

**CRANFIELD UNIVERSITY**

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**THE ROLE OF E-PROCUREMENT IN PURCHASING  
MANAGEMENT**

**School of Management**

**PhD Thesis**



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**Supervisor: Professor Alan Harrison**

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## Abstract

This exposition summarises research published in several academic articles, in order to meet the requirements of PhD by publication. The focus of the work is on the role of electronic procurement in management of the purchasing function.

From the late 1990s a number of independent e-procurement mechanisms were launched which offered potential benefits such as increased order accuracy, transaction efficiency and greater integration between trading partners. At the outset of this programme of research, e-procurement was therefore an emerging phenomenon with little academic research and presented an opportunity to investigate a largely unexplored area. Edmondson and McManus (2007) suggest that for nascent, as opposed to mature areas of research, where few formal constructs or measures exist, an exploratory, qualitative approach is required. This research followed such an approach through the use of case studies, involving observation, participation and interviews with key organisational actors. Each paper makes use of several cases in order to compare and contrast results from different organisations and to draw conclusions from multi-case analysis.

The published articles focus on the impact of core applications within e-procurement, including online reverse auctions, electronic marketplaces, online catalogue sites, and buying systems covering the 'requisition to pay' cycle. The findings from the papers address a number of core themes in purchasing management. In considering buyer-supplier relationships, it was observed that such dyads are driven by traditional buyer negotiation factors such as segmentation, power and price and that use of e-procurement applications tended to enforce such traditional behaviours. In relation to the potential for integration, the study found that integration between firms was barely affected, as the concept of integration was neither an objective nor a business case driver for e-procurement adoption. This situation reflects the finding that procurement managers pursue functional targets rather than supply chain-level objectives. However, other significant effects from e-procurement adoption were noted such as the tendency by buyers to reduce supplier numbers and a move to re-engineer the procurement function in buying firms, through automating transactional processes. The research finds that e-procurement does not have a deterministic impact on purchasing management, and that it acts as an enabler to more effective management of the function through the way its different mechanisms are deployed.

The exposition establishes that e-procurement is used in relation to supply conditions which are characterised by both 'markets' and 'hierarchies', but that it is the pre-defined purchasing strategy of the firm, rather than available technology solutions, which determines when markets and hierarchies are used. Additionally, an original model is introduced, focusing on developing an e-procurement policy which can support strategic purchasing goals. This model extrapolates findings from stages in the research, and marries together elements from various papers and frameworks therein, to produce some guidelines for adoption of this technology.



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I need to thank in particular all the companies who allowed access for me to undertake my research, as well as the many individuals within them who freely gave their time, knowledge and expertise, which resulted not only in some fascinating insights, but also some valuable contributions to the ideas in this thesis.

Thanks must also go to my many colleagues, both past and present, in the Centre for Logistics and Supply Chain Management at Cranfield, who supported my efforts with suggestions, advice, and reviews of drafts of the papers I hoped to publish.

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## **Abbreviations**

B2B	Business to Business
BU	Business Unit
CPFR	Collaborative Planning Forecasting & Replenishment
DoI	Diffusion of Innovation
EAI	Enterprise Application Integration
EDI	Electronic Data Interchange
EFT	Electronic Funds Transfer
ERP	Enterprise Resource Planning
IT	Information Technology
MRO	Maintenance Repair & Operating supplies
ORA	Online Reverse Auction
R&D	Research and Development
RFID	Radio Frequency Identification
RTP	Requisition to Pay
SCM	Supply Chain Management
SCOR	Supply Chain Operations Reference
SRM	Supplier Relationship Management



# 1. Introduction

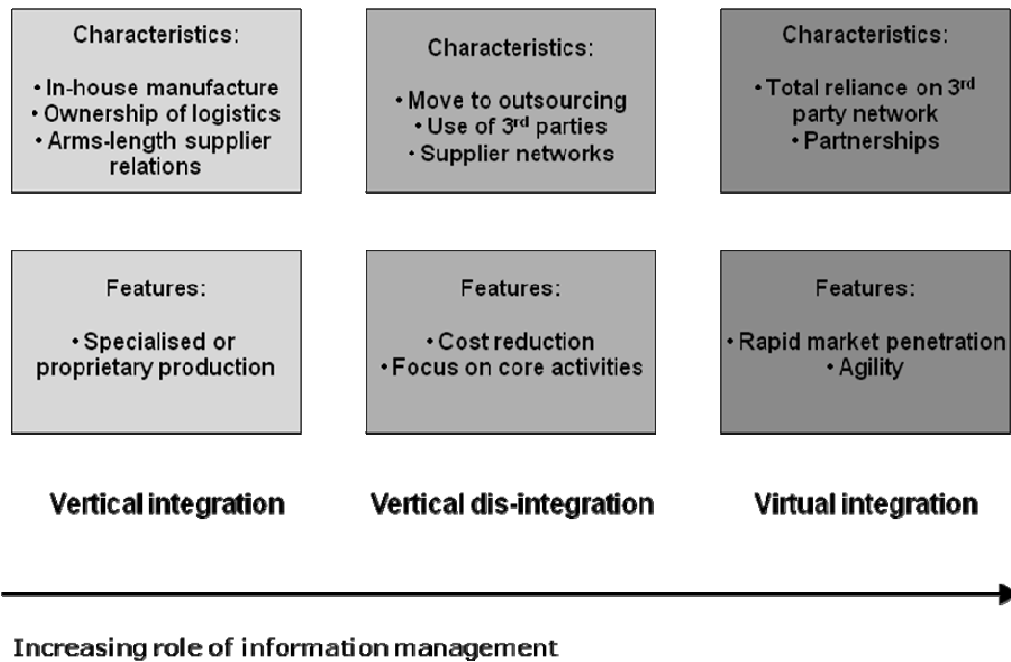
The impact of the internet on the business world has occurred with astonishing speed. In a handful of years the web has become a means of mass communication, a global sales channel, a platform for collaboration and a core feature of business strategy. The 'virtual organisation' which sheds assets and uses technology to bind together a dispersed network of suppliers, manufacturers and distributors has become a reality (Kraemer & Dedrick, 2002).

The beginning of this revolution in electronic commerce initially influenced person-to-person, or peer-to-peer communication. From the late 1990s onwards, the business community increasingly embraced the internet as a medium for trading, transacting and collaborating (Kalakota and Robinson, 2001). The rapid, and often competing, developments in web applications and software presented opportunities in many areas of business practice in terms of advancements in efficiency, improving global customer reach, lowering operational costs and re-engineering business processes (Kalakota and Whinston, 1997). Internet e-commerce has had an impact in many areas of organisational life, with both the private and public sectors as well as government seeking greater efficiency through technology deployment.

Supply chain management (SCM) has been affected by this revolution through a number of initiatives. Within retailing, availability and exchange of electronic point-of-sale data has been used to improve demand profiling and product availability (Christopher, 2005); tagging and RFID technology have enabled firms to identify and track product movements and improve security (White *et al*, 2008). Similarly, enhanced information exchange allows firms to reduce inventory, through better planning and forecasting based on real time demand data (Lambert, 2004). These new technologies potentially enable information to be deployed as a more strategic asset, allowing firms to achieve more effective management of the increasingly global and complex supply chain of today.

Much of this new technology replaced earlier, less sophisticated systems such as electronic data interchange (Mukhopadhyay *et al*, 1995). EDI was based on the exchange of data through area networks, which usually were established between communities within an industry, or sponsored by a manufacturer to enable communication exchange with its suppliers. The global and virtually cost-free nature of web communication made these networks redundant and led firms to explore wider opportunities for information exchange. Within supply chain management these opportunities are plentiful, as looking both upstream and downstream, firms deploy information to improve management of the channels (Croxtan *et al*, 2001).

