

Traditional retail supply chains work according to the motto “better, centralised and distant”. Each firm operating within these supply chains seeks to optimise its own activities and buffer itself against others upstream and downstream. And customers are strangers, walking anonymously through the store selecting from what is available.

Well, get ready for a complete U-turn – a change in direction which takes us to a very different destination.

The motto of tomorrow’s leading-edge supply chains will be “fresher, simpler and closer”. Products will flow quickly and seamlessly down value chains which encompass many different firms, in direct response to consumer orders. Consumers themselves will no longer be strangers. Far from it, they will be an integral, crucial and value-adding link in the whole process².

Such a customer-driven supply chain is, in many ways, a complete contrast to today’s structure. All the existing assets – including production facilities, distribution centres, logistics operations, ordering systems and retail stores – have been designed and developed for the status quo. To incorporate the trend of “fresher, simpler and closer” they will all need to be reconfigured – a provocative idea.

But it’s more than just an idea. Over the past five years at least one company – Tesco – has worked hard to improve processes in every area of its supply chain. It already has many of the new jigsaw’s pieces in place.

Over the next few years – thanks to a series of new and ongoing initiatives – it will come close to taking the last step, to redesign the supply chain back from the

Creating a customer-driven supply chain

BARCELONA SUMMARY

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Reconfiguring supply chains
around customers is a huge
challenge for retailers. It
needs new thinking,
innovative processes - and
ultimately, perhaps,
infrastructure change

wishes of its customers. Tomorrow's customer-driven supply chain is not as far away as we might think.

From Toyota to Tesco

At the heart of Tesco's recent supply chain successes lies an obsession with process improvement learned from Toyota.

Between 1983 and 1996, Tesco made big strides towards modernising its supply chain, introducing POS scanning, centralised automated ordering, centralised distribution, automated warehouse control and EDI with its main suppliers.

As a result, lead times to stores came down from 7-14 days to two days, and lead times from suppliers fell from 12-18 days to three days – and Tesco was able to reduce its stock holding from 4.4 weeks to 2.5 weeks.

At the same time, its range increased from 5,000 to 40,000 food SKUs and average service levels rose from 92 per cent to 98.5 per cent.³

Despite its leading position in the grocery industry, Graham Booth, Supply Chain Director of Tesco from 1985 to 2000, knew there was still a lot more to be done and sought the best role model to learn from.

Womack and Jones had just described the logic behind Toyota's success in their book *Lean Thinking*.⁴ This quickly became standard reading in Tesco and led to a

working relationship with Cardiff University Business School.

Toyota is widely acknowledged as one of the most efficient manufacturers in the world. It has grown from humble beginnings to become the world's third-largest carmaker behind General Motors and Ford, and has announced plans to become number one by 2010. Much of this growth is now coming from the many new plants being opened outside Japan, which already account for one-third of its global production.

The main driver of Toyota's growth is not brilliant products, although they regularly top the quality ratings, but a brilliant production system, whose logic pervades everything, from customer relations, product development and manufacturing, to supplier relationships.

Because Toyota buys in three-quarters of the value of the car, a key part of its success is spreading this logic to its first, second and third-tier suppliers, giving it the most efficient supply base in the world.

In Japan Toyota has around 300 first-tier suppliers – many western car-makers have more than 2,000 – mostly co-located close to its home base in Nagoya. Each part number is sourced from two or three different suppliers, and each supplier provides a wide range of part numbers to Toyota.

Relationships with suppliers are based on 30 years of joint process analysis to

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improve performance and drive out waste and cost.

As a result, parts are made just-in-time as required by assembly and picked up every two to four hours by milk runs from Toyota. At least 99.9995 per cent of the required parts are delivered right first time, on time. In other words five missing, defective or late parts every one million - which makes a huge difference when you are assembling 3,000 parts into a car every 60 seconds. Try building 1,000 cars a day with 98.5 per cent availability – representing 15,000 defects per one million.

Over the last 20 years, Toyota has also transformed its after-market parts distribution system using the same principles. Dealers pre-diagnose and pre-order parts they need each day, instead of carrying months of stock, and get two to three deliveries a day on milk runs from local distribution centres. These in turn are replenished daily from regional distribution centres (RDC). Most of its parts suppliers can now make and ship all the parts required in a day by the next day to the RDC.

The system copes with more than 400,000 SKUs, and achieves parts per million availability with less than one-third of the stock of its competitors' systems. Very few Toyota customers have to return a second time to the dealer to get their cars fixed.

