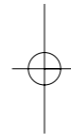


Issue 1 Spring 2001



# *Supply Chain Management in the E-Business Era*

An Investigation into Supply Chain Strategies,  
Practices and Progress in E-Business Adoption



# Foreword

The rapid growth of e-business is laying down major challenges to supply chain management in both the private and public sectors.

The subject is constantly on the lips of chief executives and directors as companies strive to keep up to speed with the pace of change and make the necessary strides forward in logistics to ensure consistent first-class product delivery to customers.

Integrating the many elements of the supply chain is the biggest challenge faced by businesses as they move away from a fragmented approach and into an electronically managed chain.

BT commissioned this study by Warwick Business School to explore the driving force behind supply chain strategies in British industry.

The primary focus was to investigate the current state of the supply chain management initiatives, concerns and drivers in public and private sectors. In addition the use and development of the Internet and associated e-business processes was examined in the context of future developments.

Some key trends have been identified. Of the 86 companies interviewed 79 per cent had a written e-strategy in place but significantly only 20 per cent of Small & Medium enterprises had a written one in place.

In 56 per cent of companies with an e-strategy in place the CEO is the designated e-champion.

CEO's are identifying the urgency to become an e-business but the research could not identify any consensus on what an e-business actually is.

A clear strategic focus remains on the needs of the customer and the drive to cut costs in the supply chain is as fierce as ever. However, in many cases there is evidence that organisations are focusing all their efforts on customer facing activities without a clear strategy on how to deliver the product to the right place at the right time at the right price.

Large global customers are to blame for the increased pressures being put on companies as they demand increased coordination in the supply chain but it is all too clear that British business is not maximising the potential of good SCM.

A major concern here is the apparent lack of clear strategic awareness of the implication and benefits of e-procurement. Procurement is viewed as an administrative process in the majority of organisations, except those with over a one billion pound turnover. For these companies procurement is of major strategic importance.

The challenge remains for companies to achieve an integrated supply chain. We hope this research, which includes some interesting case studies, will offer a useful insight into the major issues of supply chain management.

**Danny McLanglin**

*Managing Director  
BT Major Business*

ISBN 0 902610 73 2

© Simon R Croom 2001

The rights of Simon R Croom to be identified as the author of this work have been asserted by them in accordance with the Copyright, Designs and Patents Act 1988.

Published by SC Associates, Coventry, UK.

# Contents

<b>SECTION ONE: EXECUTIVE SUMMARY</b>	<b>6</b>	<b>SECTION SEVEN: E- PROCUREMENT</b>	<b>35</b>
KEY RESEARCH FINDINGS		BENEFITS OF E-PROCUREMENT ADOPTION	
Summary of the Main findings		BARRIERS TO E-PROCUREMENT ADOPTION	
<b>SECTION TWO: BACKGROUND</b>	<b>9</b>	PROCUREMENT CASE EXAMPLE – UNIVERSITY OF WARWICK	
<b>SECTION THREE: RESEARCH METHODOLOGY</b>	<b>11</b>	PROCUREMENT	
<b>SECTION FOUR: OVERVIEW OF SURVEY RESPONDENTS</b>	<b>13</b>	<b>SECTION EIGHT: FULFILMENT</b>	<b>39</b>
RESPONDENTS PROFILE		FULFILMENT CASE EXAMPLE – I-FORCE	
<b>SECTION FIVE: SUPPLY CHAIN STRATEGY</b>	<b>15</b>	<b>SECTION NINE: CUSTOMER RELATIONSHIP MANAGEMENT</b>	<b>43</b>
Boundary Spanning Supply Chain Activities		CRM CASE EXAMPLE: GLOBAL PRECISION INC.	
Core Supply Chain Activities		<b>SECTION TEN: ORGANISATIONAL AND CULTURAL CHALLENGES IN</b>	
STRATEGIC SUPPLY CHAIN ISSUES		<b>SUPPLY CHAIN STRATEGY</b>	<b>45</b>
<b>SECTION SIX – E-BUSINESS IN THE SUPPLY CHAIN</b>	<b>23</b>	<b>SECTION ELEVEN: CASE STUDIES IN SUPPLY CHAIN MANAGEMENT</b>	<b>47</b>
PORTAL CASE EXAMPLES – COVISINT AND TRANSORA		CASE 1: FORD'S THRUST ON E-COMMERCE AND INTERNET	
Covisint		CASE 2: NORTEL	
Transora		CASE 3: PROCTOR & GAMBLE	
Implications for Market Transactions of Electronic Commerce		CASE 4: TRADETEAM	
1. Cost of coordination		CASE 5: KEY INDUSTRIAL	
2. Increased propensity to outsource		<b>SECTION TWELVE: ACADEMIC REFERENCES</b>	<b>54</b>
3. Market or Hierarchy?			
E-STRATEGY			
KEY E-INFRASTRUCTURES			
E-STRATEGY DEVELOPMENT PROCESS			
AN ANALYSIS OF SUPPLY CHAIN STRATEGIES BY SECTOR			
Construction			
Manufacturing			
Transportation			
Utilities			
Wholesale and Retail Trade			
Banking & Finance			
EVOLUTION TOWARDS INTEGRATED SUPPLY CHAIN MANAGEMENT			
Where are UK organisations in terms of Progress towards Supply Chain			
Integration?			

*This report presents the findings of a research project into the Strategic Development of Supply Chain Management undertaken by Dr Simon Croom of Warwick Business School*

# Executive Summary

## Key Research Findings

### Supply Chain Management a Major Concern of E-Business

This research was concerned with identifying current business activity in terms of Supply Chain Management strategies, and we found that an important issue for supply chain management was the emergence of E-Business as a major strategic concern for large organisations, with 79 percent having a written E-Strategy. However, for small and medium-sized enterprises (SMEs), only 20 per cent had a written E-strategy.

We found that one of the direct consequences of the attention to E-Business was a clear focus on Supply Chain Management improvement. Our research showed that effective supply chain management is regarded as a critical requirement for successful E-Business Implementation.

### Cost, rather than Customer Service, a primary focus for Supply Chain Integration

The primary objective for supply chain strategy is greater integration with suppliers and customers, focusing almost exclusively on 'squeezing' costs out of the chain. This objective was common to all sizes of organisation, and across all of the sectors surveyed. We also found that large customers were placing considerable competitive pressure on their suppliers to achieve supply chain cost reduction.

### E-Business Strategies are not supporting Customer Service

This research identified a five stage evolutionary process in the adoption of supply chain strategies. The five-stage process illustrates the focus of supply chain improvements, specifically the adoption and implementation of specific E-Business systems. We found that organisations are focusing on customer-facing processes first, followed by internal (operations) processes and then supplier-facing processes. Whilst the use of sales order automation and customer relationship management (CRM) supports improved customer access, in order to deliver improved customer service there is a need to align the organisation's and suppliers' operations in order to develop an appropriate fulfilment capability. Deferring the development of operational and fulfilment capabilities until customer-facing E-processes have been implemented leads to poor supply chain effectiveness.

### The E-Strategy Process – Top-Down Vision, Bottom-Up Action

The e-business strategy is typically driven by top-down vision. We found that the CEO plays an important role in providing the overarching motivation for e-business adoption, but that the process of developing and implementing specific e-business initiatives is devolved to cross-functional teams. In addition, we also found that in large organisations there are many independent e-business initiatives, but with little clear evidence of any overall co-ordination.

Consequently, we are seeing poor project management and poor project validation for many e-business initiatives.

### E-Procurement a major, but not strategic, initiative

One of the main paradoxes from our analysis was to find that whilst a large number of organisations are involved with the adoption of e-procurement, less than half of those believed that procurement had a strategic function. The cost benefits of e-procurement were widely accepted, but there seemed to be limited evidence that there is a clear understanding of the nature of the mechanisms required to achieve such cost improvement. Without a clear strategic approach to procurement, limited benefits will be achieved. These benefits will be restricted to process cost reductions.

### Integration and Supplier capability a major barrier

The difficulties of integrating both internal and supplier legacy systems were seen as a major barrier to increased supply chain integration. In particular, supplier readiness and capability was felt by many to be the main constraint, particularly where the supply base consisted of a high proportion of SMEs.

### Summary of the Main findings

- The four main concerns for supply chain strategy are
  - Supply Chain Integration – 79.5%
  - Price and Cost improvement – 69.9%
  - Knowledge management – 56.6%
  - Intellectual property – 51.8%
- Customers' satisfaction and customers' strategies are key drivers for organisations' supply chain strategies.
- Price pressures are widespread, and have the effect of 'squeezing' supply chain costs.
- Responsiveness to customers is considered to be an important strategic objective.
- E-procurement offers major cost savings, yet less than 40% of those adopting it regard procurement as a strategic process.
- Only 20% of small-medium (less than £50m pa) organisations have an e-strategy, whilst 79% of large (greater than £50m pa) organisations have an e-strategy.
- The dominant approach to e-strategy is that the CEO sets out the broad criteria, and detailed implemented is by a cross function task force.
- This research found that e-business developments in the supply chain followed a five-stage evolution.
- The evolution of supply chain development and e-business is one which initially addresses customer-facing processes, followed by operations process

co-ordination and then supplier-facing controls. The fifth stage of our model is one of total supply chain transparency.

- The most significant barrier to supply chain integration was deemed to be supplier ability. Due to the diverse nature of the supply base for most organisations, the ability to employ common, integrated solutions is severely constrained. Initiatives to establish industry portals reflects the concern for supplier integration.
- A common barrier to supply chain improvement is the cost of developing system solutions and implementing business systems.
- System integration is a second key barrier to supply chain integration
- 70% of respondents employed consultants to support their supply chain and e-business initiatives.
- Cultural changes as a consequence of e-business and supply chain integration were centred on two themes.
  - Firstly the opportunities for technological skills enhancement,
  - Secondly, the threat felt in terms of increased monitoring and accountability, especially as a result of the introduction of systems such as CRM (customer relationship management).
- There was no clear consensus that e-business would reduce the number of people employed, but it was widely accepted that it would have a profound affect on administrative and finance functions.

## Background

This report presents the findings of a research project commissioned by BT to examine Supply Chain Strategies in thee-business era. The primary focus of the study was to investigate the current state of supply chain management in the public and private sectors. In addition, the use and development of the Internet and associated e-business processes was examined in the context of the future development of supply chain management.

### The Research Team

Dr Simon Croom, an expert in supply chain management and e-business, lead the research programme. His research team was Alistair Brandon-Jones, Ram Venuprasad and Samik Mustafi, of Warwick Business School.

### Warwick Business School

The University of Warwick Business School is Internationally recognised for its leading research in a wide range of areas, with over £11million invested by public and private sector organisations in support of its research agenda. In the field of e-business Warwick leads the field in terms of graduate and executive programmes, and operates co-ordinated cross functional research into a wide range of e-business. The School has recently established an e-business Leadership forum to promote the exchange of knowledge in effective e-business strategy and operation.

# Research Methodology

This research study set out to provide an independent analysis of supply chain strategy using an interview based methodology focusing on senior level managers in functional roles including supply chain, logistics, procurement, finance, and information technology/information systems.

**The research commenced in July 2000 and was conducted using a two-method research design.**

A survey instrument was tested and developed in July 2000 as a basis for a large telephone survey of supply chain activities and strategies in the UK. A total of 86 useable responses were completed by September 2000.