This exposition explores the interaction between industrial buyers and suppliers, through electronic procurement (e-procurement) mechanisms. Firms use suppliers and supplier networks as an alternative to ownership or vertical integration. Since the 1980s there has been a movement away from diversified and integrated industrial firms characterised by ownership, towards focus on core activities and the outsourcing of secondary activities. Figure 1 illustrates the development in the profile of the industrial firm since the 1970s. Chaffey (2009) describes this as a progression from vertical integration through to virtual integration, facilitated by technology.



**Figure 1:** From vertical to virtual integration (based on Chaffey, 2009)

In Figure 1 the first level describes the structure of industrial organisations and how they have changed. For instance in the early part of the twentieth century, most large industrial firms were vertically integrated, owning most of the means of production. The second level of the diagram describes the features of that industrial model, which today is often characterised by the need for agility and rapid market penetration.

Companies such as Cisco are moving further towards virtual integration, where a network of third party suppliers, manufacturers and distributors replaces the traditional functions of the firm which, in former decades, were under direct ownership (Kraemer and Dedrick, 2002). Firms use suppliers for strategic and operational reasons such as reducing cost of materials, components or services; innovation; access to new technology and R&D; higher quality; taking costs off the balance sheet and many others (van Weele, 2007; Monczka *et al*, 2005). There has been a movement from deploying suppliers merely as providers of goods and services, towards a more integrated relationship with the buying firm. Vendors in the Japanese motor industry often work on long-term, rolling contracts with specific vehicle manufacturers and may be co-located to enable closer working relationships and lower lead times for supply (Womack and Jones, 1998). Indeed, establishing the nature of the role of suppliers, how they are selected and managed, and their contribution to the goals of the buying firm are key themes in the literature on supply chain management.

Initially, the introduction of web technology, under the title of e-procurement, offered an opportunity to experiment with alternative methods of communication, ordering and pricing for supplies, through online transacting. However as the technology developed and functionality became more sophisticated, it allowed a re-evaluation of some of the central issues within purchasing management.



One of the complications in this debate is that e-procurement is more than one single application or software: there exist a range of technologies which can be used independently or in concert. These technologies did not develop in a sequential way, but appeared more or less simultaneously, offering firms a complex set of issues to address when selecting e-procurement tools. The academic literature has not helped this situation as there are conflicting definitions and taxonomies put forward on e-procurement and academic authors use different terminology in describing the same tools or technologies. This problem is discussed further in the literature review in chapter 2. However as some specific tools were examined during this programme of research, a definition of those tools is provided in Table 1.

Tool	Characteristics
<b>Buying/ RTP applications</b> (buy-side e-procurement)	An application hosted by the buying firm to allow users to search for products, place and track orders, receive and pay for purchases. Uses catalogues provided by suppliers or draws product data from supplier sites through punch-out (retrieving data from web sites). Automates the 'requisition to pay' (RTP) cycle.
<b>Supplier catalogue sites</b> (sell-side e-procurement)	Web sites hosted by an individual firm which displays its product range in an electronic catalogue. Allows customers to order online, usually using point and click system, linked to shopping basket, check out etc. Designed by suppliers as a channel to market.
<b>Electronic marketplaces</b> (many-to-many e-procurement)	Web portals which offer an online store for buyers and suppliers to conduct transactions. Suppliers offer content, allowing buyers to browse in multiple catalogues on one site. Marketplaces may be 'horizontal' in offering a wide range of products such as office supplies, or 'vertical', related to a specific industry or sector.
<b>Reverse auctions</b> (buyer-controlled online tenders)	Online, real time bidding events where buyers offer a contract to specified suppliers, who make reducing bids in order to gain the business. The winner in principle is the lowest bidder, although a range of criteria may be used to award the contract. Terms and conditions for the event are specified by the buying firm.
<b>e-RFX</b> (buyer analysis support)	A suite of applications which support buyer analysis of supply markets and suppliers. Includes search tools, supplier rating and scoring systems, bid analysis tools, evaluation techniques. Designed to improve decision-making by buyers.

**Table 1:** Definition of e-procurement applications (adapted from Smart, 2010a)

### 1.1. Theme of articles presented

When this programme of research began, little academic evidence existed on e-procurement as the phenomenon had only recently emerged. Software firms began offering e-procurement applications from 1999, inviting questions on how these technologies would impact the working relationship between buyer and supplier (Kehoe and Boughton; 2001; Jap and Mohr, 2002).

Consequently, the theme within this exposition has developed over time, due in part to the dynamic and fast-moving nature of e-procurement technology. Research questions were formed and developed as discoveries in one project led to further ideas for research. For example, outputs from the reverse auctions articles (papers 1 & 2) led to further consideration of the impact of different types of e-procurement mechanisms and how they operated in a supply chain context (paper 3). In turn, this

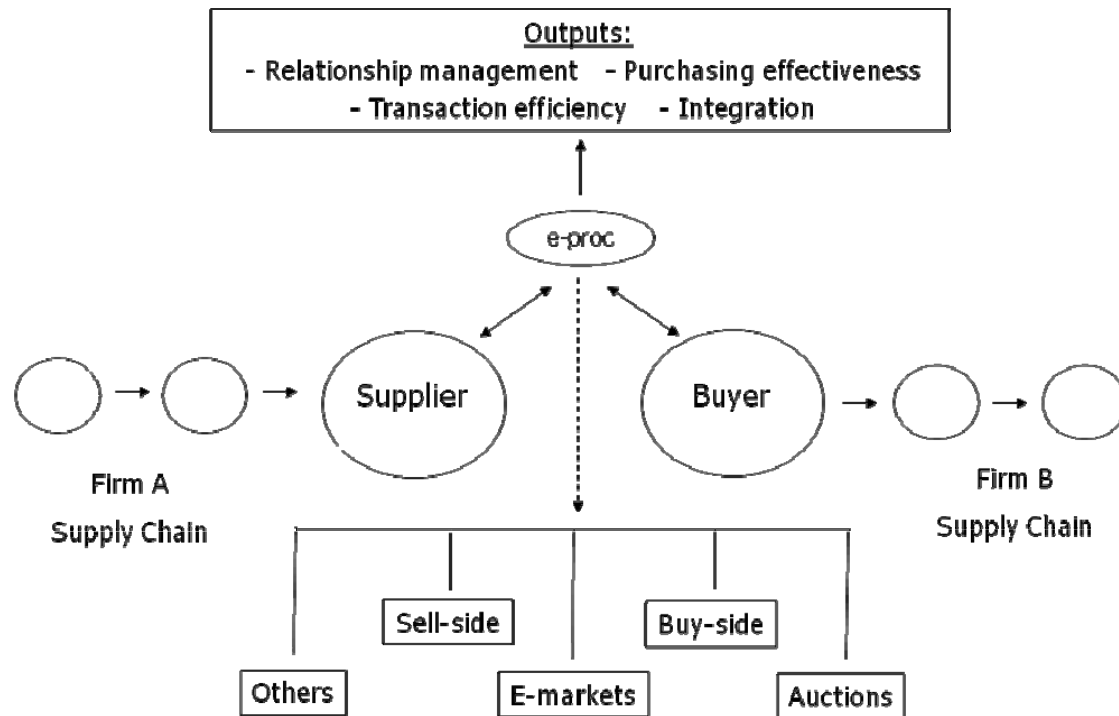
led to an examination of how e-procurement could support supply chain integration, seen in paper 4. That piece of research subsequently invited ideas on the drivers for these technologies within buying firms, and led to the development of the article on the business case for e-procurement (paper 5). Similarly the concept for paper 6, concerning the relationship of e-procurement to supply strategy, emerged during the research for papers 4 and 5. Therefore, the work, relevant research questions and the uniting theme, have all progressed as discoveries were made and as the literature itself developed. For ease of reference, Table 2 provides the Abstract from each article, summarising the topics in each paper and their relevance to the exposition.