The logic is strikingly similar to the fresh produce case studies described elsewhere in this issue.⁵ Fresh food is the model, even for after-market parts!

The principles underlying Toyota's business system are simple: -

- identify exactly the value the customer wants
- distinguish between the actions necessary to create that value and the actions which just add cost, all the way from raw material to the end customer
- align the value-creating steps so the product moves through them with minimum interruptions
- only make and ship exactly what the customer orders or takes from the shelf, as quickly as possible
- keep reconfiguring the value stream to remove interruptions and become ever-more responsive.

What Toyota is doing is organising to manage the entire value stream for each product family, rather than leaving each firm to optimise its own activities and buffer itself against others upstream and downstream.

The aim is to pull products through the value stream quickly and accurately, rather than make a forecast well ahead of demand and sell the resulting stock. It is based on improving operational capability and joint process analysis, rather than relying on supplier auctions and big centralised information systems.

Distinguish between actions necessary to create value that customers want, and actions which just add cost – from raw material to end-consumer

First step on the Tesco journey – mapping the traditional value stream

The best way of learning about the possibilities of using lean thinking in the fast moving consumer goods (FMCG) industry is to follow an example. This is exactly what was done at Tesco after 1996. We chose several product families, assembled a team from each operation and took a walk, following both the product travelling downstream and the order travelling upstream, and drew a map of the value stream.⁶

It was an eye-opening experience for all of us! (See Exhibit 1) Even in the best-run value streams there are lots of opportunities for improvement.

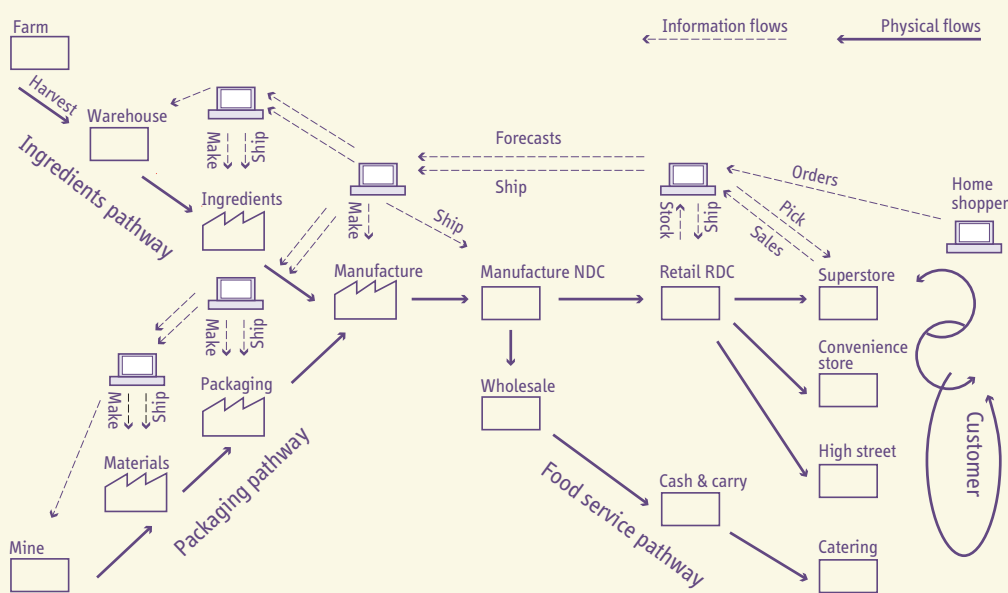
This case study is a synthesis of several such walks – in this case, based on a soft drink – from making the cardboard packaging through filling the can or bottle to the supermarket shelf. This is what we found in what we might call the traditional value stream back in 1996:

- Lots of stock and handling in the store. More stock and handling at the RDC as every product is put away, pulled down and picked by store. More stock at the manufacturer’s NDC to respond quickly to incoming orders and cope with the lead times of batch production. Even more stock of raw materials, packaging and finished goods at the manufacturing and packaging plants. In total, the product was handled 170

times and spent most of the 20 to 60 days (for fast to slow-moving variants of this product) sitting in one of seven different stocking points.

