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# CUSTOMER RESPONSIVE SUPPLY CHAINS: AN EXPLORATORY STUDY OF PERFORMANCE MEASUREMENT

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Alan Harrison is professor of operations and logistics at Cranfield School of Management. After graduating in chemistry at Oxford University, he followed a career in manufacturing industry with Procter and Gamble, BL and GEC. Having been converted to academic life, he joined Warwick Business School in 1986 as a senior research fellow studying the application of Japanese management methods to UK manufacturing. He completed his doctorate in enablers and inhibitors to material flow at Cranfield School of Management, which he joined in 1996. He is author of Just in Time Manufacturing in Perspective (Prentice Hall, 1992), and joint author of Operations Management, 2nd edition, Pitman (1998) and of Logistics Management and Strategy (2002, forthcoming).

Alan has undertaken extensive research into supply chains in several sectors, including automotive, aerospace and grocery. He has extended his research base from applications of just in time to limitations of this approach, and his recent work has been concerned with developing capabilities for enhanced customer responsiveness. This has resulted in such publications as Creating the Agile Supply Chain (Institute of Logistics and Transport, 1999) and the establishment of the Agile Supply Chain Research Club at Cranfield, which has attracted some £1 million in funds.

#### Janet Godsell

After completing a pre-University training scheme Janet was sponsored for the duration of her studies by Zeneca Ltd (formerly ICI). Courtesy of a scholarship from the Tokai Bank Janet spent an academic year studying Japanese language at Nanzan University, Nagoya. This was supplemented with 5 months industrial experience with Sumitomo Heavy Industries Ltd. and ICI/Teijin. Janet graduated from Birmingham University in mechanical engineering, manufacture and management with Japanese, and joined Zeneca Pharmaceuticals initially as a technical support engineer and then as a front line manager. Subsequently Janet joined Dyson Ltd as a production engineer with responsibility for the design and implementation of the assembly methodology for the DC03 vacuum cleaner. Janet then moved onto an Operations Development role, with an emphasis on process and systems development. Before joining Cranfield, Janet was the Operations Manager for a recently developed in-house injection moulding facility. During this time Janet was also sponsored to study for an Executive Masters in Business Administration at Cranfield University. For her masters thesis Janet investigated the use of postponement as a tool for the optimisation of the Dyson vacuum cleaner supply chain.

## CUSTOMER RESPONSIVE SUPPLY CHAINS: AN EXPLORATORY STUDY OF PERFORMANCE MEASUREMENT

We investigated four organisations to explore their use of customer-facing metrics. Each organisation claimed to measure end customer satisfaction, but this was by means of 'post event' measures like customer complaints. Based on this evidence, the measurement of customer responsiveness remains elusive, and key performance measures (KPI's) continue to focus on internal and operational substitutes. Implementation of customer-responsive supply chains will remain elusive as long as this situation persists.

#### Introduction

Materials and finished product only flow through the supply chain because of consumer behaviour at the end of the chain (Gattorna, 1998). In other words, supply chain processes should be co-ordinated in order to focus on end customer buying behaviour. Such thinking has led us to define *customer responsiveness* as planning and controlling the flow of materials through a sequence of supply chain processes in order to meet end customer buying behaviour. Particular challenges emerge when product life cycles are shortening, variety is ever increasing and – in consequence – demand is becoming more difficult to forecast. In such circumstances, Goldman et al (1995) propose that an organisation needs to be 'capable of operating profitably in a customer environment of continually, and unpredictably, changing customer opportunities'. While a number of sources stress the importance of customer responsiveness as a key business strategy, few explain how such responsiveness can be measured.

Focusing on the capability of manufacturing to respond to such 'changing customer opportunities', Matson and McFarlane (1999) define production responsiveness as:

The ability of a production system to achieve its goals in the presence of disturbances.

This work has led to the identification of four 'components of [production] responsiveness' (Kritchanchai and MacCarthy, 1999; Shaw et al, 2002):

- *Stimuli:* the responsiveness drivers
- Awareness: of the drivers and what is needed to respond
- *Capabilities:* the ability to respond to different drivers
- Goals: the targets or objectives of each firm in its environment

Goals are defined by this group of researchers in terms of customer service and cost. However, the proposed measure of customer service (change in on-time in-full delivery) is designed to focus on single, manufacturing links in a given supply chain. We return to the issue of local optimisation of metrics later in this paper.