A second, parallel stage of the study involved visits and multiple interviews with a cross-section of managers involved in supply chain management and E-Business developments

This report presents the analysis of the completed study. This research has been aimed at identifying the key drivers in supply chain strategy, and the progress and development of e-business implementation.

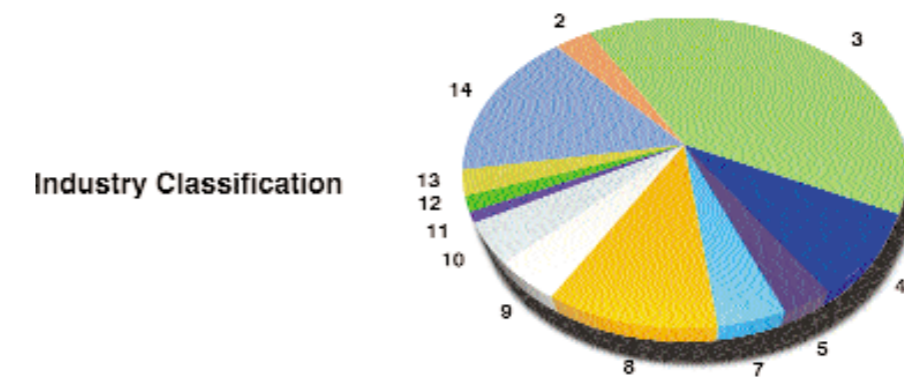
The case-based research was designed to validate the survey data and to provide a more detailed perspective of supply chain management in the UK.

*This section describes the research method employed to obtain the data and information presented in this report.*

# Overview of Survey Respondents

## Respondents Profile

86 companies were interviewed for this study. These companies spanned the entire business spectrum, and were a mix of large, medium and small business enterprises.



2-CONSTRUCTION; 3-MANUFACTURING; 4-TRANSPORTATION;  
5-UTILITIES; 7-RETAIL; 8-WHOLESALE&RETAIL TRADE;  
9-BANKING&FINANCE; 10-BUSINESS SERVICES;  
11-HEALTH CARE; 12-EDUCATION; 13-GOVERNMENT;  
14-OTHER [MAINLY TELECOMMUNICATIONS]

In terms of size of organisations that participated in this study,

- 29 participant companies had business revenues of <£250 million;
- 11 had revenues between >250million-<500 million;
- 5 companies interviewed were in the range of £500 million – <£1 billion;
- 18 in the revenue range of >£1 billion – <£ 10 billion; and
- 12 >£10 billion.
- The business revenues of 10 participant companies were either unknown or undisclosed, to maintain confidentiality.

Some of the major participants in this study included Apple Computers, AT&T, Arthur Andersen, BAA, Corus Group, Dell Computers, Ford Motor Company, Heinz, IBM, Lloyds-TSB Bank, NHS, Nestle, Pepsico, Proctor & Gamble, Sainsburys plc, Sony Corporation and Unilever.

# Supply Chain Strategy

Supply chains are the economic systems that stretch from Mother Earth to the demise of the goods or services in their final consumption or destruction. They are the conduit through which economic competition takes place.

## The Management of Supply Chains

*Competition takes place between supply chains, rather than individual organisations.*

The E-Commerce or 'E-tailing' experiences during the last year or so have highlighted how dependent organisations are upon their suppliers and distribution channels. The key objectives of making products and services available when customers demand them, at a competitive price and to the desired quality levels may seem relatively fundamental, yet we have seen time and again how poor performance in any of these respects has caused major problems for business, and yet are often beyond their control. At the heart of our understanding of supply chain management is the recognition that the ability of an organisation to exploit the skills, capabilities and resources of its suppliers, distributors and its own operations will determine its strategic and competitive success. Thus, the ability of an organisation to manage its supply chain effectively is a key strategic challenge. We believe that this is heightened by the speed at which supply chains need to operate in the 'E-World'.

The essence of supply chain management is that there should be a strong integration between the 'boundary-spanning' and the 'core' activities of an organisation. However, for many organisations supply chain management manifests itself more as an interfacing than integrating activity. It is thus important to have an appreciation of the manner in which organisations can interface their activities with those of the supply chain, and here we distinguish between boundary-spanning and core activities.

### *Boundary Spanning Supply Chain Activities*

The customer plays an important role in any organisations' strategic activity. The revenue from customers, the consequent profitability of sales, the growth of sales and market share are naturally core strategic objectives for business. It has long been recognised that customer satisfaction and customer retention has a significant impact on the profitability of an organisation. In not-for-profit sectors, customer satisfaction is an important element of performance measurement and cost-efficiency – high customer satisfaction and lower operating costs mediated by the performance of customer service delivery processes. Thus, a cornerstone of supply chain management is the management of the boundaries between the organisation and its customers.

Customer-facing activities typically involve service, support, liaison and delivery processes which are more traditionally associated with sales and marketing. Increasingly the impact of a supply chain management approach requires that these activities have a more organisation-wide focus. Typically in business-to-

*This section provides an overview of supply chain management and reports on our analysis of current strategic initiatives in the supply chain.*

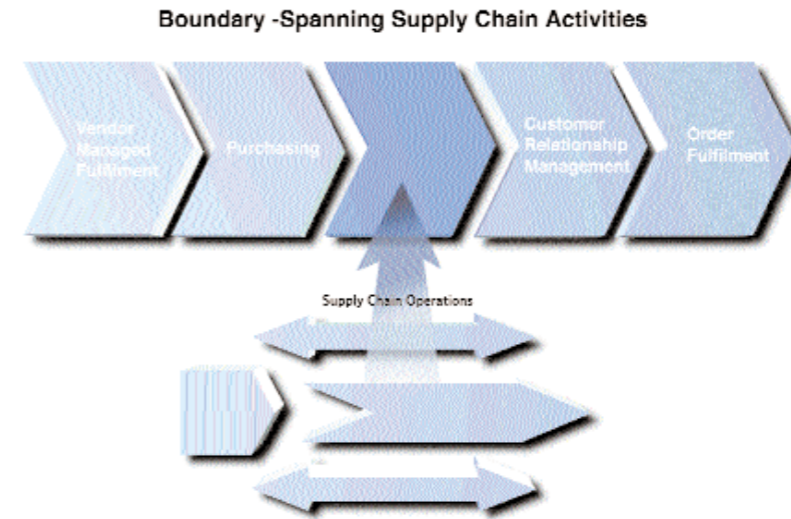
business markets customer-facing teams include representatives from operations, logistics, design and support functions as well as sales and marketing. Under the auspices of *Customer Relationship Management*, we are seeing organisations adopt new organisational structures in order to provide a clear link between the organisation's operations' capabilities and resources and the requirements of major customers or market segments.

Closely coupled to the customer-service activities of customer relationship management are the physical delivery activities aligned under the process of *order fulfilment*. The objective of the order fulfilment process is to provide the right products and services in the right place at the right time, to the right quality and at the right cost. A critical element of order fulfilment is demand and supply planning to ensure that customer orders are satisfied in a manner acceptable to the customer and cost efficient to the supplier. Increasingly we are seeing organisations working with their customers and suppliers in collaborative planning. Furthermore, the determination of exactly how, when and by what mechanisms goods and services will be distributed constitute the core decisions of an organisation's *channel strategies*. For example, direct mail order or retail distribution are two channels an organisation may take to deliver products to consumers.

Supplier-facing activities encompass the *Purchasing* of products and services from the supply market. Since upwards of 60% of the total revenue of an organisation is typically expended with suppliers, the cost and profit leverage of the procurement process is of major strategic importance. In addition to the management of current supply, we are seeing an increasing trend towards the outsourcing of activities as diverse as catering, finance, payroll, human resources, IT support and purchasing itself.

A final generic boundary-spanning supply chain activity is that of *vendor managed fulfilment*, relating to the channels employed by suppliers to deliver goods or services, often involving location of certain activities within the customer's facilities. Two common examples of this are vendor managed inventory and on-site supplier engineers.

The figure on the following page illustrates the position of the basic boundary spanning activities of supply chain management.



#### Core Supply Chain Activities

The core operations of an organisation should provide the capability to support its competitive or strategic performance. The configuration of operations processes and their alignment to the competitive needs of the marketplace are critical to the competitive success of the organisation and several studies have demonstrated the advantages gained through the application of a thorough process knowledge. (see Womack et al, 1990). We identify four core activities within the scope of supply chain management. Naturally, it would be hoped that the core operations are integrated with the boundary-spanning activities described above so that decisions taken across the supply chain complementary rather than conflict with each other.

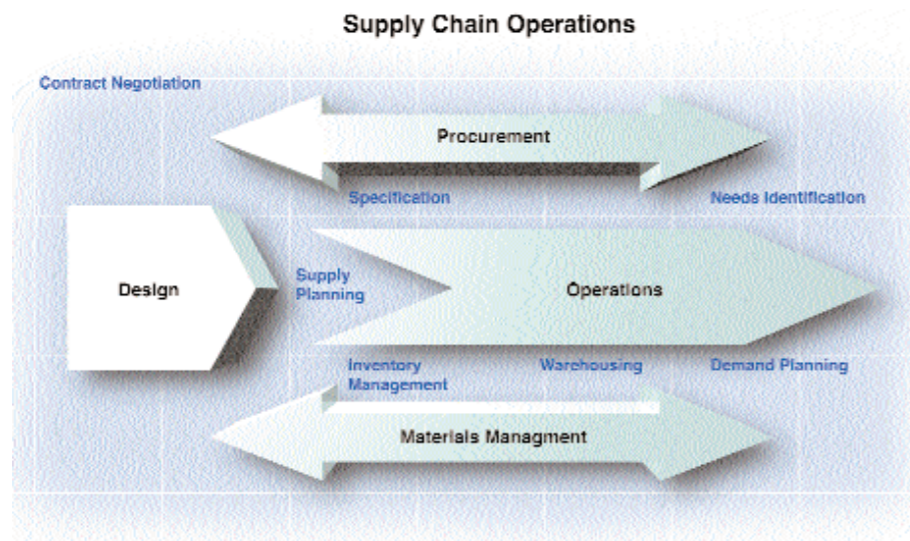
*Materials management* is concerned with the planning and control of the movement and holding of physical items. It is also concerned with the planning and control of the resources utilised in support of service delivery. Typical activities included within materials management are aggregate planning, scheduling, materials movement, inventory management, warehousing and internal transportation.

The management of the **Operations** of an organisation is concerned with the technical configuration of resources into the conversion processes employed to manufacture products or deliver services.

*Design* of products and services is an essential part of strategic development. The management of the design process is required to ensure that new goods are available to satisfy customer demands, to meet the challenge from competitors new products, or to ensure that an organisation capitalises on the opportunities presented by new technology and invention. The performance of the design process is critical to the cost effective and timely delivery of desired goods and services, and increasingly we are observing that this activity is moving beyond the organisational to the boundary-spanning domain of supply chain management. Examples of this would be the use of supplier expertise and engineering resource in new product design, and the establishment of cross-organisational project teams to deliver complex facilities.

In this research we have distinguished between purchasing, which was classified as a supplier-facing, boundary spanning activity, and *procurement* which we would define as the total process involved in the identification, specification, co-ordination and determination of an organisation's resource needs. Thus, we would classify the purchasing activity as a subset of supply chain procurement. Particularly for maintenance, repair and operating (MRO) supplies, the internal processes of procurement are typically costly and poorly co-ordinated.