The advancement in the literature has assisted in the scoping of research projects, as the recent growth in relevant publications stimulated new questions. There remain interesting research opportunities however, as the subject is still relatively immature. Most of the research output to date has emanated from the USA where the approach has been primarily quantitative, focusing on survey analysis. An important omission in the literature therefore has been in relation to qualitative research, particularly case studies of planning, implementation and usage of e-procurement tools. All the research undertaken for this exposition has been case-based and the case method is discussed in chapter 3.

The focus of previous and current research in this domain is discussed in the next chapter. Some pertinent gaps are identified in the review of the literature, and it is evident that the positioning of e-procurement tools in industrial purchasing management has not been well defined. Indeed, it is only in paper 6 within this exposition that the issue of how e-procurement connects with the purchasing strategy of the firm is fully explored.

Hence this exposition unites the contributing papers under a single theme: the role of e-procurement within purchasing management in business to business environments. The conceptual framework shown in Figure 2 summarises the focus at the outset of the research programme. The framework suggests there are a number of outputs from e-procurement deployment, derived from the literature, which affect the buyer and/or supplier according to contextual factors for those buying and supplying firms. Issues such as the buyer-supplier relationship, purchasing effectiveness, transaction cost and inter-firm integration are potentially affected by e-procurement deployment. Such impacts can be positive or negative and this research explores both advantages and disadvantages of the technology. The e-procurement mechanisms discussed here are usually driven by the needs of buyers and it is primarily the buying firm perspective which is examined in this research. However there are applications supporting supplier requirements which are equally of interest, and the supplier perspective is considered as part of the discussion and findings.

The articles presented here each address specific questions which relate to the cases analysed and to the type of applications examined. The topics in each paper naturally differ according to their context, but there are common thematic concerns which emerge across the papers and which are the subject of chapter 4.



**Figure 2:** Conceptual framework for the research

## 1.2. Structure of the exposition

This chapter describes the scope of the work undertaken and establishes the research theme developed through the articles presented. In chapter 2 the context for e-procurement is explored through an examination of the relevant domains of literature, leading to identification of the gaps in knowledge. The first subject to be highlighted is the relation of purchasing to the supply chain, establishing that interaction with suppliers to the firm is central to SCM and needs to be understood as a key activity in a supply chain strategy. Core issues in purchasing management are examined including the themes of procurement strategy, segmentation and partnerships. The role of information technology (IT) is then introduced, exploring its importance as a potential facilitator of integration between members of the supply chain. The literature analysis continues with discussion of electronic commerce and the position of e-procurement within the e-commerce landscape. This leads on to a discussion of e-procurement tools and applications, and a review of the limited body of knowledge that had been established at the beginning of this research, and how it has developed since.

Chapter 3 considers issues relating to research design, leading to a discussion of the methods used in the research. This programme of research has been based on case study analysis and the limits and advantages of the case method are explored, leading to justification of the approach for each stage of the research. The methods and techniques used in researching each article are then presented sequentially. The outputs from the articles and the research findings are discussed in chapter 4 using a thematic approach, drawing on a number of papers for each theme, and illustrating how the articles have led to the development of knowledge in this field. A number of models and frameworks contribute to these findings. The themes address gaps in the

literature and demonstrate how the field has been extended through reference to key subjects in the literature.

The final chapter illustrates, through synthesis and further insights, how the research overall has provided a contribution to the field. In support of this, an additional model is introduced which brings together the strands of the research, offering guidance on e-procurement development for both academic and practitioner domains.

**Table 2:** Table of Publications

Publication	Article Abstract	Relevance to the exposition
<p>1. Smart, A. &amp; Harrison, A. (2002), Reverse Auctions As A Support Mechanism In Flexible Supply Chains, <i>International Journal of Logistics: Research &amp; Applications</i>, Vol. 5, No. 3, pp. 275-284</p>	<p><i>The Internet offers buyers a number of solutions for automating purchasing activity through e-procurement mechanisms. Some of these solutions have yet to prove their worth, requiring long lead times to implement and achieve payback benefits. Online reverse auctions are a tool which can be rapidly adopted and which are producing price reductions for direct and indirect purchases. They also offer process benefits to participating buyers and suppliers. As supply chains learn to become more flexible and responsive in the face of shorter product life cycles and faster-changing markets, auctions offer a viable mechanism for situations where there are many suppliers and product complexity is low. They also offer an early payback for electronic marketplaces and exchanges.</i></p>	<ul style="list-style-type: none"> <li>▪ Identified position of reverse auctions in relation to other e-procurement mechanisms</li> <li>▪ Established impact on price and partnerships of reverse auctions</li> <li>▪ Proposed auctions as part of an overall relationship strategy</li> <li>▪ Developed segmentation model of how and where auctions can fit within a segmented e-procurement approach</li> <li>▪ Auctions shown to support an agile supply chain strategy</li> </ul>
<p>2. Smart, A. &amp; Harrison, A. (2003), Online Reverse Auctions and their Role in Buyer-Supplier Relationships, <i>European Journal of Purchasing &amp; Supply Management</i>, Vol. 9, pp. 257-268</p>	<p><i>Despite the move in recent years towards supplier partnerships, buying firms need at times to make use of competitive procurement strategies for certain purchases. This study examines the impact of reverse auctions on buyer-supplier relationships through six case studies, analysing primarily the supplier perspective through participant interviews. The authors identify that there are potential benefits for both parties in a reverse auction, which can offer tendering and transactional cost advantages. For buyers, it offers a competitive procurement process. The effect on relationships will depend on the extent to which buyers employ the auction as a price weapon, or whether it is used primarily as a process improvement tool.</i></p>	<ul style="list-style-type: none"> <li>▪ Illustrated conditions for success in industrial reverse auctions</li> <li>▪ Empirical evidence of time compression through the online bidding process</li> <li>▪ Introduced extended list of benefits and disadvantages of reverse auctions</li> <li>▪ Provided evidence of role of auctions in providing price transparency and exposing market price levels</li> <li>▪ Evidence of impact of auctions on buyer-supplier relationship</li> <li>▪ Model of how some categories will move away from partnership approach to more arms-length negotiations with suppliers</li> </ul>