In an earlier study of eight organisations within the context of their supply chains, we found that three themes ran through definitions of customer responsiveness in practice (Emberson et al, 2001). These themes are customer focus, visibility and co-operation, and are shown in Table 1:

| Definitions of Customer Responsiveness  |   |  |
|---|---|--|
| Customer Focus  | Visibility  | Co-operation   |
| To meet customer requirements To anticipate customer needs and over-deliver         | To enable customers to look inside,<br>transact and have visibility of product<br>in real time until receipt, thus having<br>the effect of reducing workload, and   | To communicate the desire to build business together and to take full advantage of the |
| against their expectations To be customer centric To meet the needs of the customer | increasing service levels and customer confidence.  It's understanding the demand variability that you've got for each of your segments, and it's being able to put in place a structurethat allows you to meet that demand variability | opportunities that this presents.  |

Table 1: Definitions of Customer Responsiveness (Emberson et al, 2001)

There are alternative strategies for the way in which responsiveness to end customer may be achieved. The view of Fisher (1997) and of Naylor and Naim (1999) is that there are two matching characteristics of supply chain strategy, described by 'functional-efficient' and 'responsive-innovative' combinations. 'Functional - innovative' and 'responsive - efficient' supply chain combinations are deemed to be unsustainable. However, the product/process matrix of Hayes and Wheelwright (1979) suggests a more continuous range of competitive options. Recent work by Ahmad and Schroeder (2002) reinforces the view that advantage can also be gained by 'moving off the product-process diagonal':

"...we observed certain groups that deviated from the prescription of the product-process matrix framework. These groups of plants were able to minimise trade-offs by producing products with custom options and customised products without sacrificing efficiency."

A parallel line of thinking is that of strategic alignment (Gattorna 1998). Here, the strategic response by a given supply chain to given market conditions is seen in terms of the development of capabilities which enable that strategy to be implemented. A cultural capability is developed to enable that strategy to be executed. A match is therefore developed between market needs and the capability of the chain to respond. A number of possible responses are usually necessary, depending on for example whether the needs are manifested in cost/productivity, or speed, or flexibility terms. Different capabilities are therefore needed to align with different supply chain strategies.

A model of such processes as they impact on manufacturer/retailer regions of a supply chain is shown in figure 2 (Harrison and Samuels, 2002). There are many decision categories at each of the stages listed, leading to many possible performance measurement priorities. It is easy to take 'local' decisions that optimise the process at particular points in the supply chain, yet which miss the impact of these decisions on the performance of the supply chain as a whole. Cumulatively, these 'mismatches' contribute to weakened customer responsiveness. The opportunity in such chains is for retailers to develop appropriate end user measures such as on shelf availability by sku, and to make these measures visible to upstream supply chain processes.

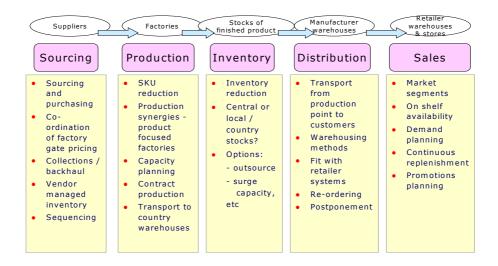


Figure 1: A Sequence of Supply Chain Processes

## **Supply Chain Performance Measures**

Led by development of the suppy chain operations reference model (SCOR – Stewart, 1997), there have been several recent attempts to create a more holistic set of KPI's for the supply chain context in which a firm operates. For example, Gunasekaran et al (2001) propose a broad-based set of metrics in which customer service *inter alia* is measured by flexibility, customer query time and post transaction measures. Practitioner conferences such as that reported by Flint (2002) advocate various solutions such as supply chain event management. But such solutions are faced with the question 'what are the key measures for a given supply chain?'

In their review of logistics performance measurement systems, Caplice and Sheffi (1995) proposed 6 criteria for the evaluation of performance measurement systems. These are comprehension, causally orientated, vertically integrated, horizontally orientated, internally comparable and useful. However, it is the business process (internal) and systems (external) nature of logistics that create so many challenges for performance measurement. 'Organisations have found it difficult to effectively measure their own logistics processes because of their cross-functional and boundary spanning characteristics' (Kiefer and Novack 1998). As Tan et al (1999) state 'organisations are increasingly faced with the reality that they cannot exist in isolation but are one piece of a complex chain of business activity'.

