COST ANALYSIS FOR WORLD CLASS CHANGE
Part 3: Financial Models in Context

David Newlands and Mark Hooper, Coventry University

This article reviews the models presented in parts 1 and 2 and contextualises their application.

INTRODUCTION

In part 1 of this series, Womack and Jones' [4] model is reviewed. Their model produces a one-time benefit to the accounts of businesses attempting to go lean. This one-time hit comes from using safety stock materials in production and in order to reduce the buffer size.

Shown in part 2 of this series, a cost-of-conformance model by Hines' et al [1] produced results. The improvement in profit derived from Hines' model would provide a budget to sustain a continuous improvement programme.

SUITABILITY TO MANUFACTURING SCENARIOS

Management must identify if their part of the supply chain can support lean. Factors influencing their analysis include:

- the extent volume varies
- the stage in the supply chain and ease with which product variety is introduced and
- the reliance of the value adding activity on process capacity optimisation.

Comparing Hines' analysis with the financial model proposed by Womack and Jones, it can be seen that:

- Stock reduction approaches to achieve lean manufacturing reduce the apparent profit during the transition period
- Quality based approaches that focus on costs of non-conformance increase apparent profit
- While Womack and Jones take beginning and end stock values, the model by Hines' only takes a single figure. Hines' model could be improved by incorporating beginning and end of period figures to take into account stock level variations.

The Womack and Jones' model simply uses up stock. If they have not already, management should consider streamlining the upstream and downstream logistics to reduce the days of stock. During concurrent engineering projects to develop new products, management should create requirements such that their suppliers are responsive to their needs. Core groups of engineers, managers and strategic purchasing project leaders would then plan with suppliers the changes needed to work closer together, and push the envelope of best practice down the supply chain. Examples of responsiveness by lean automotive assemblers show that suppliers can be developed to respond to confirmed orders, finishing goods and delivering them within minutes.

Reducing the incoming buffer can be based on various strategies including:

- Locating suppliers close to the assembler
- Locating assembly plants close to well established supplier bases
- Using low cost logistics service providers to add value by co-ordinating the inbound supply chain
- Focusing on product quality
- Ensuring workers in the assembler plant are direct employees of the suppliers while responsibility remains with those suppliers.

This article now switches to using a case history of a fast moving consumer electronics producer to examine these strategies.

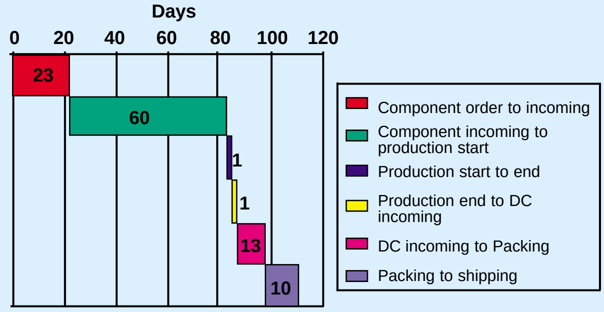
CASE HISTORY

Taking an example of a major corporation that nearly went bankrupt in the mid-90s, Figure 1 shows the durations for stock in a manufacturer' s supply chain. For this assembler, production of the core modules takes less than one shift. A further day is spent transferring the modules to the distribution centre (DC) where they wait in buffers.

This manufacturer held 60 days of production as stock. The packaging process is manual. A pallet from each consignment was re-opened by quality inspectors. If a single mistake was found, the whole consignment would be re-opened, by the packers themselves, and checked. Approximately one in four consignments were re-opened. This contributed to a considerable stockpiling. The company had a policy based on packing to order in place at that time.

Figure 1

Days of Liability



In the case example above, liabilities for inbound materials to the assembly plant and through to despatch totalled 108 days of production at full capacity. If demand turned down or stopped completely due to market requirement, all or most of this material would need to be turned over to obsolete stock. The suppliers had undertaken work to produce the goods to orders supplied by the assembler. They would need to be paid. All the staff in the assembly plant and distribution centre would need to be paid. Overheads needed to be covered. The risks associated with this situation might be acceptable if the point at which variation is introduced is at or near the end final assembly process. If the point of variation is with suppliers, the net effect on stock held could be tremendous.