<p>3. Smart, A. (2005), Exploring supply chain opportunities in the UK utilities sector and the supporting role of e-Marketplaces, <i>Supply Chain Management: An International Journal</i>, Vol. 10, No. 4, pp. 264-271</p>	<p><i>Purpose</i> – Since the privatization of UK utilities, few studies have examined supply chain management (SCM) in the sector. This paper aims to investigate the state of development of the SCM concept and the role of the emerging internet-based electronic marketplaces in supporting this.</p> <p><i>Design/methodology/approach</i> – Using a case study method, interviews were conducted with managers in seven UK electricity and water utilities. Areas explored are the firms' supply chain priorities, how eMarketplaces can support their supply chain goals and the barriers to adoption of eBusiness solutions.</p> <p><i>Findings</i> – The research reveals a strong orientation in both the electricity and water industry firms towards controlling cost inputs. Consequently, their focus is on managing procurement as the primary supply chain activity. The key barriers to eBusiness adoption identified are the problem of providing genuine benefits to suppliers, and the technical difficulties of marketplace implementation.</p> <p><i>Research limitations/implications</i> – This is an exploratory study of the domain and further work in this area needs to focus on how utilities will develop their supply chain competences and how eBusiness solutions can support them.</p> <p><i>Originality/value</i> – The research concludes that operators of electronic marketplaces have not yet delivered a convincing case for wider participation in management of the supply chain online. A stronger SCM orientation will need to emerge in utility firms before that can occur.</p>	<ul style="list-style-type: none"> <li>▪ Explored limitations of the e-marketplace model</li> <li>▪ Demonstrated that industry/market maturity has significant impact on feasibility of e-marketplaces as providers of SCM functionality</li> <li>▪ Provided list of factors which inhibit e-business adoption</li> <li>▪ Explored buyer requirements of e-procurement systems</li> <li>▪ Showed that e-procurement mechanisms can operate as stand-alone entities and are not dependent on wider supply chain integration</li> </ul>
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<p>4. Smart, A. (2008), e-Business &amp; supply chain integration, <i>Journal of Enterprise Information Management</i>, Vol. 21, No. 3, pp. 227-246</p>	<p><i>Purpose</i> – The purpose of this study is to examine how four large organisations have approached the implementation of new eBusiness mechanisms: namely online order processing, eProcurement, reverse auctions, and a private exchange. The objectives are to establish whether supply chain integration is an identified goal for the firms involved and to evaluate the extent of integration achieved through these projects.</p> <p><i>Design/methodology/approach</i> – A case study approach is used, with four separate cases being examined, leading to cross-case analysis and conclusions. The primary form of data collection was interviews with managers participating in the implementations. In order to measure the degree of supply chain integration pertaining in the examples, two frameworks from the literature are used.</p> <p><i>Findings</i> – In three of the cases it is established that there is very little, or nil integration at supply chain level and only in one case is there evidence of a supply chain perspective contributing to the project. Three of the firms did not consider the supply chain implications of implementing their eBusiness applications.</p> <p><i>Research limitations/implications</i> – The article builds on previous studies and illustrates the problems of achieving integration in the supply chain. Further research is needed to establish common attributes relating to supply chain integration.</p> <p><i>Practical implications</i> – Three of the projects examined here were based predominantly on a business case for the implementing firm only. Firms need to be aware that IT projects by their trading partners may have supply chain cost implications for their own business.</p> <p><i>Originality/value</i> – Whilst much of the literature propounds the need for integration, leading to extension of the supply chain concept, firms are pursuing IT implementations which are premised solely on internal benefits. The research illustrates that, if the new eBusiness mechanisms are to support wider supply chain goals, then the focal firms involved must take a more holistic view of how and why such solutions are implemented.</p>	<ul style="list-style-type: none"> <li>▪ Demonstrated how different e-procurement mechanisms are adopted according to buyer or supplier drivers</li> <li>▪ Provided evidence that the case for e-procurement is based on internal factors only</li> <li>▪ Illustrated where benefits accrue in e-procurement implementations</li> <li>▪ An orchestrating firm is required in order to structure e-commerce adoption across the supply chain of multiple firms</li> <li>▪ Automation of process, not inter-firm integration, is the objective of e-procurement projects.</li> </ul>
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<p>5. Smart, A. (2010a), Exploring the business case for e-procurement, <i>International Journal of Physical Distribution and Logistics Management</i>, Vol. 40, No. 3, pp.181-201</p>	<p><i>Purpose – Although e-procurement has been adopted in many industries, the business case for this technology has only partially been explored in the literature. This article investigates, through a case study approach, how a business case for e-procurement adoption was developed in three implementations.</i></p> <p><i>Design/Methodology/Approach – The paper employs a case study method and examines three industrial firms through in-depth interviews with managers involved in the projects. The cases are presented and explored individually, followed by identification of relevant drivers and problem factors.</i></p> <p><i>Findings – The research identifies eighteen drivers which can form the basis of a business case for e-procurement. A further seventeen problem factors are presented, which have the potential to militate the original case. It is apparent that the firms involved only developed a limited case for adoption and that there is a significant element of faith that the eventual results will justify the investment.</i></p> <p><i>Practical implications – A framework of the business drivers for e-procurement is introduced, in the form of a hierarchy. This framework can assist managers to classify relevant issues in assessing and developing the case for e-procurement adoption.</i></p> <p><i>Originality/value of paper – Whilst the literature offers theoretical benefits for e-procurement, the paper provides managers and researchers with empirical evidence of the drivers for this technology and of the problems encountered in implementation, and establishes a basis for further research in the domain.</i></p>	<ul style="list-style-type: none"> <li>▪ Typology of different e-procurement mechanisms</li> <li>▪ Detailed case histories on how these mechanisms used in three case firms</li> <li>▪ Table of drivers of the business case for e-procurement in buying firms</li> <li>▪ Documented militating factors in e-procurement project success</li> <li>▪ Hierarchical model of business case for e-procurement</li> <li>▪ Definition of five Criteria categories, for consideration in e-procurement project evaluation.</li> </ul>
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<p><b>6.</b> Smart, A. (2010b), E-procurement and its impact on supply management - evidence from industrial case studies, <i>International Journal of Logistics: Research &amp; Applications</i>, Vol. 13, No. 6, pp. 1-18.</p>	<p><i>Many buying firms have adopted e-procurement systems, yet the impact of these applications is still being assessed by both academics and practitioners alike. This article examines the use of e-procurement within four multinational firms, to establish the impact of these mechanisms on their approach to the supply market, using thematic parameters derived from the literature. The results indicate that the firms established a clear supply market strategy based on a segmentation model: e-procurement tools were used as tactical means to implement and extend that strategy towards the supply base. In addition, it was observed that tactics within defined segments are developing, as buying firms use e-procurement tools both to reduce supplier numbers and to leverage their volumes in price-competitive markets. Some propositions are offered on the key themes, summarising the findings in the paper and providing further indications for research.</i></p>	<ul style="list-style-type: none"> <li>▪ Analysis of the role of e-procurement in four firms, in relation to supply market strategy</li> <li>▪ Identified e-procurement as a tactical tool to support strategic purchasing decisions</li> <li>▪ Relationship model indicating interdependence between three key variables in the e-procurement decision.</li> <li>▪ Defined the impact of e-procurement on purchasing roles and productivity</li> <li>▪ Theoretical propositions in relation to seven key themes in the buyer-supplier interface</li> </ul>
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## **2. Framing the problem**

In this chapter, the research focus of this thesis is positioned through a review of the literature pertinent to the field. It identifies the relevant themes which have informed the research agenda and outlines the opportunities for investigation which arose where gaps in knowledge were identified.

When this research programme began, web-based technology was at an early stage of development and e-procurement itself was a recent phenomenon, offering a new channel in business to business markets through which goods and services could be acquired. As a nascent area, e-procurement presented a rich opportunity for research as there were few publications on the subject. Hence the chapter explores the development of literature on e-procurement, alongside extant literature themes which have underscored the research agenda and provided a context for the development of research questions.

This review is structured into analysis of three domains. It begins with an overview of SCM and the purchasing literature, including examination of key issues in the buyer-supplier relationship. Next, IT is considered in relation to the supply chain and its potential to assist integration. Thirdly, e-commerce and the relevant e-procurement mechanisms are examined, exploring how the literature has moved forward since their inception.

### **2.1 Purchasing and Supply Chain Management**

Since the introduction of the SCM concept in the 1980s, there have been numerous definitions which attempt to codify SCM and what it encompasses. In inter-organisational terms, SCM can be seen as an alternative form of organisational structure to vertical integration, which predetermines a firm to own most of the physical resources or assets involved in producing its product (Cooper & Ellram, 1993). A classic example of the integrated firm was the Ford motor company of the 1920s which owned the entire means of production, including steel works, forests and sheep farms. In effect, supply was from internal or owned sources. Today, firms who operate extended supply chains can gain competitive advantage through outsourcing to external sources which possess discrete knowledge, technology or lower costs in their field of operation (Monczka *et al*, 2005). In this regard, SCM requires the firm to co-ordinate assets, flows of product and information with a number of parties, in a chain or network (Tan, 2001).

