Lean and Agile Supply Chain Design

Tim Waddington, MIOM, V2C Limited

INTRODUCTION

There is no disputing the impact that has been achieved through Lean Thinking in western manufacturing companies, in the last decade in particular. In more recent years the concept of Agility has been proposed as an approach to cope with more volatile markets. There has been much debate, often contradictory, on the compatibility or otherwise of these two approaches.

In the 'real world' away from the debating chamber, we have seen a relentless increase in pressures on British manufacturing and a continuing flow eastwards of product manufacture. Several companies have been seduced by the low product costs in making such decisions, and without considering the wider implications some have had their fingers burned in the process.

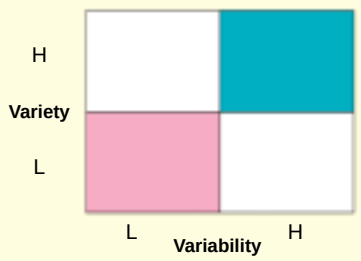
In recent months a Lean/Agile Special Interest Group has been set up by the IOM, which is seeking to find practical solutions from the Lean/Agile debate that will help companies make clear and informed decisions about their products and supply chains.

A BRIEF BACKGROUND TO LEAN/AGILE

The lean model has been seen as one major factor contributing to business success in the second half of the twentieth century. By identifying and eliminating waste in their organisations, companies have seen dramatic improvements in cost reduction and hence their productivity and competitiveness. However, in the last decade in particular, markets have become increasingly volatile and unpredictable in demand and technological and fashion changes have led to a shortening of Product Life Cycles (PLCs) and an increase in the number of product variants required.

It has been proposed that the lean model works well where demand is relatively stable and variants few, but at the other extreme a different, 'agile' model is required. One of the classic diagrams on this subject is the following:

Figure 1



(Source : Christopher, M.G., 1999 [2])

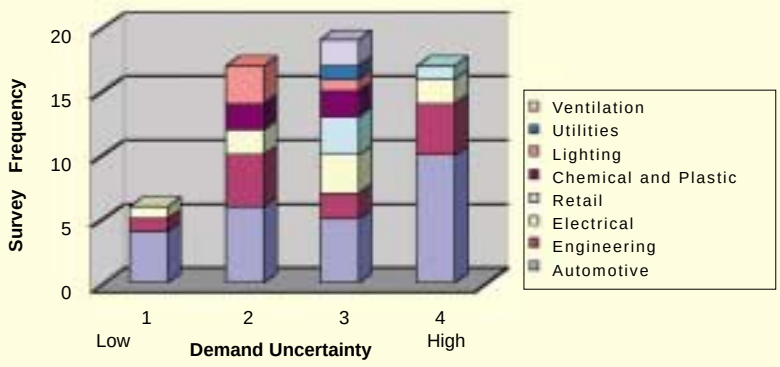
In practice, although the lean 'toolkit' has been well explained in recent years, it is less clear what the alternative agile tools would be. Indeed, many lean practitioners dispute the assertion that the agile model is required and believe that the lean one can be adapted to, and is sufficient for, varying market situations.

The model is useful in illustrating, however, that production and supply chain systems do need to adapt to changing markets, no matter which labels are used! It is also not surprising that a simple 2x2 box alone is not a practical tool for all the complexities of real markets. A recent study illustrates how demand variability varies across different industries, see Figure 2.

In addition, not only does marketplace uncertainty vary between industries and companies (as illustrated here), but also between products in the same company. If production systems and supply chains need to be adapted to market requirements, even for different

Figure 2

The New On-demand Environment



(Source: Waddington, 2001 and Childerhouse, 2001 [1])

products within one company, how can the factors that should drive such decisions be clarified?