Lambert and Pohlen (2001) go further. They propose a framework that 'focuses on managing the interfacing customer relationship management and supplier relationship management processes at each link in the supply chain', and observe:

Most of the performance measures called supply chain metrics are nothing more than logistics measures that have an internal focus...these measures may actually prove to be dysfunctional by attempting to optimise the firm's performance at the expense of the other firms in the supply chain...'

Carman and Conrad (2000) emphasise the need to put the customer first in developing supply chain metrics:

Successful key performance indicators [KPI's] are not just internally focused metrics. They also are forward facing, or focused on the customer, and ultimately, the end customer.

We consider that a focus on the end customer is a missing link in current performance measurement systems. Our earlier study of measuring agile capabilities in the supply chain (van Hoek, Harrison & Christopher, 2001) emphasised the need to measure customer sensitivity. Customer sensitivity 'includes market understanding and customer 'enrichment', but also includes initiatives such as customisation, postponement and rapid response'. The value of information sharing and order co-ordination is supported by recent, modelling-based research (Zhao et al, 2002). The purpose of this paper is to explore customer sensitivity by investigating relevant KPI's currently in use in different organisations, and to draw conclusions about the implications for responsiveness in the supply chain.

## Research Design

We elected to use a case study design in order to explore the concept of customer responsiveness in four very different organisations. Case study design enabled us to 'investigate a contemporary phenomenon within its real life context' (Yin, 1994). This design also helped us to explore new processes and behaviours (Hartley, 1994), and to capture emergent properties that would have been problematic to explore using other methods of enquiry. The four organisations were selected because each had stated in advance to us that it was addressing the issue of customer responsiveness in its own supply chain. Some brief contextual remarks about the four organisations selected are:

- ConfectionaryCo: is a manufacturer of sweets, characterised by a functional structure. However, short communication lines and a very loose framework of corporate procedures make the organisation relatively responsive and flexible. It has focused on development of 'lean' processes over recent years, but saw that the market was changing and flexibility is key to the future.
- Optico: a player in the vision correction market, struggles with a functional organisation and a lack of integration, which makes the organisation less responsive and more lean-oriented than ConfectionaryCo. It is focusing on postponement strategies.
- LaundryCo: has a long history of trying to be a lean organisation, which resulted in a reactive response to its markets. The company is undergoing a re-structuring whereby a more pro-active and responsive approach is being taken towards customers. LaundryCo is developing a network of service centres to provide high levels of customisation and responsiveness.
- Global Lighting: has focused its factory into two a commodity division which is functionally organised and run on lean principles, and a custom division which has few formal structures and which has been designed to be very flexible and responsive. The custom division is developing flexible packaging facilities to further develop its responsiveness.

A detailed review was made of all customer-focused KPI's in use in the organisations concerned, based on the collection of interview and archival evidence. The principal data gathering used our agility audit (Harrison et al, 1999) to collect respondent's views on four areas of the business (Goldman, Nagel and Preiss, 1995):

- Creating customer value: probed areas like use of customer-based KPI's, degree of product/service customisation, and knowledge sharing
- *Co-operation to enhance competitiveness*: probed areas like degree of business process orientation, team-based goals, and information-sharing
- *Mastering change and uncertainty*: probed areas like facilitation of decision-making, creation of a risk-taking environment, and development of capabilities
- Leveraging people and information: probed areas like the development of competencies, operator self-management and real time availability of end- customer demand information

We also asked questions about the KPI's used in each organisation:

- What are the main KPI's used to measure the performance of your supply chain?
- Are they based on a given framework, and if so, how was this determined?
- How often are they reviewed, and how are new targets and goals established?
- How is data collected to support the KPI's?
- Are you aware of the KPI's of any of your partners in the supply chain?
- Are you aware of the alignment of KPI choice and goals with other partners in the supply chain?

Informants were small numbers of senior managers - such as logistics directors - in each organisation, so the views expressed are likely to be biased towards what was expected or designed in terms of the PM system rather than what was perceived by those working 'in the process'.

#### Results

A summary of our findings for each of the four case study organisations is as follows:

ConfectioneryCo: our agility audit showed an organisation that scored highly on its approach to people. It had invested in developing entrepreneurial and innovative characteristics in its workforce. However, the product was highly standardised with little evidence of customisation. Lack of responsiveness was also evident in the weak sharing of data with other supply chain partners. This 'legacy of lean' centred on the enterprise was of considerable concern to the logistics director:

Current supply lines make high volumes of the same product at low cost. Now this is starting to work against us. Response time to changing customer demand is a key feature. We will move from process driven lines to pack-size driven lines.