Figure 2 is the famous value chain produced by Porter. Porter [3] developed a generic ' value chain' model based on a business system concept developed by McKinsey & Co, that identified a company' s basic direct and support activities. The model applies to a stand-alone company rather than a network of suppliers. Porter' s model was built on the premise that there will be added value contributed to materials from left to right. By convention this reflects the flow of materials and goods from suppliers through to customers. The difference between total costs incurred and the price goods are sold to customers is depicted as the net profit margin.

Figure 2

Porter's Value Chain

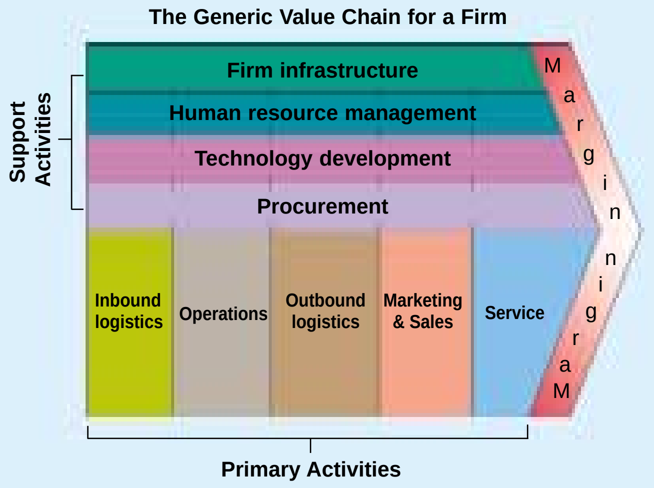
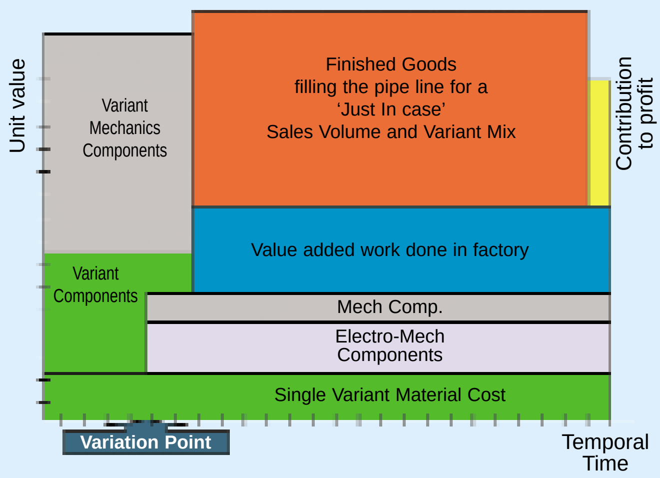


Figure 3 shows a representation of costs associated with attempting to provide variants from stock, and shows the point where variation is introduced. The yellow portion to the right hand side of the illustration shows the profit from sale of goods. This is disproportionate to the stock holding cost and exposure due to payment liability. Figure 3 examines the value of stock in the pipeline, combining the time graph shown in Figure 1 and Porter' s value chain concept of material flowing from left to right. Porter placed ' margin' on the right side of his model. This is adopted in Figure 3. Time is temporal in this model since it is based on value of days of production, which is related to plant capacity. Since sales can vary in any period from frenetic down to none, the temporal nature of time in this relates to the application of 'days-of-sales' .

Note: The source and figures for these figures are withheld for reasons of client confidentiality.