- Despite batch production of packaging and drinks, machines were only producing saleable product for between 30 to 50 per cent of available time. The rest of the time they lay waiting, changing from one batch to another, or being repaired. This was typical of most manufacturing firms running batch production.⁷ Furthermore it became clear trucks were only being used effectively for 30-50 per cent of available time, spending time queuing to unload and often back-hauling empty.⁸
- Following the order upstream revealed that it was processed in batches (overnight or once a week) by eight different systems, all double-guessing each other. The end result was that the relatively smooth signal from sales was being amplified by a factor of four, making synchronised production unthinkable. Almost all this demand amplification was caused by multiple-decision points, long lead times, poor product availability, rounding-up to full truck loads and different ordering cycles, reorder triggers and system algorithms. (See Exhibit 2)
- While average availability of 98.5 per cent was good for that time, it translated into much lower fulfilment

Exhibit 1: Traditional Value Stream



of the average shopping basket of, say, 40 items. Before selecting substitutes, this translates into a 55 per cent chance of finding all 40 items on the shelf. Even though the customer will fill their basket by selecting substitutes, it reveals plenty of room for improving the performance of the grocery supply chain, particularly for home shopping.

Second step – creating value streams which flow

These walks and the resulting maps triggered off many studies and projects at Tesco and its suppliers. At the same time, Tesco was developing its loyalty card and home-shopping projects, opening up new opportunities. As these projects progressed, Tesco began to understand what it would take to create value streams which really flow towards the customer. From the lean principles they distilled three objectives:

- one touch, continuous replenishment so products and orders flow through the value stream quickly, rather than waiting to be processed in batches
- harnessing the data required to allow customers to pull the right products through the value stream quickly, with as little amplification as possible
- applying flow and pull upstream to include production, packaging, transportation and store handling. In the store, work began on ways to

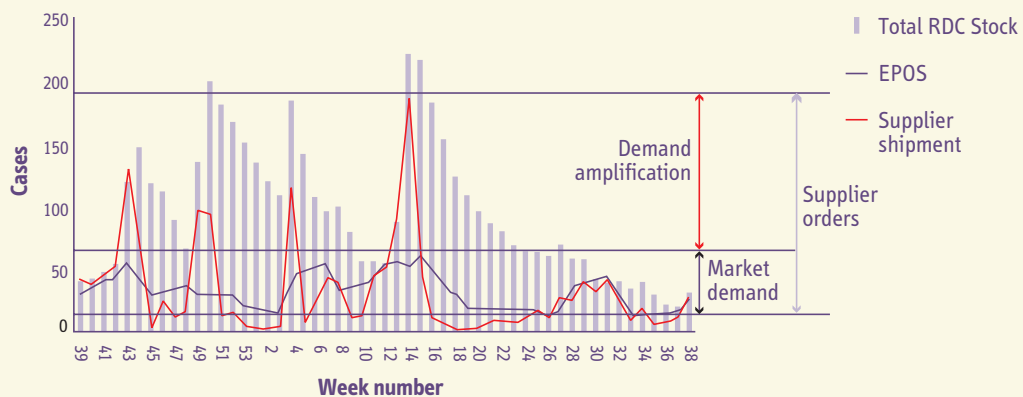
reduce handling and streamline the flow of goods to the shelf. For very fast-moving products, such as soft drinks, wheeled dollies replaced the need for shelving and shelf filling. On these products Tesco achieves 99.8 per cent availability for its customers and stock cover of 3.5 days in its total supply chain – much more like Toyota!

Moreover, these dollies could be loaded at the end of the production line and wheeled through all the intermediate steps to the store without any further handling. On these soft drink products, in-store replenishment labour has been reduced by an impressive 92 per cent and at the RDC by 85 per cent. Indeed 14 per cent of ambient volumes now flow on dollies and Tesco has saved the cost of building an entire conventional RDC.

More recently work also began in RDCs to streamline incoming receiving and inspection and to prepare to flow fast-moving products straight through to sortation and dispatch, only putting away the surplus from the full truckload.

These smaller, off-line stocks could also be used as a buffer – to cope with peaks and troughs in demand – and safety stocks – against failures to deliver. At the same time, continuous replenishment of store orders together with multiple deliveries, rather than batch processing overnight improved speed and accuracy as well as levelling the workload in the store.

Exhibit 2: Demand Amplification



Third step – synchronisation and lean manufacturing

Tesco also began to explore how its systems could pass orders continuously to its suppliers, rather than once a night. This delivers two key benefits. First, it reduces lead times because orders are calculated when needed, rather than waiting for a batch to run. Second, when suppliers' systems can respond on a continuous basis it helps to eliminate much of the noise in the order signal. This in turn opens up the possibility of making to order and synchronising production with demand. High volume replenishment orders can then be delivered directly to the RDC, bypassing the NDC.