The diagram below illustrates the core supply chain activities:



### Strategic Supply Chain Issues

The key concern of this study was to identify current supply chain management initiatives. We found that by far the greatest issue being addressed by the boardroom and policy makers was that of integration across the supply chain.

Supply Chain Strategy	
1. SUPPLY CHAIN MANAGEMENT & INTEGRATION	79.5%
2. PRICE PRESSURES & COST REDUCTIONS	69.9%
3. KNOWLEDGE DEVELOPMENT & LEARNING	56.6%
4. SPEED OF CHANGE IN BUSINESS	45.8%
5. GLOBALISATION OF CUSTOMERS & SUPPLIERS	41.0%
6. DEVT. OF E-PROCUREMENT PRACTICES	38.6%
7. LEAD TIME MANAGEMENT	19.3%
8. INTELLECTUAL PROPERTY & INFO. FLOW CONTROL	51.8%

In terms of *supply chain integration*, several of the issues identified could be aggregated within the general desire for closer management of the supply

chain. We feel the particular significance of this is the recognition that competitive improvement can be gained through closer attention to the management of the total supply chain – or at least active management of the major links in the chain. Organisations were often not primarily concerned with every stage in their upstream supply chain links (i.e. towards original sources of supply), considering that whilst first, second and possibly third tier suppliers may be considered critical within certain links of the supply chain, other suppliers and many other links were not so critical. For example, consider the situation where an organisation has a relatively low degree of expenditure, say on an MRO category such as entertainment. It may be considered sufficient to exercise limited control over entertainment expenditure through the deployment of procurement cards. So, whilst supply chain integration was certainly a major concern, it was recognised that there are limits to the extent to which it is necessary or desirable to integrate the links across the whole supply-side of the chain.

However, in terms of customer side (downstream) supply chain a heavy emphasis was placed on providing improved customer service through closer alignment to customer systems, processes and operations. A significant factor here was the role of large, global customers in driving increased co-ordination. This reinforces the findings of our earlier study with the Sales Research Trust (UK) in which we found that large, global customers are a key driver in customer relationship management and strategic account management.

- Major Customers play a critical and dominant role in driving supply chain integration initiatives.
- Organisations see customer and supplier-facing initiatives as the primary elements of their supply chain strategy.

*Price pressures and cost reductions* was the second major supply chain issue facing organisations. The majority of an organisation's costs are vested in the supply side of their operation (typically averaging 60% of an organisation's total revenue), and improvements in the efficiency and effectiveness of customer-facing activities are necessary to respond to mounting competitive pressure. These two forces produce what we termed a supply chain 'squeeze' on organisations. Many of our study participants saw attention to supply chain cost issues as the logical development of their on-going operations improvement initiatives. Furthermore, large customers again were significant in this through policies such as year-on-year supplier price reductions. Additionally, raising the capability of the organisation to retain customers is being recognised widely as a critical supply chain issue.

- Organisations attempt to 'squeeze' the efficiency of their supply chain in response to demands from customers for continued price reduction.
- One major 'squeeze' mechanism is to increase the emphasis placed on suppliers' costs.
- Activities designed to improve customer retention are largely recognising price pressures faced in the marketplace.

*Knowledge, intellectual property and the management of information flows* represented a surprising, yet important, element of current supply chain strategy. Knowledge in this context referred to the application by organisations of accumulated information and data for specific strategic aims. It should be clearly noted here that a major catalyst in raising the issue of knowledge and information management was the advent of distributed and shared information systems. In particular, the use of Microsoft Outlook, Lotus Notes and computer aided design tools were repeatedly cited as significant facilitators for knowledge deployment.

Knowledge management was seen as being of significance in two prime areas – customer intelligence and new product innovation. Customer (and supplier) interaction typically involved multiple touchpoints across an organisation, and the ability to co-ordinate and consolidate knowledge pertinent to specific customers was seen as absolutely critical to improved customer retention and to growing customer value. With respect to new product innovation, sharing data and knowledge across the supply chain has taken on an increased significance due to the increased involvement of suppliers in development .

- Information systems technology is a major catalyst in raising the profile of knowledge management as a key strategic supply chain issue.
- Two key focal areas for knowledge management are customer relationship management and new product innovation.

Undoubtedly the general business context in 2000 was dominated by e-business. Whilst at this stage we may still pose some questions about the hype versus the reality of e-business advantage, what is patently clear is the pressure in and from the Boardroom for change in response to the potential opportunities presented by e-business.

*The term 'Design Chain' was coined by Dr David Twigg & Professor Nigel Slack of Warwick Business School to describe design activities undertaken within the supply chain.*

- The rate of change in supply chain management will be a critical characteristic of strategy in the next twelve to twenty-four months.
- A sense of urgency is portrayed by this attention to speed of change, and perhaps a more worrying question we should pose is "are we seeing a 'more haste, less speed' approach to supply chain and e-enablement?"

The opportunities provided by *E-Procurement* have received a high profile in the business press and in terms of current leading consultancy initiatives. We shall explore this activity further in Section Seven of this report. In terms of the status of procurement in our examination of supply chain strategy, it is significant to note that less than 40% of respondents saw e-procurement as a strategic issue. Within these responses, centralising the procurement function was seen as desirable, achievable and in fact necessary for E-Procurement adoption.

- Less than 40% of respondents saw E-Procurement as a critical strategic issue.
- Centralisation of procurement was found to be a major strand of procurement-related supply chain initiatives.

A further contemporary theme in the business press and consultancy practice has been a concern for speed, specifically in terms of *lead-time reduction*. Often couched in the term 'fast flow logistics', speed of response to customer orders was considered by a fifth of our respondents to be a major strategic initiative for supply chain development. We would express some concern that organisations may be adopting inappropriate approaches to their supply chain by making an assumption that lead-time reduction is of major strategic importance for their supply chains.

- Speed of customer response represented the final, but nonetheless significant, strategic initiative expressed by a fifth of respondents.
- An important issue to be addressed is whether speed of response, or 'fast flow logistics' is an appropriate objective for all supply chains.

# E-Business

## in the Supply Chain

During the past decade, organisational theorists, business consultants, telecommunications managers and software vendors have directed our attention to the strategic role that information can play in the competitive strategy of firms (see for example, Bradley, Hausman & Nolan, 1993; Keen, 1988; Porter & Millar 1985).

From this literature the benefits to firms deploying such inter-organisational networks include:

- Increased efficiency of order processing,
- Reduced costs due to just-in-time inventory management,
- Locking in trading partners because of the difficulties competitors faced once a network is in place,
- Greater ability to customise products and services based upon information arising from the transactions carried by the network

(Cash & Konsynski, 1985; Johnson & Vitale, 1988).

With the increasing standardisation of web-based (Internet) applications and the availability of low cost public network infrastructures, interorganisational networks have not only proliferated, but have been applied in qualitatively different ways. In particular, as the barriers to participate in such electronic transactions diminish, some researchers believe that electronic marketplaces will also proliferate providing low cost, ubiquitous access to a massive catalogue of suppliers and customers.

Rather than having networks that only link existing trading partners in a tightly coupled arrangement, such electronic markets include larger numbers of buyers and sellers linked in a number of different and distinctive arrangements, of which we illustrate five more common *governance structures* in the diagram over page;

*It is clear from our study that supply chain strategy development and E-Business development are two critical elements of the strategic developments planned by organisations. This section of the report examines the influence of IT and e-business infrastructures on the way an organisation may arrange and manage the conduct of activities within its supply chains. We set out the findings of the section of our study concerned with generic E-strategy.*

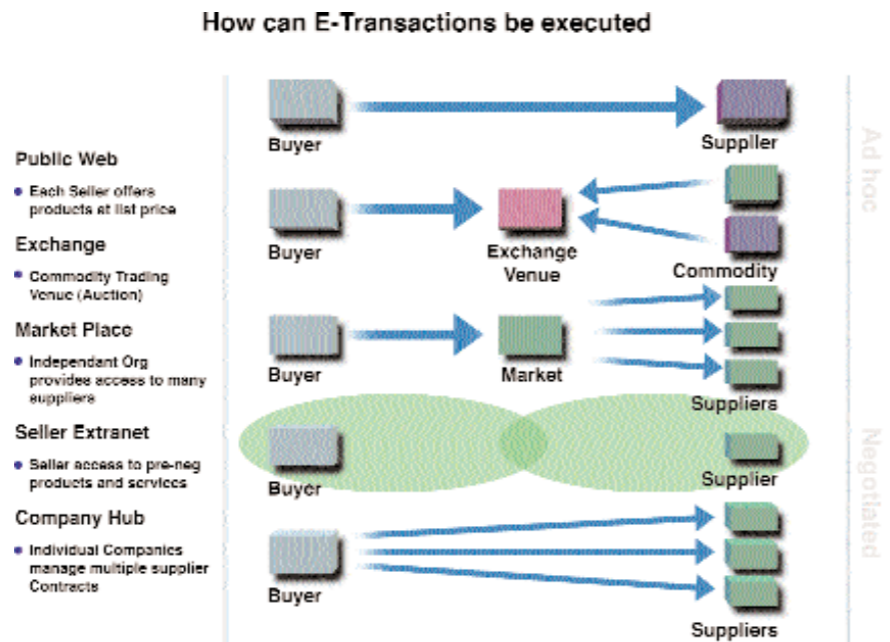


Figure 1 Arrangements fore-business relations between Buyers and Sellers

As new e-business services, consortia, and networks emerge, we will undoubtedly see organisations debating about the most appropriate form of governance structure to use. The issue as we see it will be to identify the relationship between governance structure and strategic characteristics of the trading relationship.

Holland and Lockett (1997) have noted that the literature posits that inter-organisational systems may increase the tendency towards market transactions, whilst intervening processes such as procurement strategy (notably supply base reduction) may have a converse effect of tying certain customers to particular suppliers. Thus, it is important to recognise that e-business structures will be mediated by the nature of the relationship between customers and suppliers. However, one major concern we have from our research is that little attention is being given to the impact of specific forms of governance structure on the customer-supplier relationship. We do not believe that there is a single, viable governance structure which will suit all transactions. Instead, we anticipate the use of different structures for different transactions, often using more than one route between the same customer and supplier depending on such variables as transaction value and physical location. Thus, an important strategic decision when employing e-business solutions will be to determine how customer-supplier relationships may be affected by the various governance structures they impose upon the transaction.

One of the more challenging opportunities arising from e-business initiatives at a strategic level is that of collaboration. We are seeing many organisations embarking upon collaboration across their industry through the establishment of *portals*. Two of the more widely reported examples are *Covisint* and *Transora*.

## Portal Case Examples – Covisint and Transora

### Covisint

The automotive industry portal, Covisint, has a relatively short history, having its genesis in Ford's Auto-xchange and GM's TradeXchange established in November 1999. Within three months, Daimler-Chrysler had joined with Ford and GM to announce the formation of Newco – a unified global industry exchange. In April 2000 Renault and Nissan joined Newco, which was renamed Covisint in May. By July 2000 14 major tier 1 suppliers had been invited to join the Customer Advisory Council to shape future product offerings and 40 suppliers have been offered revenue share incentive to maximise participation and value of exchange.