Figure 3

'Full Service' Supply Chain Material Cost Profile

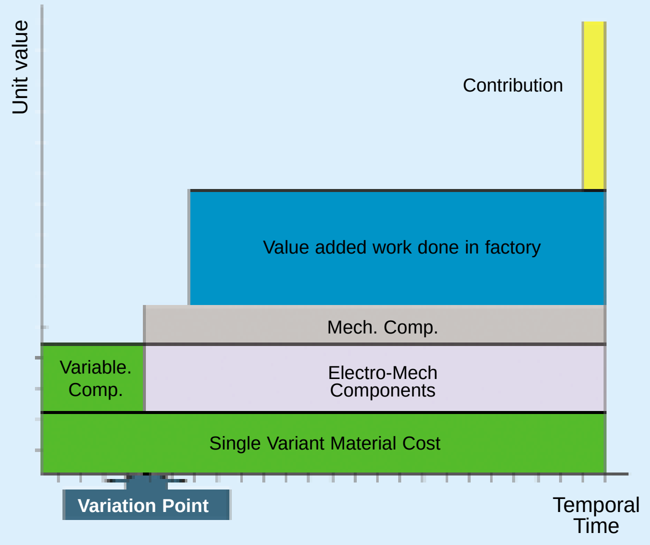


Transferring to a make-to-order mode attempts to eliminate just in case finished goods. This buffer, shown above in red, may essentially reduce in size, though in reality would likely serve to maintain capacity at maximum output during a slack period.

Figure 4 shows the net effect of producing predominantly one variant, based on Ford's principle 'any colour as long as it is black'. The elements that introduce variation are low cost items. If these items can have a high intrinsic value to the customer, differential pricing can be introduced. The contribution per unit now has a significant role, and the liability for variable components is reduced.

Figure 4

Cost Profile for Goods with an Early Variation Point and Global Distribution



Producing goods in this manner emphasises the production to delivery (P/d) ratio. Customers' expectations determine the delivery time. Production time is the time the company takes to actually produce the goods. In the case above, the P/d ratio was 3:1. This meant that the customer waited three times their expected delivery period to receive the goods. Delivery to confirmed dates was always 100%, while statistics for delivery to customers' requested date were not even measured, since it was 0%.

When production times exceed the delivery lead-time expected by the customer, the manufacturer has three principle choices:

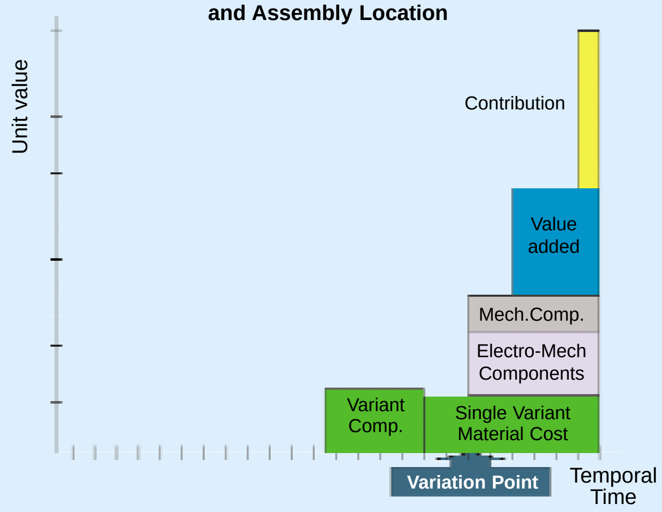
1. Large work in progress buffers will be required
2. Large finished goods buffers will be maintained or
3. Introduce customer specified variants late in the manufacturing process.

Figures 3 and 4 show the same production lead time and point at which variants are created. Figure 5 shows the same product could be produced, with a delayed variation point. The liability is significantly reduced as is the ratio of contribution to liability. The key variable that permitted this was plant location; locating the assembly point close to the market, and sourcing components locally.

Newlands and Steeple [2] showed an example of the effects on materials in the pipeline based on plant proximity to both its market and suppliers. The value of stock in that pipeline reduced to 7.32% of its original amount. The cost of transportation increased as a percentage from 0.23% to 48% of the value of stock in the pipeline. Hence, for a total of

Figure 5

Cost Profile Resulting from Developing Point of Variation and Assembly Location



about 10% of the original liability, lean manufacturing was introduced. The point of variation was delayed, and the product concept changed. This allowed the manufacturer to reduce the P/d ratio to 2:3. This meant the assembler could meet 100% based on delivery to customers' requested date since they had a ' time profit'.