There have been a number of suggestions as to the knowledge or theory-base for SCM. Croom *et al* (2000) have defined SCM as drawing on a number of existing subject domains, including Marketing, Purchasing & Supply, Logistics & Transport, Organisational Behaviour, System Engineering and Network literature. They further identify the origins of SCM as lying in industrial dynamics and the contributions of Forrester (1958). Cooper and Ellram (1993) suggest the origins of SCM are found in inventory management, where looking across the entire chain, there is an opportunity to reduce inventory build-up. Cooper & Ellram (1993a) have also described the similarities between SCM and the Japanese concept of 'keiretsu', where organisations in an industry operate within a network defined by joint ownership and planning, with strong inter-dependency.

Continuing the theme of networks, Harland (1996) suggests that the term SCM can be applied both to intra-firm integration, as well as inter-firm integration, but sees the latter definition as critical. It can be argued in this context that without intra-firm

integration, integrating with external firms is extremely difficult to achieve. The supply chain can be seen as management of either supply relationships, inter-business chains, or strategic management of inter-business networks. According to Tan (2001), SCM literature has emerged from two principal sources, namely Transport & Logistics, and Purchasing & Supply. Logistics is concerned with better management of physical distribution and the assets which support it, whilst purchasing stresses that sourcing of materials is a strategic process, creating critical links with an external supply base. In a wide-ranging review of SCM, Chen and Paulraj (2004) defined strategic purchasing and supply management as core elements of the supply chain literature. They identified issues such as supply management, supplier base reduction, relationships and supplier selection as critical to a SCM strategy.

The initial framework for an understanding of the role of purchasing in SCM came in Porter's value chain model (Porter, 2004), in which the primary and secondary activities of the firm were defined. In this model, Porter positioned purchasing as a secondary or support activity. Purchasing in fact has two roles in most organisations, firstly in sourcing direct materials which relate to the core activity of the firm, such as manufacturing inputs. Secondly, it has a role in acquiring indirect supplies, used in managing the firm's support activities, such as office equipment and computers (van Weele, 2007). Today, purchasing is seen as one of the core supply chain processes. The focus on process has been explored by Lambert and Cooper (2000) and Croxton *et al* (2001), who both define SCM in terms of process alignment. Lambert and Cooper (2000: 71) state that "successful SCM requires a change from managing individual functions to integrating activities into key supply chain processes". Croxton *et al* (2001) go further and define eight core processes which operate across the supply chain from tier two suppliers to end consumers. One of these processes is Supplier Relationship Management (SRM), which defines the nature and style of relationships with the supply base.

As the supply chain literature has developed, it is evident that purchasing and interaction with suppliers are at the core of supply chain management and need to be understood as key activities in a supply chain strategy. The positioning of this exposition is within the *purchasing management* domain rather than within the broader SCM definition, although SCM considerations are explored within the findings of the research. Note that in this exposition the terms procurement and purchasing are used interchangeably, as reflected in the literature (European articles use both terms, whilst purchasing is preferred in US articles). The remainder of this review concentrates on purchasing management as the organisational context for e-procurement.

## **2.2 Purchasing Strategy**

Whilst purchasing and the role of suppliers can be seen as a key contributor to a supply chain strategy, there is debate over whether it can be seen as a strategic activity in itself. Ramsay (2001) suggests that it is difficult for procurement to create competitive advantage, therefore it is operational, not strategic in nature. However, Cousins (2005: 422) asserts that the outcome of this discussion relates to the firm's overall direction: "If a firm adopts a cost focused approach to its competitive position it will be unlikely to consider supply as a strategic process, because its competitive priority is to reduce cost..... Whereas if a firm sees itself as a differentiator in the market place, it is likely to take a more strategic view of supply; supply will be seen as a source of competitive advantage through inter-organisation collaboration". Hence purchasing or supply policy relates to the firm's market orientation. This relation of purchasing management to corporate strategy goals has been illustrated

through a framework developed by Nollet *et al* (2005), which shows a hierarchy where supply strategy is determined by overall corporate strategy, and its relationship to other functional strategies such as Marketing.

Outsourcing as a strategic dimension of procurement was advanced through the work on 'make versus buy' by Venkatesan (1992) which suggested the decision to make in-house or to buy from external sources was a purchasing, not a manufacturing decision. Hence purchasing managers should help determine which, if any, internal resources will be developed, versus using outside contractors. McIvor *et al* (1997) describe a model for strategic make or buy decisions, suggesting this requires senior management involvement and input from a broad-based team including purchasing and manufacturing. Balakrishnan (1994) and Cáñez *et al* (2000) also discussed the role of procurement in determining make versus buy decisions. The key factor here is that purchasing functions are responsible for determining the use of external resources and outsourcing, as it is commonly known, constitutes a strategic element of procurement management.

There are more recent factors in relation to global business which also impact on this discussion. Globalisation of markets and competition has driven firms towards internationalising their procurement activity. Many businesses have extended their purchasing from local, through international to truly global supply (Harland *et al*, 1999; Quintens *et al*, 2006). This discussion of local versus global sourcing is an important element of procurement's strategic focus. It can be argued therefore that the decision to outsource and selection of local/global suppliers, and the relationships that support them, are critical to future business success and so represent a strategic contribution (Cousins, 2005).

These two issues of outsourcing and global sourcing are key elements in the strategic dimension of purchasing. There is a third element – segmentation – which is considered in the next section.

### **2.2.1 Segmentation and relationships**

The article by Kraljic (1983) in which purchasing was elevated from a backroom, support activity to 'supply management' has continued to influence thinking on procurement theory and practice to this day. Kraljic's article introduced the concept of segmentation of the supply market, based on the two axes of 'complexity of supply market' and 'importance of purchasing'. Today this is referred to as the risk/value matrix, and the segmentation model has been extended by authors such as Bensaou (1999), Gelderman and van Weele (2002) and Caniels & Gelderman (2005). It is widely employed by practitioners and several cases in Smart (2010a) refer to its use.

Two of the factors in the development of the purchasing department towards a supply management structure, were specified by Kraljic (1983: 116) as: "improved efficiency" and "integration of purchasing systems". In the 1980s somewhat elementary data exchange and systems support were available, but Kraljic's observation foresees an important role in the future for electronic data processing methods. The introduction of web-based e-procurement mechanisms almost twenty years later can therefore be seen as significant in the debate on segmentation and supply management, and an opportunity for research.

Such segmentation models suggest significant influences on the nature of relationships between buyers and their suppliers. In the risk/value matrix, segments are defined on one axis by supply market structure. This refers to both the number

and power of suppliers in the market. Where suppliers maintain a stronger position than buyers, they may dominate the channel and control price; therefore buyers should develop closer relationships with the supplying firms to ensure product availability and attempt to restrict price increases. Conversely, where buyers have a dominant position they can use market competition to achieve leverage over suppliers and reduce price. These opposing strategies have been discussed extensively in the literature and have been described as arms-length/transactional and collaborative/partnership (Leavy, 1994; Parker and Hartley, 1997). Table 3 summarises the features of the two relationship modes.