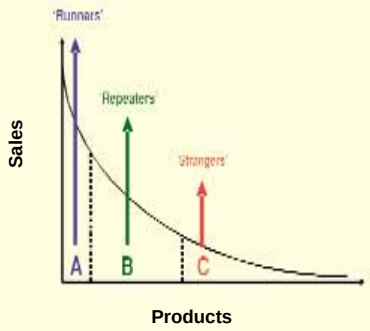
The SIG is developing a tool to help companies identify where they stand on various factors and to make informed decisions based on this information. The key questions it is seeking to answer are:

- Should we treat all our products the same (in supply chain design)? If not, how should we decide how to group them?
- Which product and market factors are the key to this decision making for our company and products?
- Finally, once products have been clustered, which supply chain designs and operations and design methodologies are most appropriate?

Clustering Techniques

One of the most common techniques used in recent years is the 'Runners, Repeaters and Strangers' approach, which groups products into three clusters based on product sales volumes:

Figure 3



Developed by the Lucas group in the late '80's, the terms have become part of manufacturing language and helped countless companies to decide on cellular design and scheduling and stocking policies.

The SIG is investigating which other factors would also be appropriate to add to this decision making cooking pot, for example:

- Product sales volume
- Demand variability
- Product variety
- Demand lead time
- Production lead time
- Product life cycle
- Margin (profitability)
- % cost breakdown (labour and material content).

In order to cluster effectively this list needs to be trimmed down to just the factors which are relevant to a particular company. The 'Runner Repeater and Stranger' model gives us 3 simple clusters. However, if we applied all the factors mentioned above, even on a binary high/low choice, then the number of clusters produced would be 128. Hardly simplified! The challenge is to achieve what Einstein said,"everything should be made as simple as possible, but not simplistic". The 'Runner, Repeater and Stranger' model may be too simple for many companies with widely varying market situations, but equally we must not drown in excessive detail.

For example, for company A, product life cycle might be a key factor, as its products range from PLCs of 6 months to 6 years (as in the case of a company making men's shirts, with both coloured seasonal 'fashion' shirts through to less fashionable white 'work' shirts). In company B, making electrical components, the PLCs might be all longer than 5 or even 10 years so it should not be used in the clustering process.

The SIG is currently piloting a clustering technique in a number of British manufacturing companies, analysing the data from their products and charting the results. For example, for a pharmaceutical company, using two of the factors, 'Volume and demand variability', their products have been grouped into three clusters, see Figure 4.

The aim is to develop a practical toolkit that will aid the decision making for supply chain design. One key application of the clustering method is to help determine the most appropriate sourcing policy for a product or component.

GLOBAL SOURCING

Offshore sourcing and manufacturing has been an increasing trend across much of Western industry for several decades. The motivation to offshore source has been primarily cost. However, several companies have got themselves into difficulties in recent years when other areas of Total Supply Chain (TSC) costs have subsequently increased. It is important to combine both marketability and physical costs:

Physical Costs =

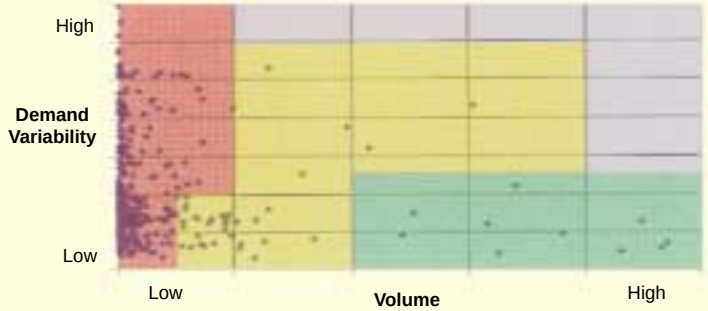
Production Costs + Distribution Costs + Storage Costs

Marketability Costs =

Obsolescence Costs + Lost sales - stock out - competition + Sub-optimum pricing

Most companies would like to make decisions based on TSC costs, but measuring them is not as easy as to simply compare product and transportation costs alone, so it is often not done. For example, rarely is a realistic charge placed upon the additional inventory that inevitably will be created as pipelines lengthen. Storage costs may well increase through inventory carrying costs and warehousing, and additions to the production costs will include transaction costs (including letters of credit, customs clearance), transportation (including emergency airfreight) and duties. Lead-times will

Figure 4



often be between 24 and 60 weeks when ordering from Asian sources. This clearly inhibits agility and increases risk of obsolescence and stockout costs if demand for those products does not come up to expectations. This is particularly the case where 'bullwhip' or demand amplification effects come into play in an extended supply chain. Equally the impact on the firm's flexibility and responsiveness is not factored into the equation.

