						
1	15745	472	103%	345	70	126%
2	15785	512	103%	256	- 19	93%
3	14230	-1043	93%	410	135	149%
4	14896	- 377	97%	137	-138	50%
5	16005	732	105%	335	60	122%
6	14975	- 298	98%	167	-108	61%
Average	15273			275		

This is more easily seen when comparing the percent variability data in a graph, as shown below.



This raises two points to consider:

- 1) With their higher level of demand variability, what is the real cost impact on the business of the “red” SKU’s?
- 2) With the higher percentage stability of demand for the “green” SKU’s how difficult is it in reality to create levelled production and fixed schedules for these items?

Conclusion

Implementing levelled production to help achieve moving to flow may not be as impossible or ridiculous as many people seem to think. Is it not worth a little more consideration? What indisputable information would the “Glenday Sieve” reveal for your company?

Appendix 1:

An Example of applying the “Glenday sieve” in Food production

A manufacturer of savoury snack products produced 285 SKU's on 15 packaging machines, each engineered to run numerous product types and pack sizes to give production flexibility. The sieve analysis showed just 7% of the product range, 20 items, accounted for 50% of sales. Using these 20 “green” items to create product families based around product types and pack sizes resulted in a further 96 SKU's becoming part of these 20 “green” families, totalling 41% of the range, yet a staggering 92% of the sales volume.

Fixed cycle schedules were implemented for these families on certain machines each week – not too difficult a task with only 20 families to plan, rather than 116 individual products as before. However to be able to do more frequent changeovers required faster throughputs. Analysis revealed the bottleneck was the main fryer which had a capacity of 1.8T per hour, whereas the filling machines had a combined capacity far in excess of this. A rapid improvement workshop (kaizen blitz) was run on this “yellow” constraint. As is typical with a well run kaizen blitz, the team achieved an amazing result through a series of breakthrough and continuous improvements, managing to get the throughput on the fryer up to 2.2T per hour – not to be able to produce more but to be able to devote more time to changeovers on the fillers.

What was more difficult at first – apart from stopping people interfering with the fixed cycles – was accepting that fixed cycle packing machines needed very different performance measures to the other machines. However the accountant realised this separation of the “green” stream (41% of the product range yet 92% of the sales) from the “red” items (8% of the sales yet 59% of the range) gave him a much better opportunity to calculate the real cost of producing these items. This made some of the decisions about whether to produce the “red” items much more objective, in contrast to the emotive and subjective arguments inside the company whenever they tried to tackle reducing the “product range tail” with sales and marketing.

Meanwhile amazing things were happening as a result of the fixed cycles for the 20 “green” families. No fire fighting, deliveries of raw and packaging materials to match the cycle, changeovers becoming faster and lower stocks with better customer service. The operators also found the system a lot easier, less stressful and they felt more empowered even though they were producing more output per hour than before.

At the same time people were working on “blue” opportunities to make the whole supply chain easier to manage and reduce the chances of things going wrong. For instance products were previously packed into printed cardboard cases because they were cheaper to buy than using stick-on labels that could be applied on line. However what this simple costing did not take into account was the complexity for planning, ordering, stocking and handling of over 200 different cases – and the problems that caused with inventory checking and errors in the data.

The company moved to “naked” cases that were labelled online – even though the simple purchasing costs looked on the face of it higher, the overall complexity was much reduced. The combined effect of “blue” improvements such as this was far less disruption to production, more space in the warehouse and factory floor, less fixed costs associated in the planning, ordering, stocking and handling of materials, improved reliability throughout the supply chain, more flexibility and lower overall costs.

Appendix 2:

An Example of “One Business or Two”

A manufacturer of hydraulic pipes and couplings produced 2,000 SKUs with a 48 hours lead-time to customers, something they were finding costly and hard to consistently achieve. Analysis showed over 50% of sales came from only 92 products, or 5% of the range. The other products were ordered infrequently in small quantities, even as single items.

Armed with this information, the company decided it needed two types of factory, a high volume repetitive facility and a flexible jobbing shop. It was not cost effective to build two factories or even to physically separate the equipment. The company had to find another way. They worked out what equipment would be needed for the high volume SKU’s in a fixed cycle and the staff required. This equipment was painted green and all the employees were given green overalls.

The remaining equipment was painted beige with beige overalls for the employees. Although the equipment and staff were totally intermingled on the shop floor, each business operated totally differently. The “green” factory had fixed hours of work, JIT deliveries and improvement activities focussed on achieving faster cycle times and increased productivity. The “beige” factory had variable hours according to the level of work each week from the variable demand of the small sellers, purchasing of materials only when required and running improvement activities focussed on flexibility and responsiveness.

They had effectively created two businesses with policies, procedures and measures appropriate to each. However the added value, flow and what was seen as “muda” in each business was completely different. Although on paper the “beige” factory looked a more expensive way to make products than the “green” factory, the reality was that it achieved the required customer service without causing short term plan changes and fire fighting, as in the past. It enabled standard products to be produced in a totally fixed and repetitive cycle, achieving levels of efficiency, throughput and lower stocks across the supply chain never thought possible, resulting in better customer service and margins while still maintaining the range.

A footnote illustrates the mind set issues faces when moving to Lean. A visitor to the site congratulated the MD on what he had achieved and asked him how long it would be before all the workers in green were sufficiently trained and experienced to become flexible enough to be given beige overalls. The MD’s response was that would never happen and the visitor should try and answer for himself why that was. Privately the MD shook his head, as he knew the visitor had not understood and probably never would!