CONCLUSIONS

The Womack and Jones' model is exclusively focused on reducing buffer stock. The model focuses on the manufacturing account and makes the assumption that all excess cash is contributed to profit. This assumption may be mis-leading, as the surplus, for example, could be used to fund overheads or reinvestment.

The Womack and Jones' model would require a cost of conformance model to support the implementation. The Womack and Jones' model can assist companies to reduce the work in progress in the supply chain. Similar effects could be achieved by reducing work in progress and buffers. This could be applied both internally and at the various supplier tiers in a value chain. If the Womack and Jones' model is implemented by management without the support of a conformance model, they would simply achieve a one-time boost to the accounts. This would be sufficient if the business environment will sustain that strategy. If the environment requires frequent changes, the strategy should be to hold buffers of parts at their minimum value and ensure that the processes that add value are streamlined using business process reengineering.

Hines' model is based on a self-financing improvement process. This can be applied to all business environments, whether lean is applicable or not. As a consequence, the model can be used on its own and is not arbitrarily linked to the Womack and Jones' model.

A principle conclusion from this analysis is that companies should balance the increases in apparent profit shown from Hines' model against the apparent losses incurred while using up safety stock when going lean in Womack and Jones' model.

While each company is unique in its business niche, management should create bespoke financial implication models to suit their business strategies. These may well then be used:

- To undertake sensitivity analysis in order to identify the aspects of the business that are most vulnerable
- To provide budgetary information to executive management
- To provide targets and benchmark information.

When considering the radical changes espoused by qualitative management gurus, each set of managers should quantify the impact, and if necessary put the plans to shareholders.

Key variables to reducing cost of materials include:

- Actively reducing non-conformance costs
- Plant location near the market, sourcing from local suppliers
- Delaying the point of variation in the value chain
- Ensuring significant compatibility, commonality and carryover in the product range
- Designing components to be customised by the customer at or after the point of sale
- Co-ordinating with trade customers when running promotions and producing special editions.

REFERENCES

[1] Hines, P., James, R. and Jones, O. *"Innovations in Procurement Management"*, "Cost Benefit Model for Decision Making in Supplier Development Activities", in Cox, A. (Ed). 1996, pp 63-84.

[2] Newlands, D. and Steeple, D. "Logistics and Supply Chain Development: Part 3 - A Quantitative Simulation for Logistics Opportunities", *Control, Institute of Operations Management*, July 2000, pp 21-23.

[3] Porter, M. *"Competitive Advantage; Creating and Sustaining Superior Performance"*, Free Press, Macmillan Inc, 1985.

[4] Womack, J. and Jones, D. *"Lean Thinking: Banish Waste and Create Wealth in Your Corporation"*, Simon & Schuster, New York, 1996, p138.

About the authors

David Newlands is an Associate Member of the Institute of Operations Management. He has worked in various industrial positions, from his apprenticeship through to sales, system calibration, test engineering, lecturing and research into supply chain issues. He gained a B.Eng. in Manufacturing Systems Engineering and is completing his Ph.D. in Business Resource Development, which includes Supplier Development and Benchmarking.

David is a part of the Business Support Unit, at the School of Engineering, Coventry University in the UK.

Dr. Mark Hooper currently works as a senior lecturer in Engineering Management and heads the Manufacturing and Supply Chain Management Centre within the School of Engineering at Coventry University.

Having worked in industry for six years, Mark undertook a Master of Science degree in advanced manufacturing systems followed by research, leading to a PhD, into the relationship of organisational culture and values to the attainment of business excellence. He then worked for two years as a research fellow within the Manufacturing and Supply Chain Management Centre. His current research interests include the structure and strategy of advanced manufacturing and service organisations including agile manufacturing systems.