There will be many occasions where, even taking all the above costs into account, it will still make sense to source in low-cost, offshore locations. For example, high volume products with limited variants, limited variation in demand, high labour costs and long product life cycles. However, for other products where demand is much more volatile and harder to predict, local sourcing may be preferable.

The clustering technique being developed by the SIG aims to help companies with this decision making, as illustrated by two examples below.

CASE STUDIES

Two companies that have used the clustering technique to clarify their global sourcing decisions have been a British lighting products company and a North American clothing company.

For the lighting company a number of its products had become commodity in nature, and as such a UK based company would struggle on the basis of price when competing with imports from low labour cost countries such as China. However there was also increased demand for low volume, customised products.

By identifying three supply chain routes, China, Morocco and the UK, they are seeking to keep TSC costs to a minimum.

The strategy of the North American clothing company combines a low cost pipeline offshore (in Honduras) and a responsive pipeline in the USA.

The US plant makes small runs of complex styles, and produces them quickly. It also 'tops-up' high volume products as required to meet extreme demands. These two agile pipelines account for some 20% of the total volume. The clustering techniques has thus identified the agile 'home-based' niches to complement low-cost Honduras manufacture.

	Stable demand	Volatile demand
High Product Volume	**China** High volume, cost efficient	**Morocco** Flexible, top-up production
Low Product Volume	**UK** Flexible production	**UK** Flexible production

	Stable demand	Volatile demand
High Product Volume	**Honduras** High volume, cost efficient	**USA** Flexible, top-up production
Low Product Volume	Not applicable	**USA** Innovative, flexible production

(Source: Author based on Stratton & Warburton)

CONCLUSION AND AIM OF A LEAN AND AGILE SIG

Companies do need to adapt their manufacturing systems and supply chains to varying product and market situations. A wide range of factors can have an influence on these decisions, and these factors are likely to be different for different companies. Clustering frameworks can simplify such decision making, and the ongoing research through the SIG aims to further test and refine these frameworks in industrial companies and share the results, for example in *Control*.

● We are looking to set up a Lean and Agile Special Interest Group. If there are manufacturing companies out there who would like to be involved, contact Tim Waddington on:
timwaddington@V2Climited.co.uk

ACKNOWLEDGMENTS

Martin Christopher,
Cranfield School of Management
Dan Jones, *Lean Academy*
Denis Towill, *Cardiff Business School*
Peter Willats, *McKinsey Consulting*

REFERENCES

[1] Childerhouse P., "Enabling Seamless Market Orientated Supply Chains", *Cardiff University, PhD Thesis,* 2001.

[2] Christopher M., "Responding to the Global Supply Chain Challenge", *Supply Chain Management Review,* Winter 1999.

[3] Christopher M. and Towill D., "Developing Market Specific Supply Chain Strategies", *The International Journal of Logistics Management*. Vol. 13, No. 1, 2002.

[4] Waddington T., "The Integrated Supply Chain: Fact or Fiction", *Durham University, MBA Thesis,* 2001.

[5] Warburton R. and Stratton R., "Questioning the Relentless Shift to Offshore Manufacturing", *Supply Chain Management,* Vol. 7, No. 2, 2002, pp 101-108.

About the author

Tim Waddington, MIOM is the Director of the business consultancy V2C Ltd., a member of the Delos Partnership, and heads the Lean/Agile Special Interest Group. Prior to V2C Ltd. he was a Director and shareholder of Forward Vision (International) Ltd., a lean manufacturing consultancy company, and before that worked for Philips Electronics. He teaches the Operations Strategy and Lean Improvement modules for the Durham University MSc in Manufacturing and during the last decade he has guided many companies, across a range of sectors, in the implementation of Lean Techniques.