A key next step is for Tesco and its suppliers to jointly analyse changes in demand patterns using CPFR to adjust production volumes and decide where the off-line stocking point should be and how much stock it should hold at any one time.

Tesco has, in common with many retailers, struggled not with the concept of CPFR but with establishing a shared need with its suppliers.

This should not be a surprise given that most supply chains are currently designed to make to forecast in big batches and to ship from central distribution centres. It is for that reason that CPFR has only become a live project at Tesco this year.

Many manufacturers have already been

using lean manufacturing techniques, such as productive maintenance (TPM) to achieve much higher machine utilisation. Several have also been developing equipment to, for instance, continuously fill a soft drink line, rather than mixing big batches in tanks, to make smaller and variable-sized batches.

The next step is to improve changeover times to the point where every product can be made every cycle – every day fast-moving products and every week for slow-moving products.

When companies have this level of accuracy and responsiveness together with levelled orders they can begin to use much simpler pull systems to trigger production in line with demand, rather than manually adjusting the weekly MRP schedule, itself based on relatively old forecast data.

Many of Tesco's suppliers are reluctant to move from batch manufacture to lean manufacturing and so Tesco has a programme of education for them. It believes greater value can be delivered to customers through the application of these principles.

But two further pieces of the puzzle still have to be put in place. The first is primary distribution – where, instead of suppliers delivering stock to Tesco DCs, Tesco picks up products from suppliers using milk runs, very much like Toyota (and now many car companies).

In common with many retailers Tesco has struggled, not with the concept of CPFR, but with establishing a shared need with its suppliers

This will help improve transport utilisation and back-hauling, as well as allowing levelling and synchronisation of deliveries to RDCs. It will also place a greater discipline on suppliers to have exactly the right products ready for shipment, ultimately direct from the production line.

Smaller suppliers might collaborate to run their own milk runs to a consolidation point and milk runs could be extended upstream to pick up packaging and ingredients.

The last step – the customer is no longer a stranger

All this great work culminates in one place – where product meets consumer in store, on the shelf. No supply chain can perform efficiently without information, but until recently retailers had virtually zero information about the most important supply chain player of them all – their customers. They had aggregate data from bar code scanning, but they had no idea of who these customers were, what they were buying, when or where.

However, since 1993, when it launched its Clubcard scheme, Tesco has been filling that information vacuum. Clubcard is now carried by 11 million consumers in the UK. In addition, home shopping – by definition – is conducted with known, named consumers whose transaction data you can collect.

What's more, with home shopping (which Tesco introduced in the late-1990s), it is in the position – for the first time – to discover what consumers wanted to buy but couldn't, because it was not available and its staff had to choose a substitute for them.

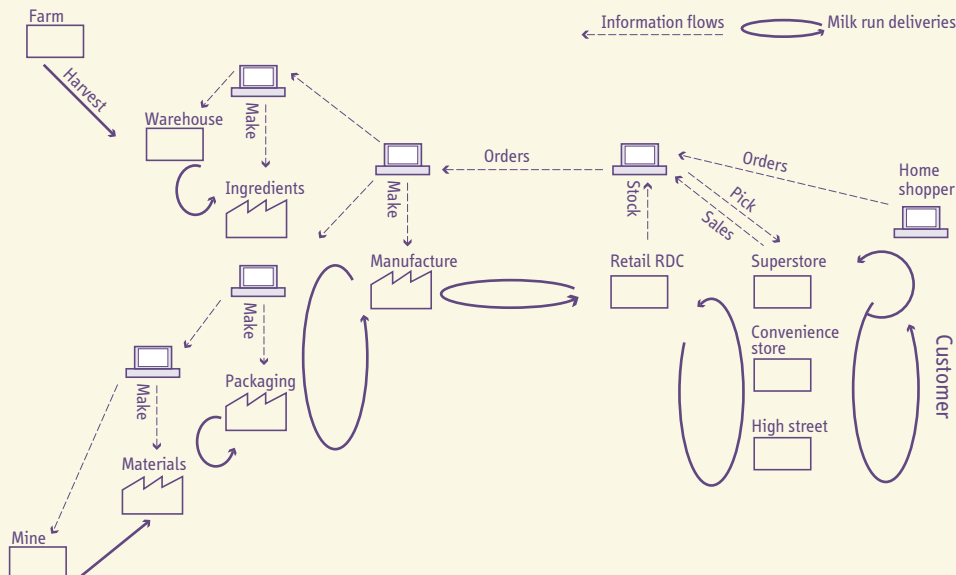
All this data adds up to one critical change. The customer is no longer a stranger. And the data isn't just used for better-targeted marketing initiatives and promotions.