Covisint's function will be to unify not only procurement, but also supplier to customer logistics and knowledge management in the product development process across the global auto industry to provide a common infrastructure and increased transparency across the auto supply chain. Representing well over \$200 billion expenditure per annum, the potential co-ordination and transaction cost benefits from Covisint's operation is acting as a major catalyst in its development.

### Transora

In May 2000, 49 global FMCG majors agreed to collaborate in a joint venture to create a portal – Transora (which literally translated means "crossing boundaries"). The motive behind this move is simple – to lower procurement costs.

The global FMCG industry is a \$1.3 trillion market, and has some of the world's most recognised brands. Nearly \$900 billion [about 2/3rd of the industry's revenue] is spent annually to procure goods and services and purchasing practices in this industry are fragmented. Furthermore, the entire value chain in the FMCG industry carries an inventory of \$1 trillion. With manufacturers making purchases from over 200,000 suppliers the FMCG supply chain is characterised by inflated procurement costs; a direct consequence of inconsistent & incomplete information, and thus inefficient procurement processes.

Besides being the first of its kind owned by the FMCG industry, Transora will have services spanning the entire supply chain – from suppliers to manufacturers to retailers, and provide procurement, vendor and product catalogues, online order management, supply chain collaboration and financial services. Transora currently partners, buys and leases existing technology. As the company grows, proprietary technology will be developed to sustain growth and improve functionality.

Transora is expected to be operational in the last quarter of 2000. By 2001, the company also aims to provide other strategic services like collaborative planning, forecasting and replenishment between manufacturers and retailers.

The prospect for the development of electronic markets and electronic hierarchies poses some important questions about the impact of the Internet on the buyer-seller relationships across supply chains. Here we briefly discuss the key impact of the Internet and E-Business on the operation and economics of supply chain management.

## Implications for Market Transactions of Electronic Commerce

### 1. Cost of coordination

Most economists believe that what is not for the costs of coordination markets would generally be more efficient mechanisms for production than hierarchies. These costs of coordination relate to the planning, control, management and administration of economic activity. It is held that purchasing goods and services on the open market raise the costs of coordination through the additional search costs in identifying appropriate suppliers, costs of specifying and enforcing contracts, and the administration of the financial settlement (Williamson, 1975). For example, customers can have difficulty specifying what they want and searching through the many alternatives to find the best suppliers and best wares, and suppliers incur costs in advertising the availability of their goods and services to potential customers (Malone et al, 1987).

Malone and colleagues (1987) hypothesise that increased use of electronic methods for searching and sourcing will reduce such coordination costs and, ceteris paribus, will increase the proportion of economic activity coordinated by markets. (p. 489). In other words, lowered coordination costs would encourage more out-sourcing, enabling firms to buy goods and services less expensively than to produce them in-house (Malone, 1987; Malone et al., 1987; Malone et al., 1989). To the extent that the cost of communication and information processing are reduced, the cost disadvantage of out-sourcing a production process is also reduced.

### 2. Increased propensity to outsource

Outsourcing is a term referring to the recourse to market transaction for products, services and processes formerly undertaken internally. Trends in the UK and USA indicate that the incidence of outsourcing is increasing (Croom, 1998).

Business activity	Outsourced by 1991	Outsourced by 1996	Will have outsourced by 2001
Property services	13	42	46
Application development	5	29	41
IT technical support	4	21	34
Legal services	7	19	27
Distribution/support	9	21	24
Infrastructure maintenance	4	10	14
Manufacture/ assembly	6	9	12

Trends in outsourcing; (Croom, 1998 – from PA Consulting Group)

In addition, existing evidence at the industry level indicates that that increases in investment in information technology are associated with a decline in average firm size and rise in the number of firms. Kambil (1991) also shows that industries investing more of their capital stock in information technology also contract out more of the value of the goods and services they produced to external suppliers (i.e., a higher buy/make ratio in production), but with a two-year lag from the time of investment. As investment in information channels increases, it is therefore anticipated that firms will increase their level of outsourcing.

### 3. Market or Hierarchy?

In short, the literature tends to indicate that the form of governance structure employed will be determined by *appropriateness* to the characteristics of the exchange.

Malone and his colleagues (1987) predicted that in the steady state, greater use of interorganisational networks would lead to more market-like relationships among firms. Unfortunately, much of the empirical evidence reviewed so far does not support this expectation. Most research on interorganisational networks has used case studies of specific private network-based systems to examine the conditions under which firms' use external data networks and the strategic advantages they seek to achieve.

A multi-organisation study by Brousseau (1990) reviewed 26 inter-organisational networks, finding that most were used to reduce production or distribution costs and served to reinforce already existing hierarchical relationships among firms. Only in two--the petroleum business and textiles--was the use of inter-organisational networks associated with buyers gaining advantage by having more suppliers from which to choose.

Taken collectively, much of the previous case study research illustrates that interfirm networks are often used to support *electronic hierarchies*, rather than electronic marketplaces.

Thus, where data networks are proprietary and fragmented, (as was the case before the growth of the Internet), electronic hierarchies are more common than electronic marketplaces. This further suggests that when public and ubiquitous data networks are available, the same constraints on connecting low volume trading partners, or potential partners for whom anticipated volume is uncertain, does **not** exist. Under such conditions, electronic marketplaces, where more fleeting trading relationships can economically be supported by network-based transactions, could be more likely but economic rationality would lead firms to adopt closed network operation. Open markets are likely to exist for low value and low risk purchases, and for search and tendering processes.

Applying 'e' factors to business is not a magical solution for an organisation. As Michael Dell, founder of Dell Computer, said: "If you take a business that's a bad business and put it online, it's still a bad business – it's just become an online bad business." The existence of strategic approach to E-business is one we would encourage, and in fact insist, in order to ensure that whatever form of E-business organisation and operation is adopted, it supports and develops organisational

capability. A guiding doctrine here is ...**"if you can't support the business case for your e-strategy, then think again"**

**E-Strategy**

A total of two third's of all of the respondents had a strategy fore-business, but when we analysed the data further, the size of organisation was found to be a major determinant in E-strategy development. There is a clear divide in terms of E-Strategy between organisations with less than £50million turnover pa and those with more than £50million turnover pa.

*Does your organisation have a clearly written or expressed E-Strategy?:*

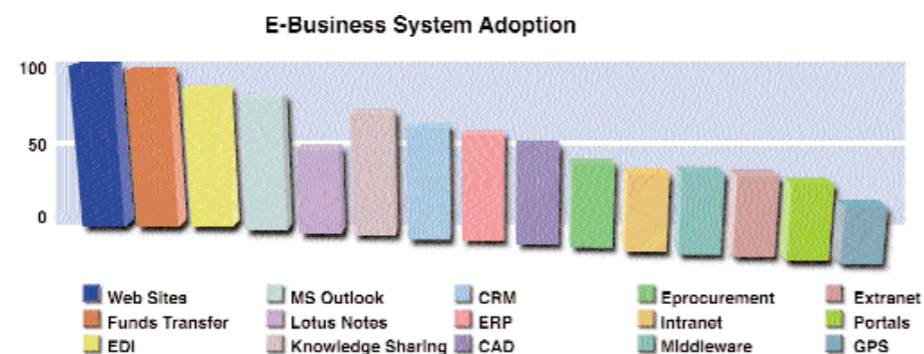
	Yes	No
Less Than £50m. pa	20%	80%
More Than £50m pa.	79%	21%

In terms of the organisational champion for E-Strategy, in over half the E-Strategy group the CEO was the main proponent, followed by CIO or IT Director. Typically, CEOs were making statements such as "we must become an e-business". Problematically we could not identify any consensus of what an e-business was, other than one which was active in all fields of Internet-supported business processes. Consequently, an understanding of the e-strategy implementation process will help to illustrate the nature of supply chain strategy and e-business strategy in UK organisations.

**Key E-Infrastructures**

IT plays a critical facilitating role in the deployment of e-business. Indeed, we would even claim that the choice and implementation of E-Infrastructure would have a profound impact on the supply chain processes to which they are applied. Thus, in evaluating supply chain strategy we were interested in what infrastructure was under evaluation or in use as this will provide a strong indication of the progress of supply chain improvement.

Respondents were invited to identify the specific business Systems currently in place (including pilot adoption) in order to clarify the infrastructure developments in progress. The chart below provides a profile of current penetration of E-Infrastructures.



In the context of current supply chain practices conducted electronically, it is not surprising that funds transfer and EDI dominate the list. All major banks provide support for electronic funds transfer via the BACS system and this provides a secure, low cost means of payment. EDI (electronic data interchange) on the other hand is relatively costly except for high volume communications between common trading hierarchies. The advantages of EDI include integration and presentation of data in a common format. Thus, we found EDI in common use for the exchange of data between frequently trading partners, such as retailers and their major suppliers, manufacturers and their major suppliers. Often, EDI is deployed for the management of major transformed resource supply chains, i.e. for components and materials in manufacturing, or saleable products in retailing. The cost per unit is then relatively low, the benefits of high speed transmission and the sunk cost of investment are all factors which are seen as likely to sustain EDI, or at least integrate it into an Internet-EDI structure for the management of specific high frequency exchange supply chains.

In terms of knowledge management, a major strategic supply chain issue as we saw earlier, nearly two-thirds of respondents were employing knowledge sharing systems, which included Microsoft Outlook (The preferred platform for nearly 70% of our survey), Lotus Notes and certain more specialist systems. Using an existing, and to some degree ubiquitous, package such as Outlook within organisations was enabling greater communication and coordination in areas of innovation, product development, customer strategies, sourcing, specifying and supply management, and training and development co-ordination.

CRM (customer relationship management) and ERP (Enterprise Resource Planning) systems were in use in over half of the respondents, highlighting the emphasis being placed in supply chain strategy on customer-facing and operations control. Less than 40% of respondents were currently deploying e-procurement, indicating a phasing, or lag, in supply chain e-business evolution between customer-facing and supplier-facing processes.

The use of 'middleware' recognises the challenge of integrating e-solutions with legacy systems, and thus 37.3% of respondents were addressing system integration challenges.

Our study of transport and logistics systems identified only just over one fifth of respondents deploying or exploiting any form of order tracking or vehicle tracking system.

**E-Strategy Development Process**

Typically organisations are establishing cross functional e-business development teams to drive forward the planning of their e-business implementation, with over seventy percent of respondents stating that they are using consultants to support the implementation of various e-business initiatives. The broad scope of e-business strategy naturally demands a cross-functional approach, and amongst the larger corporations studied, involvement of suppliers and partners was a common element of e-strategy implementation.

### An Analysis of Supply Chain Strategies by Sector

In this section, a brief overview of supply chain strategies and initiatives is provided relating to the five main industry sectors analyzed.