While standard production methods and low manufacturing cost had been the guidelines for previous investment policy, this had resulted in inflexible production lines, large batch sizes and fixed methods for palletising and shrink wrapping. A next generation investment strategy conceived a reduced cycle time for a complete product range on each production line, and development of the capability to match individual retailer needs by packaging format (hence the term 'pack-size driven lines').

Confectionery Co sought to measure supply chain performance across Europe by using a 'supply chain cockpit' of metrics. The metrics covered the manufacturing process to the national distribution centre (NDC) for a given territory. An overview of the measures – which were reviewed by a cross-functional is given in Table 2:

| Measure          | Definition   |
|------------------|--|
| Customer service | Percentage of case fill per NDC  |
| Volume demand    | Forecast, planning and actual volume demand                            |
| Supply issues    | Production utilisation against product demand                          |
| Manufacturing    | Production line flexibility – number of                                |
| frequency        | times a product has been produced for                                  |
| index            | that month   |
| Stock levels     | Divided by product type and manufacturing site                         |
| Financial        | Manufacturing and logistics costs, cash utilisation and overhead costs |

Table 2: Supply Chain Cockpit Measures at ConfectioneryCo

Further data for this case were collected from one of ConfectioneryCo's major customers, a large chain which we refer to here as RetailCo. Supply to RetailCo is based on vendor managed inventory (VMI), whereby the two organisations work as a team. Full pallet loads are supplied on 24-hour lead times from the manufacturer to the retailer's NDC, from where it is supplied to local distribution centres and thence to the stores. RetailCo measures all of its suppliers on a standard set of measures, shown in Table 3:

| Measure               | Definition   |
|-----------------------|--|
| Service level         | Roll cages delivered to stores / roll cages                          |
|                       | ordered by stores  |
| Service level -       | Roll cages delivered to stores / roll cages                          |
| promotions            | ordered by stores  |
| Service level – new   | Roll cages delivered to stores / roll cages                          |
| products              | ordered by stores  |
| (new products on sale |  |
| for <8 weeks)         |  |
| Inventory indicator   | Average inventory level per week, calculated as number of days sales |
| OOS - days            | Number of days out of stock. Products                                |
| ·                     | unavailable for delivery to store due to supplier delivery problems  |
| Manual entry          | Number of times the bar code on the                                  |
|                       | product could not be read by the till bar                            |
|                       | code scanner   |

Table 3: Supplier Performance Measures

In spite of these published measures, the main focus was actually on-shelf availability. RetailCo was using audit teams to discover reasons why suppliers could deliver 99% availability to the retailer's NDC, yet only 80-85% service levels were being achieved in the stores.

Internally, ConfectioneryCo continued to place a strong emphasis on productivity and efficiency, and its internal KPI's reflected this. None of the formal KPI's – at either manufacturer or retailer – reflected the principal concern of poor on-shelf availability, although this was the primary 'unofficial' concern. And there was a noticeably weak datasharing process between ConfectioneryCo and other supply chain partners.

**Optico:** the supply chain that we investigated is based on four main stages. Manufacturing in Europe is based on three plants. These feed local warehouses based near to each plant. Thirdly, the local warehouses feed a European Logistics Centre (ELC) on a weekly basis, which also receives weekly deliveries from other non-European Optico countries. Fourth, freight forwarders and carriers take Optico products from the ELC to stallite warehouses, distibutors and wholesalers, opticians and homw delivery. A major project has been the development of postponed packaging, allowing private labels and special packs to be generated at the ELC.

Our agility audit showed an organisation that was very 'lean - oriented'. A focus in manufacture on efficiency and utilisation rates was amplified by the regulated nature of the industry. The functionally oriented organisation structure and slow decision making processes were driven by the parent organisation in North America. Limited success in postponement activities in the ELC suggested that there is scope for much greater effort in this area.