Tesco has taken the card much further and put it at the heart of its operational systems. It acts as a focus for improving the operation and integration of the whole supply chain, not just on the enabling IT. Over the next two years, for example, Tesco plans to use loyalty card and home-shopping data to customise the range of products displayed in each store to the buying profile of that stores' customers.

This will give customers a better-targeted offer and at the same time ensure exactly the right stock is in the right place, eliminating another source of order amplification and enhancing both the customer experience and the effectiveness of the supply chain.

Stores that stock the products its customers want, rather than everything available in the retailer's wide repertoire, are much more able to fulfil true consumer demand.

Exhibit 3: Flow value stream



The results of flow

So what will our case study look like once all the pieces have been put in place? Products will be made to order and picked up by milk round, where they flow through the RDC and out to the store within five to 15 days, being touched only 70 times and stopping in only two stocking points. (See Exhibit 4)

Machine effectiveness should rise to 70-80 per cent and transport effectiveness to 50-70 per cent, as well as cutting out one trip and many extra miles. Orders will pass through only two independent decision points and amplification will fall from 4:1 to 2:1.

Most important of all, service levels will rise to 99.5 per cent, increasing the chance of first-time fulfilment of the basket of 40 items to 82 per cent. This must be a win-win situation for all parties compared with today's traditional value stream.

The foundation of any flow system is that every step becomes interdependent – and fully capable of delivering exactly to promise. Without this there will always be a need to carry intermediate safety stocks.

In addition, sales and order data need to be passed upstream continuously with minimum interruptions and manipulation. Without this there will always be the need at each point to second-guess and keep buffer stocks. Of course, contingency stocks are needed for

known sales volatility, promotions and the introduction of new products.

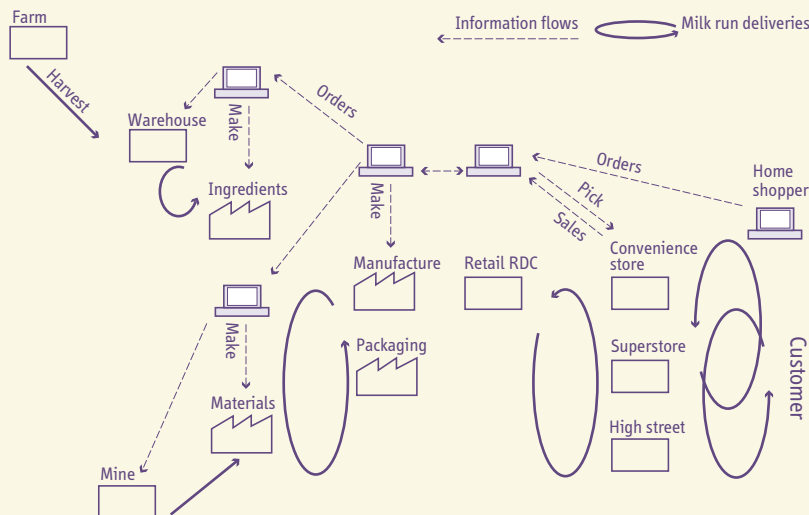
Achieving this level of process excellence within one company takes time. It is more difficult across firms, when actions and costs incurred by one may well have benefits elsewhere along the value stream. The way forward is to build win-win deals where both sides gain – such as smoothing orders in return for synchronised production – and based on fair outcomes so that both sides want to continue to the next round, driven by a shared view of the eventual outcome.

Where might this lead?

Flow is certainly not the end of the story. But it is probably as far as one can go with existing assets in their existing locations – production facilities, distribution centres, logistics operations, ordering systems and retail stores. Remember that these assets were designed for a different world – a world of mass production and mass consumption – where the prevailing logic was to centralise production in large, focused factories, to automate handling in large distribution centres and to stock a growing range of products in ever-larger stores.

The natural consequence is that companies need expensive systems to manage this complexity. Also, products travel further and are handled more often between the farm and the table. Three

Exhibit 4: Compressed value stream



words summarise this thinking – bigger, centralised and distant.