#### Construction

- This study included only three respondents from the construction sector.
- Little evidence of e-business initiatives being undertaken by these respondents.
- The key supply chain concerns related to speed of change in relationships and capabilities

#### Manufacturing

- Thirty-four respondents were from the manufacturing sector.
- The following table sets out the key supply chain and e-business issues for manufacturing organisations:

Strategic Supply Chain Issue	Percentage
Price and Cost pressures	100
Supply Chain Integration	82
Knowledge Management	58
IPR (Intellectual Property Rights)	55
Globalisation	45
Intranet & Extranet developments	45
E-Procurement development	45
CRM	33
Lead-time Reduction	30
Procurement Strategy	25

- The following table summarises manufacturing sector e-business strategies and developments:

E-Business Activity	Percentage
Planning and Control	91
Design	79
Selling and CRM	64
Knowledge Management	55
Supplier Payments	50
Payments from Customers	47
Procurement	47
Exchanges, Marketplaces & 'Portals'	35

#### Transportation

- Seven respondents were from the transportation sector.
- The following table sets out the key supply chain issues for transport organisations:

Strategic Supply Chain Issue	Percentage
Price and Cost Pressures	100
Supply Chain Integration	86
Globalisation	71
Procurement Strategies	57
Knowledge Management and IPR	43
Speed of Change	29
Lead Time Reduction	14

#### Utilities

- Three utility organisations were included in the study.
- The key supply chain issues being addressed by these organisations were in order of importance:
  - Price and cost pressures
  - E-Procurement
  - Knowledge management
  - Customer relationships management

#### Wholesale and Retail Trade

- Thirteen respondents were from the wholesale and retail sector.
- The key supply chain management concerns for organisations in this sector are:

Strategic Supply Chain Issue	Percentage
Price and Cost Pressures	77
Supply Chain Integration	77
Globalisation	62
Procurement	46
Knowledge Management	46

- The dominant e-business strategies were centred on customer and supplier payments and e-procurement.

**Banking & Finance**

- Four respondent organisations were from the banking and finance sector.
- Key supply chain issues for these organisations were:
- Supply chain integration
- Knowledge management

The key e-business activity with which these organisations were involved was electronic procurement.

**Evolution towards integrated supply chain management**

The scale and complexity of achieving an integrated supply chain – or a ‘glass pipeline’ to use the terminology of one of our respondents – is evidenced by the lack of any clear best practice supply chain examples. There are a few specific illustrations of industry-specific chains in which a high degree of co-operation and coordination has been evidenced – notably in the steel and automotive sectors in the UK – but our studies have found little evidence of truly integrated supply chains. What we have been able to identify, however, is a generic ‘route map’ towards integration based on the development of e-solutions for supply chain management. Illustrated below is our five-phase evolutionary model of supply chain process integration:

**E-Business in the Supply Chain - Five Phases of Evolution**



<b>Focus</b>	B2C	B2B	Hi engineering Process	B2X	Transparency
<b>Systems</b>	E-mail, Web, EDI	CRM	ERP, Knowledge Management	E-Procurement	E-Fulfillment
<b>Processes</b>	Sales, Order-taking, Payments	Account Management	Operations Planning and Control	Supply Base Management	Total Logistics, Supply Chain Positioning
<b>Strategies</b>	Sales Growth	Key Customer Management	Operations Improvement	Procurement	Supply Chain

Each of the five stages is distinctive in focus, purpose and resource requirements. In the following table we provide an insight into the key characteristics of each of the five stages. Naturally, organisations may demonstrate evidence of activity in more than one stage, and will often be undertaking a variety of initiatives in each or most of these stages. However, this model sets out the general sequence of progress to be found in various core activities of supply chain management.

	<b>STAGE ONE</b>	<b>STAGE TWO</b>	<b>STAGE THREE</b>	<b>STAGE FOUR</b>	<b>STAGE FIVE</b>
<b>Objective</b>	Improving ease of access to customers	Segmenting customers according to their strategic importance	Operations coordination, planning and control.	Supply management	Efficient materials management
<b>Key Enabling Resource</b>	Channel technology	Customer Intelligence	Process data	Procurement procedures	Logistics co-ordination
<b>Typical Information Systems</b>	Web Site, payment and e-mail	Customer Relationship Management	Enterprise resource planning (ERP). Knowledge networks	Supply & supplier database catalogue. Intranet	Order tracking. Global positioning. Scanning & barcoding
<b>Operational Focus</b>	Customer access	Appropriate customisation	Process efficiency	Total external expenditure control	Systems transparency and integration
<b>Primary strategic challenge</b>	Credit control	Customer portfolio	Operations Cost	Total cost of acquisition	Availability

As an indication of the level of integration currently observed within UK supply chains, we identified the level of activity currently taking place at each of the five stages. To do this, we have analysed the focus of e-business Activity, i.e. the areas of E-Infrastructure currently under management and project evaluation. We specifically wanted to know what management initiatives had been undertaken during year 2000 (in order to allow for Y2K issues), and discovered that efforts in the adoption, utilisation or development of email followed by web site initiatives, dominated our study respondents activities, as indicated by the table below:

<b>E-Business Activity During 2000</b>	<b>YES</b>	<b>NO</b>
1. E-MAIL	85.9%	10.6%
2. WEBSITES	83.5%	7.1%
3. INTRANET	38.8%	57.6%
4. EXTRANET	36.5%	60%
5. E-PROCUREMENT	43.5%	54.1%
6. CRM	29.4%	67.1%

*Where are UK organisations in terms of Progress towards Supply Chain Integration?*

In order to identify the current level of supply chain integration of UK organisations we employed our five-stage evolution model as a basis for analysis. By including both the level of activity in e-business systems initiatives and the main supply chain initiatives being considered or employed, we were able to identify the total incidence of activity relating to each of the five stages. We further identified evidence relating to ‘advanced’ activity – which in this model we take to imply partial or complete use of the systems and strategies evidenced in each of the five stages. Not surprisingly, implementation in support of stages three, four and five are less advanced than stages one and two.

	STAGE ONE	STAGE TWO	STAGE THREE	STAGE FOUR	STAGE FIVE
<b>Total Incidence</b>	84.7%	56.5%	50.5%	41.1%	36.9%
<b>Advanced Implementation</b>	84%	54%	37%	29%	12%

- The dominant focus of ‘E-Supply Chain’ Strategy is at present centred on the transitions between phases 3-4, focusing on re-engineering operations and improved procurement.
- This should not be taken to infer that organisations are exemplars in any of the processes within stages 1 to 5.
- The progression of Supply Chain strategy follows a path which can be described as shifting the strategic emphasis from **customer** to **operations** to **suppliers** to **total chain logistics**.

# E-Procurement

Typically, organisations spend between 50%-70% of their revenue on purchased goods and services. We are also seeing an increasing tendency towards outsourcing non-core activities, which will further increase the scale of procurement expenditure.

In our previous research (Croom, 2000, 1999 & 1998) we explored the impact of E-Procurement upon the management of MRO (maintenance, repair and operating) supplies. The main conclusions from our previous research are:

- E-Procurement process costs are approximately one third the cost of traditional MRO procurement costs.
- E-Procurement provides greater visibility of the procurement process.
- E-Procurement provides improved management information for purchasing decision-making.
- An increase in procurement capability as a direct consequence of E-Procurement adoption will be supported by an increase in the level of outsourcing.
- E-Procurement will impact upon the structure of supply chains through supply base reduction and the requirement that all suppliers are E-enabled.

From the current research we found that policy makers are well aware of the opportunities provided by E-procurement, with over 90% of respondents stating that E-Procurement was a key area of activity. However, as we saw earlier, only 40% of respondents consider procurement to be a strategic issue in their supply chain management. The significance of this is the impact on the status of the procurement function, and the implication for strategic purchasing. E-procurement certainly offers the potential for significant efficiency gains, but not without attention to the role and development of purchasing as a core capability of the organisation. By removing the administrative burden of order placing and providing improved management information, e-procurement provides a powerful platform from which to exploit the organisation’s strategic leverage and undertake major total supply chain cost improvements.

It is our belief that without a strategic capability in procurement, organisations are unlikely to gain any significant benefit from e-procurement in the long term.

*Benefits of E-Procurement Adoption*

Given the intense publicity surrounding the impact of e-procurement, our findings reflected much of the focus of recent management writing and system vendors’ publicity. The four main benefits of E-procurement identified by our respondents were:

- 58.8% respondents believed that whilst the main benefits to be gained from adoption of E-Procurement would be financial, it was not generally believed that the financial benefits of e-procurement would meet the widely 'hyped' benefits promoted in the press.
- 45.9% believed that improved information flow was an important benefit of E-Procurement adoption.
- 41.2% answered that E-Procurement adoption would lead to better internal and external communications.
- 40% saw improvements in planning as a benefit from adopting E-Procurement.

A major concern here is the apparent lack of clear strategic awareness of the implication and benefits of e-procurement. It is certainly clear that procurement is viewed as an administrative process in the majority of our respondent organisations, the exception being organisations over £1 billion turnover. Large organisations typically invest greater resource into their purchasing and procurement function – for such organisations procurement is of major strategic importance. This was underlined in our study by the planned increase in the level of outsourcing by 56.5% of our respondents as a direct consequence of e-procurement adoption.

#### Barriers to E-Procurement Adoption

Naturally there are many barriers to the adoption and implementation of e-procurement, significant amongst these being cost and system integration. These barriers serve to restrain the adoption of e-procurement, and in some cases act as significant barriers in the process for implementation e-procurement.

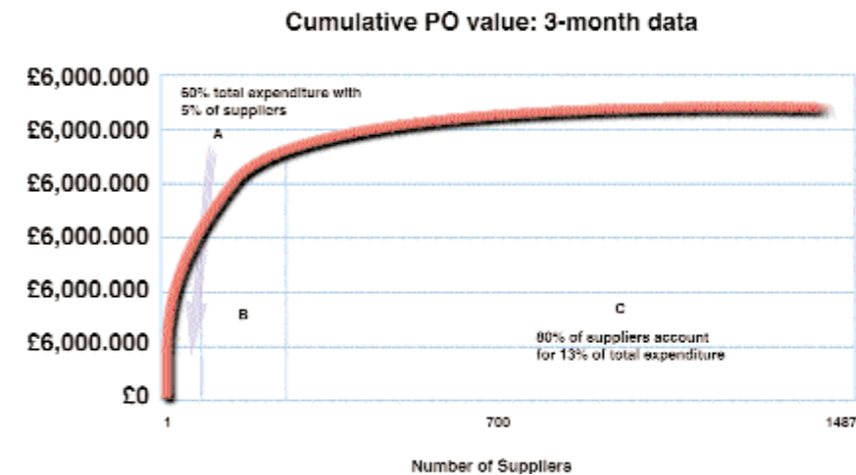
- 49.4% considered Development Costs to be the major barrier to adoption of E-Procurement;
- 35.3% believed System Integration to be a barrier, while 27.1% believed otherwise. Most of those that considered this to be a barrier were Small and Medium Sized Business Enterprises, while the Larger ones believed the contrary;
- 34.1% said that Culture was a barrier to E-Procurement adoption, but 28.2% said otherwise. Again the trend of answers were similar to the above;
- With respect to Development Time, 22.4% of the survey believed this was a major E-Procurement adoption barrier whilst 38.8% disagreed, and did not see development time as a barrier.
- Only 16.5% believed that Security Issues were a concern for E-Procurement adoption. (44.7% actually believed the contrary).

#### Procurement Case Example – University of Warwick Procurement.

The University of Warwick represents a typical service-sector example for an illustration of the nature of procurement in a medium to large organisation.

Universities, as with many other sectors of the economy, are facing market pressures that have a direct implication for their cost effectiveness. With approximately 50% of the University's income spent with suppliers of goods and services, procurement has the potential to make a major contribution to the financial performance of the organisation.

Whilst a small, centralised purchasing department has responsibility for a range of common University requirements, many academic departments and functional areas of the University undertake their own procurement. The largest departments in terms of expenditure are the University conference and hospitality departments, Information Technology Services, Department of Engineering and the Business School. Each of these departments employs staff to co-ordinate various aspects of their purchasing.