Features	Arms-length or Transactional mode	Collaborative or Partnership mode
<b>Timescale</b>	Short-term	Long-term
<b>Type of interaction</b>	Transaction-based	Relationship-building
<b>Relationship driver</b>	Power	Added value
<b>Focus</b>	Price	Joint profit
<b>Style</b>	Contractual	Trust-based
<b>Planning</b>	Separate	Shared
<b>Attitude to gains</b>	Win-lose	Win-win
<b>Integration</b>	Minimal	Extensive
<b>Management commitment</b>	Low	High

**Table 3:** Arms-length and Collaborative relationship modes (adapted from Smart, 2010a)

These options are not pre-determined and must be selectively implemented for the buying firm; consequently there are contrasting positions in the literature on how buyers should respond to this choice of relationship modes and the features within them.

An important element in this context is the issue of power, shown in Table 3 as a driver in buyer-supplier relationships. In regard to wielding power, Cox (1999) sees the role of the buyer as exploiting or seeking to dominate the supply market wherever feasible. This approach is also known as 'value appropriation' (Cox, 2001) and is premised on buyers exploiting supply market positions for their own gain. Here, value refers to the available profit within a trading dyad. Ramsay (2004) has demonstrated how power dominates transactions between buyers and suppliers and that it may be impossible to conduct commercial negotiations without power being exercised by one party over the other. The idea of value is examined further by Cox (2004a) where he suggests that firms seek profit through value capture and that this objective is not commensurable with the idea of "win-win" in negotiations. Hence firms should seek to extract maximum profit from transactions with trading partners through "win-lose" outcomes.

Cox (2004b) extended the debate by suggesting that there are more options than the established relationship dichotomy suggests, where arms-length relations can be

non-adversarial, and collaborative ones can be adversarial. This apparent contradiction is explained by his observation that firms seek a relative share of value appropriation in all forms of commercial transaction. Hence an “adversarial collaborative relationship” (Cox, 2004b: 353) exists where a trading partner provides significant linkages or product/service adaptations, but still aims to maximise value appropriation from the contract.

Cox’s arguments are a useful indicator of some modes of buyer behaviour, however he takes a primarily supply-based perspective and ignores the wider SCM issues which may impinge on the relationship mode. Nevertheless, power is a significant factor in the buyer-supplier interface and is considered further in the discussion of the research findings.

### **2.2.2 Partnerships**

The issue of partnering has received considerable attention in the literature since the late 1980s. Such articles began to appear alongside the literature on logistics and SCM, which itself only developed during this period. The debate was influenced by developments in the Japanese economy, and Toyota in particular, where concepts such as JIT, lean and supplier integration were introduced (Womack and Jones, 1998). Dwyer *et al* (1987: 13) described partnership as a ‘relational’, as opposed to ‘transactional’ exchange and suggested that partnerships require a balancing of benefits and costs, by both parties. Spekman (1988) added to the debate by illustrating how both buyers and suppliers need to demonstrate relationship commitment where partnerships are put in place. He also supplied an extensive list of questions the buying firm must answer in choosing partner suppliers. Evidence from Burt (1989) illustrated how working in partnership with fewer, closer suppliers could improve quality and lower costs in the longer term. He cited firms such as Xerox and Polaroid who achieved both of these targets in their supplier partnership programmes.

Blancero and Ellram (1997) observe that pre-1990 the literature on partnerships was mostly conceptual or anecdotal, but during the 1990s more empirical evidence appeared. For example, Larson (1994) demonstrated a relationship between buyer-supplier partnership and both higher quality and lower total costs. The partnership approach was summarised by Carlisle and Parker (1989: 5) who stated that “co-operation between industrial users and sellers is a far more powerful strategy for making them both more profitable in the long term than any adversarial approach yet devised”. This perspective has informed much of the supplier collaboration agenda over the last twenty years.

Whilst this early literature appeared primarily in US articles, by the 1990s European authors were advancing the theme. Hines (1993) considered the issues in materials management and the movement towards partnerships, particularly in a manufacturing environment, demonstrating that the Japanese model could be applied in Europe. Boddy *et al* (1998) describe partnering as an opportunity to remove waste from the supply chain, involving both sides in more open, shared projects and processes. A study of the German engineering industry suggested that although they were increasingly common, the attributes of successful partnerships were not well understood and needed to be developed (Lemke *et al*, 2003).

At the same time, publications have emerged which question the validity of the partnership approach and suggest dangers in its wide-scale adoption. Ellram (1991) analysed the success factors and barriers to partnerships and observed that a key

barrier is whether both sides can obtain benefits that surpass those gained in traditional relationships. Similarly, Anderson and Narus (1991) noted that whilst partnerships had become commonplace, they are not always in the interests of suppliers who may find more profit in the transactional relationship. Kamath and Liker (1994) suggested that partnering could still be affected by the exercise of power, leading to a situation of dependency within partnerships rather than equality. From a UK-based survey, Boddy *et al* (1998: 149) identified six significant barriers to partnering: *underestimating the scale of change; underestimating the turbulence of partnering; unresolved priority conflicts; overreliance on personal relations; cost, benefits and value add not defined; insufficient focus on the long term.*

A significant point was made by Burnes and New (1997) who found that very few real partnerships existed in the research conducted and suggested that partnerships may be more rhetoric than reality. Cousins (1999) in particular cautions against the difficulty of managing partnerships and the increased cost of such relationships. One of the strongest stands against partnership comes from Parker and Hartley (1997) who, using arguments from economic theory, illustrated that the parties involved in partnership may be less likely to achieve a win-win result than those involved in adversarial contracts. Similarly, Forker and Stannock (2000) showed that “there can be a better understanding between buyer and supplier in the ‘competitive’ exchange and that market mechanisms may be a better method of satisfying the needs of contracting firms” (cited in Smart and Harrison, 2003: 258).

The segmentation and relationship positions discussed here offer buyers choices on how to develop and operate supplier interactions - there is no guaranteed benefit from one relationship mode over another. It has therefore been suggested that a combination or range of relationships needs to be established, using a portfolio approach (Gibbs, 1998). From this perspective, the segmentation models (Kraljic, 1983; Olsen and Ellram, 1997; van Weele, 2005) offer an ongoing, valid solution to mixed-mode relationship strategy. As my programme of research began, this issue had not been explored in relation to the new purchasing technology. Hence the advent of electronic procurement mechanisms offered opportunities for research on these segmentation and relationship issues vis-à-vis e-commerce. This gap was explored in the early stages of the programme of research presented in this thesis, principally in papers 1 and 2 and subsequently in paper 6.

## **2.3 Information Technology and Integration**

In tandem with the growth in purchasing and SCM literature, there has been a body of work examining the role and impact of IT in the supply chain. One theme in the supply chain literature identifies the need for integration between members of the chain, proposing inter-firm exchange of information and re-engineering of processes (Lambert, 2004, Croxton *et al*, 2001).

Models of inter-firm integration were developed initially by Stevens (1989) and subsequently by Morash and Clinton (2000). Such models suggest that there are considerable benefits in developing integrated processes and functions with trading partners in the chain, both up and downstream. Handfield and Nichols (1999) suggest the three components in supply chain integration are: information management, inventory management and relationship management. Supplier collaboration and integration have been advocated through the concepts of lean and JIT where suppliers play a key role in supporting a lean strategy (Hines, 1996). The earlier discussion on collaborative relationships highlighted that many firms are looking to integrate strategic suppliers and thereby to create longer-term

relationships, with greater inter-dependency, although it should be recognised that this inter-dependency is not necessarily the same as integration.

