Evaluating Alternative Supply Chain Models for the Provision of Humanitarian Aid into Africa

The research outlined in this paper was commissioned from the Logistics and Operations Management Section of Cardiff Business School (CBS) by the charity Advance Aid in order to provide an independent and systematic evaluation of conventional methods of supplying aid products to Africa compared with the model of local manufacture and prepositioned stocks proposed by Advance Aid.

CBS has played a leading role in the development and application of the Lean Principles to supply chain improvement and many of the Value Chain Analysis tools that are now commonly used in industry were developed as a result of research at Cardiff. Over the last 15 years a number of major supply chain projects have been carried out sponsored by industry and government, including a recently completed five-year programme applying Value Chain Analysis to the UK agri-food industry funded by the UK government. The approach adopted in all projects is of a highly practical and applied nature, aimed at delivering quantified benefits in terms of improved supply chain performance for the organizations involved. The research has been reported in an extensive range of publications in both academic and practitioner journals.

The ‘Lean’ context

The theoretical framework and practical tools used in the analysis are based on the approach known as ‘Lean Thinking’ (Lean). Lean provides a methodology for the analysis and improvement of business processes be that procurement, manufacturing, distribution or indeed whole supply chain operations. It is based on the system of business management originally developed by Toyota, the Japanese automotive manufacturer, but which in recent years has been adopted by many companies and organisations throughout the world, in both commercial and non-commercial environments. Lean not only provides a set of tried and tested methods with which to analyse and benchmark supply chain processes, but importantly also provides a framework for their radical and continuous improvement.

Although first developed and applied in manufacturing industry, Lean approaches have now spread to many other sectors including healthcare, defence, financial services, local government and agri-foods. Leading companies that have adopted Lean (such as Tesco, Boeing, Porsche and Wal-Mart, to name but a few) have achieved startling improvements in performance and have reported significant reductions in costs and waste, whilst at the same time achieving dramatic improvements in lead times, quality and delivery performance. The research outlined in this paper is, as far as is known, the first application of Lean within the humanitarian sector.

Value chain analysis

Value chain analysis (VCA) is the approach to supply chain improvement based on Lean principles and methodologies. In all sectors, supply networks are complex involving many organisations, many products, many markets and customers. VCA focuses on the analysis of specific value chains, where a value chain is identified as a particular ‘target product’ or product group, sourced from a particular supplier and destined to a particular end user or market group. This disaggregated approach has two important benefits: firstly it provides an analytical mechanism with which to break into the complexity of supply networks in a manageable and effective manner; secondly experience has shown that analysis of particular target or pilot value chains almost always highlights features, problems and opportunities that are common across the wider supply network and as such provides a basis for broader decision making.
Supply of tarpaulins

The Advanced Aid model proposes the supply of an emergency kit comprising some 12 items including shelter, blankets, kitchen sets, water carriers, hygiene kits and mosquito nets. The specific product on which this analysis has been based is tarpaulins.

The map shows the current global network for the supply of tarpaulins to Africa.

A ‘Current State’ map was developed for each value chain, identifying all the steps that the product takes from point of manufacture to the point of delivery to beneficiaries. Each step in the chain was then measured against certain key performance indicators (KPI’s). For example transport links are measured in terms of frequency of service, average transit time and variability in transit; warehouse operations in terms of holding capacity, stock levels and response times; manufacturing operations in terms of production capacities and lead times.

Importantly the analysis also identified four ‘top level KPI’s for the value chain as a whole namely: value chain lead time; supply chain vulnerability; total costs; and carbon footprint. The performance of the five chains are summarised in the charts of the following page.
Lead times ‘from stock’, which is generally held relatively locally, do not vary as much as ‘replenishment’ lead times when it is necessary to go right back to the factory for new supplies. Manufacturing in Africa cuts all lead times significantly.

The further that the stock needs to travel, the higher the number of transport legs involved and the higher the number of ports that have to be transited and country borders that need to be crossed. All of these have the potential for delay, accident or bureaucratic interference.

The total delivered cost of a tarpaulin, once transport and warehousing costs have been added to manufacturing costs, is not dissimilar for VCs 1, 2, 3 and 5. The one that stands out is VCA, which involved air transportation from Europe to Africa.

The African solution (VC5) has the smallest carbon footprint, with VC3 being three times as large and VC2 five times as large. But all of these are significantly smaller than VC4, the air cargo route, which adds a very large carbon footprint to its high costs shown in the chart above.

**Conclusion**

The analysis has identified the potential benefits of African manufacture and local stockholding of humanitarian goods compared to alternative supply models. The work has also demonstrated how value chain analysis can provide a systematic and quantified approach to the analysis of humanitarian supply chains. However the ‘Current state’ mapping as described here is only the first step in the application of Lean principles to supply chain improvement.

In this exercise VCA has been used to compare, at a strategic level, alternative supply models. More often VCA is used as a basis for identifying opportunities for improvement of existing supply chains and is followed by the systematic application of a well-established set of Lean improvement tools and techniques. It is suggested therefore that Lean and value chain analysis have significant potential to facilitate the improvement of existing international humanitarian supply chains and in helping to develop efficient African-based alternative supply systems.

**Dr DAVID TAYLOR**

Dr David Taylor is Senior Research Fellow in the Logistics and Operations Management Section of Cardiff Business School. He joined Cardiff in 1997 and has worked on a number of major research projects involving the development and testing of Lean approaches to supply chain improvement. A key characteristic of his work has been to ensure that his academic research has been firmly related to practical application and in consequence he has worked with many companies both in the UK and abroad. He has published two books and over 30 articles on supply chain management.