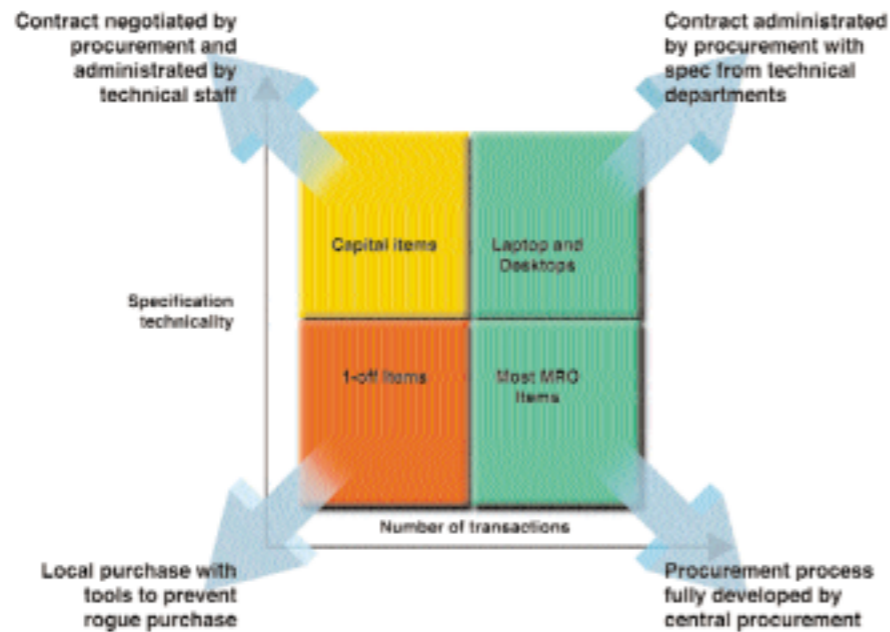


Again, as with many other organisations, there is a clear Pareto distribution of expenditure, in which 60% of all expenditure is with just 5% of the University's total supply base. The figure above shows their profile of expenditure.

Use of Pareto (or ABC) analysis in the majority of organisations will demonstrate a very similar distribution.

In providing an analysis of the range of products and services purchased by the University, it was possible to classify different categories according to their degree of technical complexity and the volume of transactions. Such a classification is important in any context as it provides a useful platform for determining the organisational approach to the four categories of expenditure.

Strategic analysis of an organisation's purchasing requires clear identification of the characteristics and contribution of their resource expenditure, from which the appropriate form of procurement is developed. We have identified four different procurement processes to be utilised by the University, emphasising the different requirements placed on the organisation as a consequence of scale and complexity.



# Fulfilment

## Discussion

Fulfilment remains one of the more problematic areas of supply chain management. The ability to provide goods or services in the right quantity, to the right place and at the right time is a particularly challenging task for the supply chain.

Typically, the scope of fulfilment strategies available to organisations ranges from direct shipment to cross docking.

The table below provides a broad overview of three generic forms of fulfilment:

	<b>Direct Shipment</b>	<b>Warehousing</b>	<b>Cross Docking</b>
<b>Inventory Management</b>	By Manufacturer	At Warehouse(s)	At Suppliers
<b>Order Picking</b>	From finished goods	From store location	From multiple suppliers locations
<b>Transport network</b>	Deliver direct to customer from production. Possible transshipment between plants.	Goods held in store, supplied via warehouse picking. Possible transshipment between warehouses	From Suppliers, throughwarehouses (for 'cross docking') to customer. Little transshipment.
<b>Key benefits</b>	No warehouse costs	Minimises inventory stockout risk	No holding costs

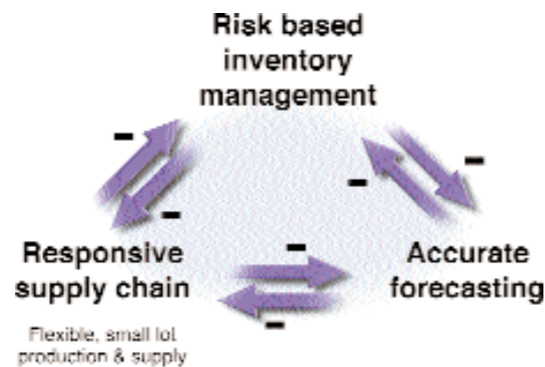
A critical determinant of the form of fulfilment strategy adopted is the profile of demand from customers. Marshall Fisher's paper 'What is the right supply chain for your product?' from 1997 Harvard Business Review sets out a simple framework for the design of the supply chain, illustrating the significance of fulfilment at a more strategic design level.

He contends that there are two generic forms to the supply chain – functional or responsive. The functional chain exists to minimise costs, whilst the responsive chain exists to provide high levels of customer service in the face of variable demand.

	<b>Functional Products (e.g. continuity products)</b>	<b>Innovative Products (e.g. Seasonal or promotional products)</b>
<b>Efficient Supply Chain</b>	High revenue and earnings performance through low cost operation	Poor revenue through high cost and low availability
<b>Responsive Supply Chain</b>	Low earnings through high costs and excess capacity	High revenue and sales growth resulting from high availability

Expanding on Fisher's framework, the work of Abernathy et al (2000) underlines the importance of clear identification of the demand profile on a product-by-product basis (or service-by service). They contend that the choice of fulfilment policy has a profound effect on the profitability of an operation. They highlight the trade-off often inherent in a single fulfilment policy between customer service level (i.e. percentage of orders fulfilled on-time) and inventory costs. In particular, where a supply chain handles high volume and low volume products, there is often either a high inventory cost for low volume products, or conversely a low customer service performance for high volume items. Their recommendation is to classify products and/or services according to the volume and variability of demand (see also Slack et al 2001). In order to successfully align the supply chain to customer market demand, it is clear that there is a need for effective forecasting, and we see the use of collaborative forecasting, planning and replenishment (CPFR) across-business platforms as a significant attempt to reconcile different demand profiles with different supply chain structures.

In an attempt to consolidate the issue of fulfilment, we would focus on the trade-off between forecasting accuracy, inventory exposure and supply chain configuration.



In the diagram above, the negative signs indicate the impact of an improvement in one area of fulfilment activity upon the corresponding fulfilment activities. For example, an improvement in forecast accuracy will reduce the need for a risk-based inventory strategy. In this illustration, a risk based inventory strategy refers to the implications of the risk of stock-out – so more accurate forecasting reduces the risk of stock-out *when demand exists* for an item. (The italicised point is critical – a stock out is only important if there is unsatisfied customer demand as a consequence). Likewise, the adoption of a responsive supply chain configuration reduces the need for accurate forecasting and also reduces the risk of stock outs.

We believe from our experience of supply chain management that this simple three-way trade-off is ignored by most organisations, with the consequences of both high fulfilment costs and poor customer service.

Thirty six percent of the respondents were undertaking development to their fulfilment processes, all of who responded that they were intending to deploy

an 'E-Fulfilment' approach. Of those respondents undertaking fulfilment developments, exactly half had completed the implementation of e-enabling their transport management and warehousing. Amongst the technologies being deployed, global positioning and order tracking systems were the dominant technologies associated with e-fulfilment. It is significant that the majority of organisations who have even espoused a fulfilment strategy are large (i.e. greater than £50m pa). The table below indicates quite clearly the divergence between large and small companies in terms of their development of a fulfilment strategy.

	<b>Current Fulfilment Strategy</b>	<b>No Fulfilment Strategy</b>
<b>Total Sample</b>	<b>36.1%</b>	<b>61.4%</b>
Less than £50m pa	5.6%	94.4%
Greater than £50m pa	46%	54%

A number of benefits and barriers to the adoption and implementation of a fulfilment strategy were identified. These are outlined in the table below.

<b>Benefits of Fulfilment Strategy</b>	<b>Barriers to Fulfilment Strategy</b>
36.5% improved Information Flow	38.8% Development Costs
34.1% Financial Benefits	31.8% Systems Integration
30.6% Customer Satisfaction	20% Culture
29.4% Improved Communications	11.8% Development Time
25.9% Better Understanding of the Market & Customer	7.1% Security Concerns

#### **Fulfilment Case Example – i-Force**

i-Force provides fulfilment solutions to industry, and has established a reputation for world class fulfilment operations. It is widely recognised that many supply chains suffer from poor availability and high process and logistics costs. To this end effective fulfilment is a critical operational capability for which many organisations are now turning to third party providers. Indeed, in our study only 29% of respondents used any of their own transport for supplying customers or collecting from suppliers. In addition, all of those organisations using their own transport also relied on supplier and third party transport for a significant proportion of their logistics movements.

One of the main challenges in the fulfilment process is to be able to provide a portfolio of services – many current third party providers are clearly focused on specific segments of the distribution process. Criteria such as size, weight, value and distance are often used to distinguish between fulfilment strategies, yet as we discussed above, demand variation is often neglected in planning the fulfilment strategy resulting in mis-matching of supply chains to market. iForce recognise the need to understand the total demand profile and the physical characteristics of products in developing a total fulfilment solution.

iForce also provide their customers with data 'e' services through a proprietary, fully wired software suite: 'SMaRT'. iForce sell their business as providers of excellent customer service solutions. The standard solution comprises three legs. One leg is their contact centre skills that help clients develop an integrated relationship, through the web, phone and mail, with customers. The next leg is the fulfilment operation offered, which provides clients with bespoke delivery of physical products, and the last leg is the data base skills which help clients understand their consumers better. iForce has developed their business from the bottom up around systems and data, hence they are in a better position to deliver the above than a standard third party logistics provider.

By matching their own proprietary logistics software and fulfilment systems i-Force concentrate upon the critical characteristics of customer requirements and supply chain process in order to design the logistics structures and software control systems to serve the needs of their partners.

In many ways, the emergence and success of companies such as iForce underline the criticality of fulfilment as a supply chain capability. Yet, we have found throughout our research that even 'world class' manufacturers are facing significant supply chain co-ordination and integration problems which require efficient and effective fulfilment solutions. Problems of matching supply to demand are fundamental to the success of supply chain, and even more so in an era of e-business where rapid transmission of order from user to supplier may need to be matched with next day delivery.

# Customer Relationship Management

Many organisations will have a few customers who account for a large proportion of their revenue, and may also have customers who represent a significant opportunity for future growth and development. Such customers we describe as strategic or key accounts, and they require different marketing and supply chain responses than other, smaller customers. The process of strategic account management is a company-wide process, requiring dedicated sales and support staff to develop the customer relationship, as well as clear identification throughout the operations of the company and its suppliers. Priority and bespoke services are developed for strategic accounts, whilst at the same time a considerable amount of effort is expending internally in the communication and promotion of the strategic account process. Thus, we would expect to see major organisational adaptations wherever companies are adopting higher levels of customer relationship management (Croom et al, 2000). We found that the main initiatives supporting improved strategic account management within supply chain activities were the adoption of CRM systems such as Siebel, order tracking systems and knowledge systems.

As we saw previously, customer-facing initiatives are amongst the first phase of evolution of e-business in the supply chain. A significant increase in the use of Customer Relationship Management (CRM) systems was identified, with 48% of our respondents adopting some version of a CRM system. In addition, the main rationale for a number of other e-business initiatives was the perceived impact on customer service and profitability. Most notably, 62.5% of respondents cited improved customer service as the main benefit they expected to gain from their e-fulfilment initiatives.