In the retail industry, programmes such as Quick Response (Christopher and Juettner, 1999) and CPFR (Andraski and Haedicke, 2003) have used sharing of demand information to achieve benefits such as reduction in lead time and lower inventory holding. Barratt (2003) demonstrated the role of collaborative planning and vendor managed inventory in supporting integration, with both being dependent on mutual access to the trading partner's sales and performance information. The use of point of sale data in retailing has facilitated improvements in order fulfilment levels and availability of product on the shelf (Christopher, 2005). There is also evidence that potential benefits are more likely to be achieved, the deeper this supply chain integration is extended, either towards suppliers and/or customers (Narasimhan and Das, 1999; Krause, 1999; Gilbert and Ballou, 1999). Hammer (2001) proposes that these benefits will come about primarily through re-engineering of processes between firms.

The growth in use of web-based technology facilitates this exchange of information between organisations. In a case study on ABB Controls in Finland, Nurmilaakso and Kotinurmi (2004) describe the use of XML language to enable integration. Kirchner (2004) suggests the adoption of common data standards through initiatives such as RosettaNet (<http://www.rosettanet.org>) will enable greater levels of inter-firm process integration. A further trend is towards systems interoperability: enterprise systems such as SAP can potentially be linked directly between firms, or via middleware, such as WebMethods (<http://www.softwareag.com>), described in detail by Davenport and Brooks (2004). This integration of separate enterprise systems is also known as Enterprise Application Integration (EAI). Puschmann and Alt (2004) describe an EAI project undertaken at Robert Bosch Group, illustrating the systems architecture used in this context. However, it has also been suggested that EAI can bring unexpected difficulties and Sharif *et al* (2004: 166) identify the problem of 'beneficiaries' and 'victims' as a possible outcome of EAI. In an alternative example, the convergence of ERP and SCM applications is described by Tarn *et al* (2002) who suggest that the deployment of these systems in tandem can lead to integration between firms.

Cagliano *et al* (2003) investigate a number of web technologies and suggest that such technology will assist greater integration in SCM, linked to a strategy of collaboration with key supply chain members. One outstanding example of deep integration through technology can be seen in Cisco corporation, where web platforms link the entire order to fulfilment cycle, taking data from customers and processing it through to vendors to create purchase or manufacturing orders (Kraemer and Dedrick, 2002). Cisco offers a rare example of the 'virtual supply chain' where the central or organising firm outsources the majority of physical tasks such as manufacturing and distribution to third parties, retaining a role principally as manager of the flows of information (Chaffey, 2009; Chandrasekar and Schary, 1999).

These examples would suggest that integration between firms can be engineered in a deterministic way, by merely deploying the appropriate technology. Yet there is considerable evidence that supply chain integration is difficult to capture, due to human, cultural and organisational factors. Indeed these factors have been a core concern in much of the supply chain literature over many years. Amongst the first authors to write extensively on SCM, Ellram and Cooper (1993) described the similarities between SCM and the Japanese concept of 'keiretsu'. This concept is "characterised by a strong, central leader, and a limited network of parties with whom the keiretsu participants conduct business" (p. 5). The parties involved in such commitments must have strong process integration. Similarly Cooper and Ellram



(1993) suggest firms who wish to create a successful, integrated supply chain need to share similar corporate philosophies and cultures. These factors support necessary outcomes such as joint planning and sharing of risks and rewards. Sharing benefits from channel integration was also posited by Ballou *et al* (2000) as an important supply chain objective. Lambert and Cooper (2000) stress the need to move from the management of individual functions to the integration of key supply chain processes, but suggest compatibility of corporate cultures is imperative for success. However, such outcomes have been shown to be difficult to achieve.

In a detailed investigations of organisational factors, Akkermans *et al* (1999) identified that functional silos were one of the principal blockages to the integration agenda, creating embedded 'roadblocks' in the organisational structure and culture. It was demonstrated by Fawcett and Magnan (2002) in a survey of US firms that inter-firm integration was actually quite rare. One of the key barriers they identified was internal functional conflict. They state "finding a supply chain where seamless value-added processes are managed from the 'supplier's supplier to the customer's customer' remains an elusive challenge" (p. 354). In a study of fourteen European firms, Bagchi and Skjoett-Larsen (2002) noted several significant barriers to integration including weak leadership, concern by managers over loss of control, and the need for a 'prime mover' in the supply chain who can drive forward the integration agenda.

Even where integration is a desired outcome, Fawcett *et al* (2007) established that systems incompatibility, problems of implementation, and levels of connectivity all hindered the integration agenda. In a subsequent study, Fawcett *et al* (2008) identified several cultural barriers to implementing effective SCM, including lack of trust, unwillingness to share risk and reward, inflexible systems and processes, lack of training and resistance to change. Further barriers to achieving integration have been identified as: fear of technology, organisational structures, yielding sovereignty and resistance of people (Fawcett and Magnan, 2002; Barratt and Oliveira, 2001; Frohlich, 2002).

There is a strong theoretical argument for greater supply chain integration, yet this outcome is clearly inhibited by a range of technical and organisational factors. The issue is complicated further by the lack of a coherent consensus on what supply chain integration actually entails. Paper 4 explored this issue at length and proposed that the components of integration should be the subject of more research in order to clarify the critical, influencing factors (Smart, 2008). One explanation for this continuing confusion is that researchers have allowed themselves to believe that the arrival of web technology somehow has removed these organisation-level barriers.

The issue of e-procurement specifically has yet not been discussed, but my early research into this area suggested a need for exploration of the integration issue in relation to e-procurement and the various mechanisms which it incorporates. In effect, we need to understand how, if at all, e-procurement will assist in this move towards integration between buyer and supplier firms. This represents an interesting gap for investigation. The context for this will be discussed in the following sections which look specifically at elements of the e-procurement literature.

## **2.4 Electronic commerce and e-procurement**

Since the introduction of commercially viable computers, both industry and government have sought ways to use information to improve processes, lower costs and raise productivity. One of the earliest form of electronic commerce to be widely

adopted was electronic funds transfer (EFT) between banks, using proprietary networks. These systems formed the basis for the millions of transactions now undertaken every day with credit cards and other forms of electronic payment (Kalakota and Whinston, 1997). In the airline industry, electronic reservations and ticketing systems were developed and connected between carriers and travel agents, to lower the cost of doing business and to improve customer service (Malone *et al*, 1989).

In the 1980s, the growth of personal computers was followed by electronic mail and messaging and business use of electronic data interchange. These EDI systems were based on telecommunications infrastructure and allowed users to create their own bespoke networks to exchange information. Such networks were developed in a range of industries including automotive, chemicals and aerospace, where large corporations used EDI to communicate with suppliers (Mukhopadhyay *et al*, 1995). However as EDI was based on private networks, requiring outlays to build the system and further costs every time a new member was added, it contained financial and operational limits on its expansion (Kalakota and Robinson, 2001).

Internet technology facilitated significant growth in information exchange, with both ease of access and cost of use being vastly reduced (Chaffey, 2009). New forms of electronic or web-based commerce evolved which allowed firms to move beyond communicating in dyads and to instigate network or virtual organisations (Borders and Johnston, 2000). Similarly there was growth in the role of intermediaries who could offer value-based propositions, through network efficiencies (Kalakota and Whinston, 1997). In consumer terms, the major impact of the web has come in online retailing and electronic distribution of media (de Kare-Silver, 2000). As a consequence of these many developments, commentators began to expound on how e-commerce would revolutionise business. This enthusiastic approach to e-commerce led to an internet 'bubble' which lasted a few years from 1999, with the swift growth and demise of erstwhile internet entrepreneurs, some offering unsustainable or dubious business propositions. Porter (2001) challenged much of this speculation by stating that the internet does not change fundamental approaches to strategy and that firms need a suitable strategic evaluation before entering into e-commerce projects. More recently there has been a return to basics and particularly in the business-to-business arena firms began to consider investments which could offer specific benefits and payback, such as e-procurement.