Lean thinking arrives at quite different conclusions:

- end customer demand is not as volatile as we think – most of the volatility is created by the system
- faster and accurate responsiveness is the key to higher availability and basket fulfilment, and to lower costs, not holding more stocks. Fresh food is indeed the model
- the gains from centralisation and scale are invariably offset by additional costs elsewhere in the value stream – indeed the compression of time and distance are the key to responsiveness and lower cost.

So as we begin to achieve flow we also need to think carefully what this might mean for investment in new facilities and systems. The easiest way to see where lean thinking might lead is to take an example of what might be called a compressed-value stream, in which every aspect of the value stream has been rethought from scratch.

A “right-sized” store, close to the customer’s home, acts as the point of contact with the retailer. It carries a customised range of fresh and fast-moving products and can obtain anything from the complete range of slow-moving products from the RDC or local superstore to order within a few hours.

Customers can order on the web at

home or do so in-store, adding to the goods they have selected in the store. They can either pick up their goods later or have them delivered to their home. The retailer is proactive in offering products, services and advice to regular customers based on regular feedback – not just orders – from them.

A contract processor, which bottles and cans soft drinks for several different brands, is located next to a cluster of RDCs belonging to several retailers. This is just one of its plants distributed around the region.

It fills just enough of each product to replenish what was sold in the local region the day before (or what was sold in the previous few days for slow-moving products).

Cans and bottles are printed after being filled, not before, and any packaging is made next door, closely synchronised with the needs of the filler. Products are packed by store and shipped by frequent milk rounds to their destinations, bypassing the off-line buffer.

One can imagine the throughput time in this compressed value stream might be as low as one to three days and the product is only touched 20 times, with only one off-line stocking point. Machine effectiveness could be as high as 90 per cent and the number of trips reduced from four to two, including to the customer’s home. (See Exhibit 5)

Exhibit 5: Soft drink value stream

	TRADITIONAL	FLOW	COMPRESSED
Touches	170	70	20
Throughout time – days	20-60	5-15	1-3
Stocking points	7	2	1
Machine effectiveness %	30-50	70-80	80-90
Transport effectiveness %	30-50	50-70	70-85
Transport trips (incl. customer)	5	4	2
Decision points	8	2	1
Order amplification	4:1	2:1	1:1
Service level %	98.5	99.5	99.95
Basket fulfilment % (40 items)	55	82	98

One decision point eliminates almost all the demand amplification and service levels are now high enough to guarantee almost perfect basket fulfilment.

Three words also capture the implications of lean thinking for this industry – fresher, simpler and closer. These are indeed provocative ideas, triggering a change in the direction of our thinking about supply chains. This is just one example of how these ideas could play out in the future.

Given the growing diversity in types of customer and the many alternative routes to market, there will never be just one correct solution.⁹ Indeed the challenge is to think through what these ideas might mean for an individual's own situation.¹⁰

However, the key to doing so will be a relentless focus on customer needs, a substantial effort to improve operational capabilities and joint process analysis with your supply chain partners. Tesco is already five years down this path. And its journey has just begun.

¹ This article was based on our presentation to the ECR Conference in Barcelona in May 2002. We would like to thank Graham Booth, Barry Knichel and Barry Evans from Tesco and David Simons, Robert Mason and Nick Rich from Cardiff who all played a key part in this story.

² This mirrors the point made by Alan Mitchell, Extending ECR to the Customer,

ECR Journal, Summer 2001.

³ Data presented by Graham Booth to the Lean Summit in Birmingham 1997.

⁴ James P Womack and Daniel T Jones, *Lean Thinking: Banish Waste and Create Value in your Corporation*, Simon & Schuster, 1996.

⁵ See the article by Takeda and Matsuo elsewhere in this issue.

⁶ The methodology for mapping the value stream is described in J Shook and M Rother, *Learning To See* (1999) and DT Jones and JP Womack, *Seeing the Whole* (2002) published by the Lean Enterprise Institute at www.lean.org and www.leanuk.org.

⁷ The Overall Equipment Effectiveness is the product of equipment availability (breakdowns and changeover time), performance (minor interruptions and slow running) and quality (defective products and scrap).

⁸ Using a similar Overall Logistics Effectiveness measure.

⁹ See Maureen Johnson, *The Store of the Future*, ECR Journal, Spring 2002.

¹⁰ Explored further in Daniel T Jones, *Thinking outside the Box*, ECR Journal, Summer 2001.

Yesterday's supply chains worked to the logic of 'better, centralised and distant'. Tomorrow's watchwords will be 'fresher, simpler and closer'