KPI's used in the manufacturing process are recorded in Table 4:

| Measure                      | Definition  |
|------------------------------|---|
| Output                       | Number of units produced                            |
| Yield                        | Measured for each process                           |
| Outgoing Product Quality     | PPM defects for samples of outgoing products        |
| Productivity                 | Units per man-hour                                  |
| Overtime                     | Measured per process                                |
| Process performance Index    | Downtime, setup time, utilisation and process yield |
| Major customer complaints    | As occurred   |
| Sales                        | Value   |
| Order fill rates, Back order | Percentages   |
| status                       | T 1   |
| Corrective action requests   | Trends per process                                  |
| Cost Improvement             | Budget variance, actual versus                      |
| Programme                    | target  |
| Business Process             | Budget variance, actual versus                      |
| Improvement                  | target  |

Table 4: Manufacturing KPI's at Optico

Customer satisfaction metrics in use at the ELC for Optico are shown in Table 5:

| Measure         | Definition                              |
|-----------------|---|
| Order fill rate | Percentage of orders available for      |
|                 | delivery                                |
| Unit fill rate  | Percentage of order lines avialable for |
|                 | delivery                                |
| On time         | Percentage of shipments available for   |
| shipment        | collection by haulier on time           |
| Customer        | Percentage of complaints received       |
| complaints      | against number of orders processed      |

Table 5: Customer Satisfaction KPI's at Optico's ELC

Optico was also working on delivery performance KPI's for the various freight forwarders and carriers, and a complaints management system to log complaints and direct them to the relevant production unit.

We thus concluded that the KPI's used in Optico were very internally focused, in line with the functional organisation strucure in force at the time. The emphasis was on efficiency and financial returns. There were no direct measures of customer satisfaction or of end customer demand.

**LaundryCo:** here, the supply chain activities we investigated were similar to those for ConfectioneryCo, and comprised manufacturing, national distribution centre (NDC), customer distribution centre (DC) and the retail store. LaundryCo has been involved with a number of leading-edge retail logistics projects, including 24-hour replenishment ('day 1 for day 2), and movement from 5-day to 6/7-day ordering. The aim is to develop nothing les than the customer sensitive supply chain:

We're looking to streamline the entire supply system, from the supplier to the customer and we're going to produce to demand, based on actual consumption. We're going to let the end customer define what's needed and deploy the necessary technology to make it happen.

A 'zero touch' ordering system aimed to allow customers to place orders on the web with no human intervention. Orders are automatically routed to the order management system and processed for picking and despatch. Delivery to customer DC was by a fleet of contracted hauliers, and full truck loads were gradually giving way to a more flexible service.

Our agility audit indicated an organisation that was still relatively slow and reactive towards market opportunities and to changes in demand. While a number of projects and rhetoric indicated the forward thinking needed to meet the aspirations indicated in the quote above, reality was still somewhat distant from this ideal state. Co-operation with the major retail customers was well developed, and LaundryCo tried hard to meet customer plans and objectives. But, like ConfectioneryCo, service levels to the customer DC were not being matched by stock availability on the shelf, and much remained to be done to improve the 'last mile' logistics.

Supply chain activities at LaundryCo were split into sales and marketing (S&M) and customer logisites (CL) aspects. KPI's for the two parts reflected the difference in emphasis. Table 6 shows the KPI scorecard for S&M, and Table 7 shows that for CL:

| Measure      | Definition                              |
|--------------|---|
| Availability | Product availability measured against   |
|              | customer orders                         |
| Volume       | Total volume shipped                    |
| shipped      |   |
| Missed cases | Total amount of cases not available for |
|              | shipment after availability check       |
| +/-3% sales  | Sales plan forecast accuracy for one    |
| plan: 1 mo   | month                                   |
| +/-3% sales  | Sales plan forecast accuracy for six    |
| plan: 6 mo   | months                                  |
| SKU accuracy | SKU farecast/sales plan accuracy        |
|              | measured as moving average percentage   |
|              | error                                   |

Table 6: KPI Scorecard for S&M at LaundryCo

| Measure      | Definition  |
|--------------|---|
| Zero Touch   | Percentage of orders on Order   |
| Orders       | Management System without human interference                              |
| Logistics    | Percentage of cases not available for                                     |
| missed Cases | picking at the NDC  |
| Delivery     | Percentage of orders delivered against                                    |
| Reliability  | the requirements of the order   |
| On time      | Percentage of orders delivered against agreed order time                  |
| Billed       | Percentage of orders billed correctly                                     |
| correctly    | ,   |
| Payscore     | Variation in days of payment by customer against agreed contractual terms |
| Productivity | Percentage difference in resources available and workload handled         |

Table 7: KPI Scorecard for CL at LaundryCo

LaundryCo was still somewhat held back by its long history of focusing on lean. The performance measurement system for both S&M and CL reflected this legacy, with a focus on internal KPI's that are easy to measure. However, its aspirations to become more customer responsive had been clearly spelt out, and LaundryCo is putting in place a new organisation structure and is developing new more agile distribution operations to meet these aspirations.