This study found that the drive for improved customer relationship management arose from several directions, principally global customers and the organisation's desire to improve customer retention. Significantly, customer and brand-related issues were cited as the main driver for e-business initiatives by 64.4% of respondents.

Amongst the important initiatives in place, 77% have introduced customer call centres, whilst 56.6% of all respondents currently employ CRM software.

## **CRM Case Example: Global Precision Inc.**

Global Precision Inc. (GPI) is a global manufacturer of engineering products serving a number of high precision sectors. In Europe they have eight customers who account for 74% of their revenue, and 82% of their profit. Currently GPI are in the first pilot stages of a CRM system implementation, the focus of the pilot

*(the name of the company has been disguised due to the commercially sensitive nature of the case example)*

being on the development of the system and the associated hardware required to support organisation-wide intranet access. Ten months into the pilot the project has received full board approval for implementation. Initially, the main investment of the CRM project will be staff training and development. This will take two forms. The first is specifically for training in the use of the system. However, GPI recognise that they need to make a significant investment in the development of the organisation's strategic account management capabilities. To this end a series of internal workshops and executive development programmes have been commissioned to provide the support for the effective deployment of the CRM system. Furthermore, the active involvement of each of the eight strategic accounts has been solicited in the development of their strategic account plans.

For GPI their implementation of the CRM system represents one aspect of their strategic account management process. They recognise that the CRM system alone will not deliver the improvements in customer service and account profitability, but will be a major facilitator in an organisation-wide strategic change process towards effective strategic account management. However, one of the early benefits they have gained has been to focus the organisation on the nature and significance of customer relationships, even for the smaller customers. The issue they now face is one of designing and managing appropriate relationships with their customers. As their European Vice-President stated recently... "...The customer intelligence we can now bring to one place means we can take conscious decisions about the relationships we have with customers. For us the challenge is making just the right amount of investment in time and effort for each relationship"

## Organisational and Cultural Challenges in Supply Chain Strategy

By far the greatest barrier for organisations supply chain strategy development and implementation was found to be supplier ability. Partially this is an issue of perceptions, as many business customers were expecting their suppliers to take the lead in customer-dictated initiatives. Given that many organisations are addressing customer-facing supply chain improvement through improved communication, customer relationship management and web-based ordering, it seems on the face of it to be paradoxical that suppliers are seen as a major barrier to integration across the supply chain. We found very little tangible evidence of the real barriers, except in one important area – systems integration. As illustrated by the active participation of suppliers in industry portals such as Covisint, suppliers face several customers each of whom may have different and incompatible systems. In many of our study organisations the desire to establish an on-line sales presence was confounded by the potential for major customers to dictate adoption of proprietary sales-order/e-procurement interfacing. This is not a new situation, in fact the challenges faced by EDI (electronic data interchange) users was one of common protocols as well as high fixed costs. The Internet may be a ubiquitous platform, but the systems enabling e-business are expensive and are not clearly integrated across the supply chain.

We contend, therefore, that the major cultural and organisational challenges are those presented by integration and collaboration. In particular, the vexing problem of intellectual property and commercial confidentiality. We can only watch and see how the many collaborative portals develop between sworn competitors.

In exploring cultural challenges within the organisation, we found that the development of open systems such as CRM (customer relationship management) tools was viewed with considerable suspicion by sales people – almost a 'big brother' mentality. Typically sales people have retained a vast amount of information relating to their accounts and have not been required to document and share this. CRM systems, however, impose greater accountability by sales people for their activities.

One of the main benefits of E-procurement is claimed to be reduced transaction costs, which as most of our respondents noted, will manifest itself in terms of reduced staffing overhead. Job losses in processing activities is seen as inevitable, although the challenge of new systems and new processes implies a greater need for systems and process expertise, as well as professional capabilities in order to capitalise on improved information and the rapidly supply chain terrain.

Many respondents had observed that e-strategy and e-infrastructure changes were serving as a catalyst for many individuals to embrace technological training and to see such developments as a personal career opportunity. In addition, the view that technology drives cultural change was a constant refrain from respondents. Naturally, it is very difficult to draw any valid conclusions from survey methods of any cultural shift, but it is useful to recognise that the perception of cultural shift was significant.

We could not identify any clear consensus regarding the impact of supply chain integration upon organisational staffing levels. However, there was widespread agreement that administrative activities and finance process would be automated, resulting in headcount reduction in associated areas. For some, notably public sector organisations, the issue of redundancy was a contentious and sensitive issue.

# Case Studies in Supply Chain Management

## *Case 1: FORD's thrust on E-Commerce and Internet*

Ford Motor Company (FMC) is one of the world's largest automobile manufacturers, which has operations spread across the globe and revenue more than US\$160 billion.

In its quest to be a web-enabled global enterprise, FMC has planned a major thrust on e-commerce and the Internet. FMC has set itself a very clear and focused view on the Internet. In order to help achieve its goals, the company set up Ford ConsumerConnect (FCC) in October 1999. Mr. James C. Gouin, chief financial officer, Ford ConsumerConnect, said, "Internet is a technology that will help us transform the business. Ford's view on the Internet is that the consumer will win. In addition, it would be to our competitive advantage to act quickly. Through the Internet, we should be able to lead change, especially in overseas markets."

The company is also very clear that to bring its plans to fruition, it would need to have the best partners. It has, therefore, tied up with a host of companies. Over the last eight months, FMC has invested \$ 100 million in B2B ventures and \$ 250 million in B2C ventures internationally. Also, as part of its aim of becoming a seamless organisation, it is networking its vendors and dealers.

As part of its e-business landscape, in B2B, FMC's strategic priorities are setting up an operating exchange with four original equipment manufacturers (OEM) and two technical partners, getting FMC systems/ processes ready for the exchange and engaging global suppliers.

In the B2C landscape, FMC has considered four important factors including dealer connectivity, manufacturing capability, a good brand and a good technological engine. In B2C, FMC's strategic priorities are to maximise CarPoint and CarClub, to integrate the Trilogy venture and to accelerate progress in built to order (BTO) and order to delivery (OTD).

Last year, FMC was the first automotive manufacturer to take an equity stake in the all-makes automotive site, CarClub.com that has established an on-line niche, providing unique auto-related products and services to club members. Its joint venture with Microsoft for MSN CarPoint is to create an easier way for consumers to design and order the car they want. Late last year, FMC entered into a joint venture with Trilogy, a leading provider of enterprise class e-business solutions. The software will provide multi-channel commerce applications to facilitate the consumer experience between FMC, the dealers and the consumers.

*This section provides four brief case examples of organisational approaches to Supply Chain Management in the e-business Era*

The company's website, www.Ford.com has over 1.5 million unique visitors per month and according to Media Metrix, is the top OEM site. A retail BTO was launched in Canada in May 2000. It also set up an Internet Fleet BTO which is an industry first and enables companies to order fleet of vehicles for employees over the Internet. The Buyer connection on the site is generating over 1000 leads per day.

Ford pre-owned.com showrooms have been set up in the USA in Atlanta, Boston, New York, Oklahoma City and San Francisco and a national expansion is in the offing. This site already boasts over 100,000 unique visitors per month and already more than 2,100 units have been sold through this site.

Percept@ is a network of call centres and has been set up with the objective of operating world-class, web-enabled customer relationship centres globally. Percept@ generated \$ 45 million revenue and is already profitable in 2000. It assumed control of the Toronto centre in April 2000 and opened an Australia centre in April 2000. All UK call centres are expected to be up and running by late August 2000. Percept@'s aim is to allow Ford vehicle owners to connect to the centre via telephone, fax or e-mail in case of vehicle emergencies or for assistance in directions, reservations etc. Additionally, the centre will be able to provide a detailed record of the vehicle to include sales, service and financial transactions. All this to enhance the management of the continuing relationship between the consumer and Ford.

#### **Case 2: NORTEL**

Northern Telecom is one of the leading global telecommunications manufacturers with revenue in 1999 of \$22.2 billion. During 1999-2000 Nortel has undergone a major re-organisation along a customer-supply chain configuration in order to improve the level of service and profitability of their customer offering.

In our previous study (Croom, 1998) we documented their e-procurement initiatives, and following from this we have now observed how a total supply chain perspective is being adopted in order to improve process performance from order through to fulfilment.

A key element of the Nortel supply chain strategy is rapid response to customer orders. This has concentrated their efforts in a number of critical areas. Firstly, they have established customer account teams to provide a single contact point for customers. Secondly, Nortel have established customer order houses to co-ordinate fulfilment across their whole product range. This will involve changes to the warehouse and logistics design for customer and product categories in order to support postponement, which will naturally require attention to the nature of product modularity.

The prime objective of Nortel's supply chain strategy is lead time reduction and improved availability. Coupled to this, e-strategy initiatives are underway in many parts of the operation, a decentralised process which is centrally co-ordinated in order to provide a cohesive and compatible infrastructure.

Nortel's initiatives reflect the whole spectrum of supply chain activities and processes as illustrated by our five-stage model. Such an undertaking is naturally an adventurous one, and is coupled with Nortel's rapid growth through acquisition in order to capitalise on the phenomenal market demand for their communications technologies.

#### **Case 3: PROCTOR & GAMBLE**

##### **Background:**

Proctor and Gamble {P&G} sells more than 300 brands of consumer packaged goods in 140 countries around the globe. With an annual revenue of over \$38 billion, P&G's main business offerings are in fabric & home care, paper, health & beauty care, and food & beverage products.

##### **Purchasing at P&G:**

P&G's current annual spend on goods & services are \$26 billion. The breakdown of P&G's purchase spend is: \$12 [46.1%] billion for raw materials and packaging, \$5 [19.25%] billion on marketing goods and services, \$5 [19.25%] billion for MRO and capital equipment, and \$4 [15.4%] billion for corporate facilities.

Since the company's founding in 1837, the purchasing function has always been viewed as vitally important and great emphasis is put on its purchasing capability for organisational effectiveness. The organisation has a Global Business Systems [GBS] Group, comprising purchasing and accounting professionals, whose skills are bought by the other business groups. Individual business units carry out the purchasing process across the organisation. The purchasing/operations managers of the business units are assisted by purchasing professionals who have been bought out from the GBS group. However, bulk strategic items are purchased on global contracts.

##### **The Challenge for P&G:**

Almost all aspects of P&G's global business operations are planned, controlled and managed using information system support. The company has implemented the SAP ERP system for their finance operations and is also in the process of employing net auction systems as an 'e' solution for their purchasing functions. The sheer pace of change and the strength of emerging business models have forced P&G to develop business practices that should give them long term competitive advantage. The main challenge however is for P&G to develop and implement these capabilities successfully amongst their stakeholders.

##### **E-Procurement at P&G:**

Over the last couple of years, P&G have been actively engaged in e-procurement initiatives. The organisation has a clearly expressed strategy for enterprise wide e-procurement adoption. The key benefits seen by P&G in the adoption of e-procurement are **cost**, i.e. transactional savings, and **data and information exchange** 'on-line' with various suppliers. P&G also see e-procurement as driving a better price-quality relationship, besides rationalisation in procurement. The company has also taken a lead role in setting up **Transora**.

Currently, P&G have restricted their e-procurement activities to non-strategic purchases, like MRO goods and services. The company has primarily conducted these activities through the Global Net Exchange and Worldwide Retail Exchange, saving significant costs in buying commercial goods through these exchanges. Purchases through these 'e' channels account for between 20%-40% of the company's purchase budget.

P&G is still feeling the tangible benefits of e-procurement but the company sees lack of standardisation amongst buyers and sellers, i.e. data exchange layout, as a possible barrier towards faster adoption of e-procurement practices.

#### **P&G's Web Order Management process:**

According to Lars Kortbaek, the European proprietor for P&G's Web Order Management [WOM] initiative, the two underlying factors to enterprise wide implementation of this process are NOS growth and cost reduction. P&G are using the WOM initiative to focus on the company's sales order acquisition and information exchange processes. Hence, the company has positioned this as a commercial initiative and not a cost savings project.

This initiative, which is still in its early stage of development across Europe, provides customers with an electronic means to place their orders and offers them financial incentives if they send electronic orders. The company is also offering incentives, like sharing of systems purchase costs, to their customers who do not have electronic networks in place.

The WOM is a P&G proprietary tool and the company believes that by being the first mover in this initiative they can develop the industry standards for this process.

#### **Case 4: TRADETEAM**

Tradeteam is the leading independent logistics provider to the UK drinks industry and it owes its success to the reliable service it offers to public houses. Drinks deliveries have to be made in full and on time if the good reputation of the company is not to dry up along with the pubs.

During the nineties, the drinks and leisure industry experienced significant growth as the major brewers redefined their markets. Manufacturers and retailers increasingly found that traditional distribution methods were becoming outdated and less effective and they needed a faster and more effective way to deliver to the thousands of pubs and clubs through the UK.

In response, Bass, in partnership with Excel, formed a new independent business called Tradeteam with the objective of providing a drinks logistics service to Bass and other customers.

Successful drinks distribution relies on a complex logistics system, which encompasses sophisticated inventory management to ensure that the right quantity of a variety of drinks is in the right place to satisfy customer requirements. The system relies on the quick and accurate transfer of data from outlet to office to depot so a robust network is critical.

Tradeteam worked with BT to develop its communications infrastructure to support its service promise. The backbone of the system is a data network, which passes on information quickly and cheaply from the point of sale to a central control, in effect facilitating 'just in time' drinking.

The BT solution came in the shape of a flexible and cost-effective private network, which uses a central processing system to provide fast and reliable deliveries to multiple sites. It also includes a bespoke, fully integrated customer help desk.

Today, Tradeteam has 2,000 employees across 38 locations and a fleet of 700 vehicles to ensure that around 1.75 million tonnes of drinks – equivalent to 8 million barrels of beer a year – are delivered weekly from a range of brewers and suppliers to 25,000 outlets through the UK.

"We chose BT because we were looking for an organisation that could combine creativity and reliability because the cost to us of the network going down would be huge. In the two years since its installation, the system has proved to be totally reliable", says Stuart Ayling, Tradeteam's IT manager.



### **Case 5: KEY INDUSTRIAL- ELIMINATING HIDDEN PURCHASING COSTS**

Key Industrial, the UK's largest catalogue retailer of light industrial and commercial equipment, are working towards reducing customer transaction costs by almost 90 per cent through a new e-commerce venture.

The company supplies anything from jiffy bags to shelving & pallet trucks. It has no retail outlets and sells over 50,000 products by mail order, sending out 1.5 million catalogues a year to its customers throughout the UK and the rest of the world.

The launch of Key Industrial's web shop in July 2000 gives customers access to the latest product information and the option of purchasing online. For Key Industrial it offers a cost-effective means of responding to client demand, reaching out to a far wider client base with a potentially much larger range of products.

Tony Bailey, Key Industrial's managing director, says, 'e-commerce has a crucial role to play in our vision for the future. Many of our major customers are already buying online and we must constantly be receptive to their needs. The demand for e-commerce is has never been stronger and if we don't provide solutions for our customers – then others will.

BT worked closely with Key Industrial on the design and launch of the web shop. The goal was to pull together different elements of traditional catalogue production and amend them for the online environment. The result is that customers now have access to a product database through a personalised electronic catalogue, which can be tailored to their specific needs to make ordering as easy and convenient as possible.

This is just the start, continued Bailey, our intention is to become a true 'click and mortar' company by mid 2001.

'The biggest challenge was the successful transfer of our data classification system to a digital format,' says Bailey. 'Key Industrial was determined to get the move to e-commerce right. Customers will only try the web-shop once; therefore it had to be right first time.

Electronic orders, which are currently handled in the same way as orders taken over the telephone, fax or by post, are keyed into the system manually, but this year the system will be digitally integrated so that orders are processed automatically.

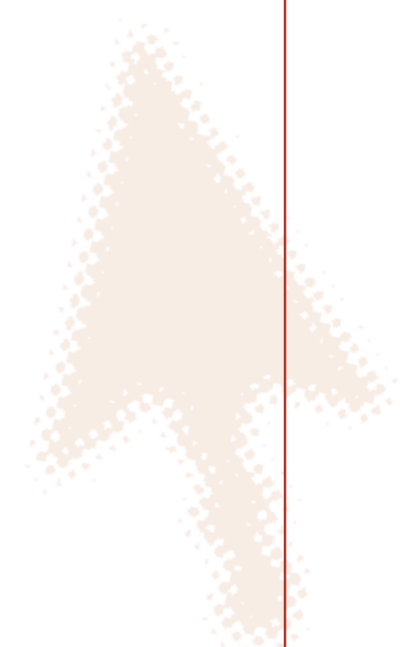
Using technology for electronic purchasing dramatically reduces purchasing costs to the end user. 'On average, it costs a company £50 to £60 to raise a purchase order manually and they can do it on-line for approximately £6,' says Bailey.

These purchasing cost savings are significant, and helps us to maintain customer loyalty.

E-commerce will also give Key Industrial customers access to Europe's largest product range and much more in terms of services – There is an e revolution going on within the Manutan Group – customers are telling us what they require

and we are responding accordingly. Combine this with reduced purchasing costs and it is a win-win strategy.

Key Industrial is the 3rd largest division of a pan-European group owned by Manutan International. Following the success of this initiative, the next phase in the development of its e-commerce strategy will be the launch of a group wide website across Manutan International's nineteen locations and 380,000 products.



# Academic References

- Abernathy, FH; JT Dunlop; JH Hammond & D Weil. 2000. Control Your Inventory in a World of Lean Retailing. Harvard Business Review. November-December. Pp. 169-176.
- Bradley, S., Hausman, J. & Nolan, R. (eds.). (1993). *Globalization, Technology and Competition: The Fusion of Computers and Telecommunications in the 1990s*, Boston, Massachusetts: Harvard University School Press.
- Brynjolffson, E., Malone, T., Gurbaxani, V., & Kambil, A. (1993). Does information technology lead to smaller firms? Unpublished manuscript, Cambridge, MA: Massachusetts Institute of Technology.
- Cash, J. I. & Konsynski, B. R. (1985, March-April). IS redraws competitive boundaries. Harvard Business Review. 134-142.
- Croom, SR; K Wilson, A Millman, C Senn, D Weilbacker (2000) "Managing Global Customers" Velocity, The Journal of the Strategic Account Management Association (SAMA) Spring 2000
- Croom. S.R. (2000). "The Impact of Web-Based Procurement on the Management of Operating Resources Supply" The Journal of Supply Chain Management. Winter. Vol. 36; No. 1. pp 4-13 (10 pages)
- Croom. S.R. (1999). "The Implication of Electronic Procurement for Major Account Management" Journal of Selling and Major Account Management Vol. 1 No.4. pp.47-63
- Croom, S.R. (1998) 'Optimising the Purchasing Process for MRO Items: An investigation of the Strategic and Operational Value of adopting a Web-based System for the Procurement of Operating Resources'. Warwick Business School Working Paper
- Croom, S.R. (1996) The Management of Dyadic Capability in New Product Development: A Qualitative Analysis of Customer-Supplier Relationships during the Jaguar X300 Vehicle Development Programme. University of Warwick Ph.D Thesis
- Davenport, TH (1993) *Process Innovation: Re-engineering work through Information Technology*. Boston Harvard Business School Press
- Evans, P & T Wurster (2000). *Blown to Bits. How the new economics of information transforms strategy*. Harvard Business School Press
- Finnegan, P, Galliers R & Powell, P (1998) "Systems planning in an electronic commerce environment in Europe: rethinking current approaches" International Journal of Electronic Markets. May
- Fisher, M. (1997) What is the right supply chain for your product?' Harvard Business Review March-April
- Ghosh, Shikhar (1998) Making Business Sense of the Internet. Harvard Business Review Mar/Apr
- Hart, P. & Estrin, D. (1991, October). Inter-organisational networks, computer integration, and shifts in interdependence: The case of the semiconductor industry, *ACM Transactions on Information Systems*, 9, (4), 370-398.
- Johnston, H. R. & Vitale, M. R. (1988, June). Creating competitive advantage with inter-organisational information systems. *MIS Quarterly*, 153-165.
- Johnston, R. & Lawrence, P. (1988, July-August). Beyond vertical integration: The rise of the value-adding partnership. *Harvard Business Review*, 94-101.
- Kambil, A. (1991). Information technology and vertical integration: Evidence from the manufacturing sector. In M. Guerin-Calvert & S. Wildman (eds.), *Electronic services networks: A business and public policy challenge*, (22-38), New York: Praeger.
- Keen, P. (1988). *Competing in time: Using telecommunications for competitive advantage*. Cambridge, MA: Ballinger Press.
- Kekre, S., & Mudhopadhyay, T. (1992). Impact of electronic data interchange technology on quality improvement and inventory reduction programs: A field study. *International Journal of Production Economics*, 28, 265-282.
- Lucas, H., Levecq, H., Kraut, R. & Streeter, L. (1995, November). France's grass-roots data net. *IEEE Spectrum*, 71-77.
- Malone, T., Yates, J., & Benjamin, R. (1989, May-June). The logic of electronic markets, *Harvard Business Review*, 166-171.
- Senn, JA (1992) "The myths of Strategic Information Systems: What Defines True Competitive Advantage?" *Journal of Information Systems Management*, Summer, pp.7-2
- Slack, NDC; S Chambers & R Johnston. 2001. *Operations Management*. FT Pearson Education
- Steinfeld, C. & Caby, L. (1993). Strategic organisational applications of videotex among varying network configurations. *Telematics and Informatics*, 10 ( 2), 119-129.
- Wildman, S. & Guerin-Calvert, M. (1991). Electronic services networks: Functions, structures, and public policy. In M. Guerin-Calvert & S. Wildman (eds.), *Electronic services networks: A business and public policy challenge*, (3-21), New York: Praeger.
- Williamson, O. (1975). *Markets and hierarchies: Analysis and antitrust implications*. New York: Free Press.
- Womack, J, D Jones, and D Roos. 1990. *The Machine That Changed The World*. New York: Rawson Associates.
- Zucker, L. (1986). Production of trust: Institutional sources of economic structure: 1840-1920. In B. Staw and L. Cummings, (eds.), *Research in organisational behavior*, (Vol. 8, 53-111), Greenwich, CT: JAI Press.



For more information about this report and to contact BT visit  
[www.bt.com/egovernment](http://www.bt.com/egovernment) or call 020 7778 5627