**Global Lighting:** this is indeed a global organisation dedicated to the lighting industry. It had recently re-focused its operations into commodity products and a custom products

division. It is on the latter division that we addressed our investigations. The mission of this division was:

To create imaginative and integrated solutions from concept to completion in partnership with project specifiers worldwide. We will achieve this by utilising our 'in-house' facility and team of specialists to deliver high quality and value for customers and ourselves.

The custom products division produces variants on commodity products and completely customised products for the European market. The end customer is the building architect, and the division wins orders as a result of its specialist skills and ability to quickly meet the customer's individual requirements. We investigated foiur stages of the supply chain. These were the manufacturing plant, the associated warhouse, wholesalers and the end customer. The position of the wholesaler is historical, although the larger contracts now go direct to the end customer. Also, while most orders are currently consolidated at the Global warehouse, custom division plans to undertake more and more direct shipments.

Our agility audit showed that the custom products division aligned closely with the principles of agility. The parent company, now manifactested by the commodity products division, is still rather functional and hierarchical in nature. The main KPI for manging this division is labour productivity. A labour value for every product has been calculated, and productivity is watched closely. Other KPI's are based on quality and on health and safety issues. The monthly report translates the productivity measures into financial according to three variances – labout, scrap/material and overheads. There are no further supply chasin or distribution measures, and a recative approach to custopmer complaints, which are delat with on an ad hoc basis.

Custom products division on the other hand has no KPI's in place. Operational performance is monitored by means of sales turnover and gross margin. An entrepreneurial environment exists, with designers, operators and suppliers all working together with no distinct forms of performance measurement.

#### **Conclusions**

Our investigations focused on the logistics operations of four organisations. Each was finding the development of customer responsiveness measures a difficult challenge. Typical examples in use were the traditional 'easy to measure' KPI's, such as order fill rate, percentage orders available for delivery, unit fill rate, percentage of order lines available for delivery, on time shipment, percentage of shipments available for collection by haulier on time, customer complaints and percentage complaints against number of orders processed. We concluded that none of the companies studied had developed KPI's that were clearly related to end customer satisfaction. The closest measure of customer satisfaction is based on the logging of customer complaints. But this is a reactive measure that is 'post event'.

Most of the measures were still internally and operationally orientated. Measures like in-store availability of products, and differentiated offers and deliveries are currently not adequately measured. ConfectioneryCo and LaundryCo were 'market oriented' firms that undertook ongoing research of their respective customer bases. While both were developing measures of on-shelf availability, there were two major problems:

1. on-shelf availability was being measured by market research, which took place during weekdays. While this was cost-effective, it failed to engage with the problem of peak

- trading on Saturdays, and other time-based surges in demand. IT-based alternatives can work for stable demand items, but are less effective for items with irregular demand and promotions. And the issue remains 'how do you get the retailer to respond to out-of-stock warnings quickly'?
- 2. there was a widespread recognition among manufacturers that on-shelf availability did not match service levels to the retailer's DC. However, the solutions to this problem are largely out of the hands of the manufacturers under current 'arm's length' relationships that are common in the industry.

We were impressed however by the unique position of the custom division at Global Lighting. It combines the qualities of two different operations in a new win-win synergy. The custom division uses the knowledge, experience and capital-intensive facilities from the commodity division to place it in a very competitive position. This allows it to act as an SME while using the facilities and knowledge of a larger organisation. The commodity division benefits by the proving of new methods and materials in the 'laboratory' environment of its sister organisation. It is a working example of the 'lean and agile' paradigms described by Christopher and Towill (2000), although it goes a stage further by demonstrating the potential for innovative/responsive products (Fisher, 1997) to provide win-win synergies with efficient/functional products in the same organisation.

This research suggests a rather disappointing picture of lack of customer alignment of KPI's in the supply chains studied. All four cases studied were large international organisations, but all relied on traditional, easy-to-measure KPI's. While organisations may be claiming to measure end customer satisfaction, the reality appears to be that they measure operational performance related to dealing with their supply chain customers. While the research described in this paper was limited to the four organisations studied, and one must be cautious about generalising such conclusions, we believe that measures of end customer satisfaction remain elusive. We plan to continue to work with these and other organisations to search for better solutions and the environments in which they may be made to work.

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