Within the field of electronic procurement, there has been a proliferation of definitions and models to describe the technology and where it fits within supply chain and/or purchasing management. Starting with the broader definitions, Kehoe and Boughton (2001) offer a taxonomy of supply chains, illustrating where internet technologies sit in this schema. However, this is a high level classification where electronic procurement is seen as a generic application. Similarly, a model of 'internet-enabled mechanisms and information flows' by Garcia-Dastague and Lambert (2002) offers generic definitions such as 'information hubs' and 'purchasing aids', which are defined as either 'coordination flows' or 'market mechanisms'. In reality some of the definitions they offer can operate as *both* coordination *and* market mechanisms. Cullen and Webster (2007) define a model of B2B commerce based on the number of suppliers and buyers participating in each activity, but this includes a range of internet mechanisms and does not define them specifically in procurement terms.

Amongst the more useful examples, Croom and Brandon-Jones (2007) categorise e-procurement into six 'structures' based on how the transaction or interaction between buyer and seller is organised, through technology and purchasing consortia. This categorisation has the advantage of accurately reflecting the role of the applications

or solutions being deployed. Rajkumar (2001) simplifies this approach further by defining four technologies: e-procurement; e-catalogues; auctions and marketplaces. Probably the most useful summary is by Davila *et al* (2003) who provide a more specific definition of the applications, citing four 'models': e-procurement software (which relates to buy-side applications in Table 1); market exchanges; B2B auctions; purchasing consortia.

There are however some confusing definitions in the literature. A classification is offered by de Boer *et al* (2005), citing six forms of e-procurement: e-MRO; web-based ERP, e-sourcing; e-tendering; e-reverse auctioning; e-informing. This classification is not particularly helpful as it separates out activities which are part of the requisitioning process (tendering and informing) and which should be classified under e-RFX applications. Quayle (2005) builds on this confusion by taking this six-level definition and citing alternative sources for its origin. The most serious instance of inappropriate definitions comes from Wang *et al* (2004) who propose 13 'applications' in e-procurement. Their definition includes: *plan and schedule production, achieve cross-functional coordination, collaborate with suppliers on product design issues, develop an integrated supply chain*. However these four examples are not actually applications, they are internal-to-external processes which often involve more than just a procurement perspective. Such definitions add confusion to what e-procurement encompasses. To compound the problem, this definition has been adopted by Percy and Giunipero (2008) and Percy *et al* (2008) and used as a basis for a survey of over 1000 US companies to establish their usage of e-procurement. Their findings have to be viewed with caution, given the doubtful definitions on which they were founded.

None of the definitions found in the literature are sufficiently precise. Most of them describe applications out of their context and some even include activities or processes which are not specific to procurement management. The situation is a concern as it is evident that some of these models are theoretical and not grounded in how e-procurement applications are used (although this has not prevented them from being cited by a number of subsequent authors).

From the foregoing debate there was clearly a need to classify e-procurement applications in their proper organisational context, to enable a more accurate understanding of how they are specified and used in practice. My own definition of e-procurement applications was provided in chapter 1 (Table 1), as used in papers 5 and 6. In this table, e-marketplaces are seen as a generic solution. However segmentation of the e-marketplace model allows usage of alternative modes of interaction, which are explored in section 2.4.2. Online purchasing consortia are often classified as e-procurement mechanisms, but they have not been investigated within this programme of research. These are not in reality applications at all and are more accurately classified as industry alliances which deploy the web as their channel of communication with suppliers.

#### **2.4.1 E-procurement themes**

A number of articles addressing e-procurement in a broad sense have appeared since 1999, which have moved forward the subject and identified areas for research. The core literature themes on e-procurement technologies have been:

- adoption (Batenburg, 2007; Gunesekeran and Ngai, 2008; Percy & Guinipero, 2008);
- success factors (Puschmann & Alt, 2005; Angeles & Nath, 2007; Smeltzer & Carter, 2001)

- implementation (Shakir *et al*, 2007; Croom & Brandon-Jones, 2007);
- barriers (Angeles & Nath, 2007; Hawking *et al*, 2004; Tanner *et al*, 2008;
- supplier issues (Deeter-Schmelz *et al*, 2001; Davila *et al*, 2003);
- integration (Shakir *et al*, 2007; Angeles & Nath, 2007).

The potential benefits of e-procurement have been well documented, covering issues such as process improvement, price reduction, shorter purchasing cycles and compliance to contract (Tatsis *et al*, 2006; Ash and Burn, 2003; Lancioni *et al*, 2003, Presutti, 2003). Whilst this literature continues to develop, most of the evidence comes from conceptual papers or from surveys, with little qualitative or case evidence being put forward.

A weakness of many of these articles is that they consider a range of mechanisms under the e-procurement heading, without dealing necessarily with the role and impact of those individual applications. Frequently, e-procurement is treated as a generic subject and as shown in section 2.4 above this has led to some weak or confusing definitions of the technology. In the contributing papers and in this exposition itself, it is shown that these mechanisms do indeed impact on the organisation in different ways. In particular, reverse auctions and e-marketplaces have defined streams of research and these are discussed in more detail in subsequent sections of this chapter.

In consideration of the factors which influence buyer-supplier interaction, paper 6 provided a detailed review of relevant literature and identified seven core buyer-supplier themes. These are: Communication; Integration; Compliance; Price; Supplier numbers; Supplier resistance; Relationships (Smart, 2010b). For a detailed discussion of these themes, the reader is referred to paper 6, pages 424-428. These themes are examined further in chapter 4 of the exposition, where the findings and conclusions from the research are evaluated under thematic headings.

#### **2.4.2 E-marketplaces and exchanges**

From the 1980s, when organisations began to expand their use of IT, a number of theories were advanced which sought to explain how interactions with suppliers would be affected. This literature examined the potential impact of trading through electronic markets.

The electronic trading concept was explored by Malone *et al* (1987) who discussed the role of electronic markets and electronic hierarchies. Their definitions are based primarily on the work of Williamson (1975) on transaction cost economics. In this definition, *markets* refers to trading in open, competitive marketplaces characterised by fluctuating supply and demand where there are multiple interactions between buyers and sellers, affecting price, quality design etc, and these market forces offer buyers choice and competition. In *hierarchies*, managerial decisions, rather than market forces, influence supplier selection and here firms choose to procure from a specified source or sources, which may be either vertically integrated, or externally owned. The authors outline the trade-off between *production* and *co-ordination* costs in acquiring products and services. In markets, production costs are low and co-ordination costs are high; in hierarchies the opposite applies. What Malone *et al* (1987) determine the 'electronic integration effect' applies when IT is used to speed up communication, save time and reduce errors. Within electronic trading, they provide an argument for a move towards greater *market* interaction due to its significant reduction in costs of co-ordination. In a subsequent paper, Malone *et al*,

(1989) predicted a growth in electronic markets through: a) the power wielded by major corporations over suppliers, requiring them to transact electronically through databases or catalogues; b) sector-based associations or groups establishing electronic communities on a collaborative basis.

Taking the idea of markets and hierarchies one step further, Clemons *et al* (1993) established the 'Move to the Middle' hypothesis. This theory supports the concept of greater outsourcing as suggested by Malone *et al* (1987) but suggests that buying firms will establish a longer term relationship with a smaller cohort of suppliers. Subsequent research by White *et al* (2004) supported this claim with evidence that buying firms operating in an exchange had established closer relationships with fewer suppliers.

Bakos (1991) proposed that electronic markets provide opportunities to reduce search costs, resulting in efficiency gains through reduced cost of intermediation, as well as greater allocation efficiency for buying firms. He also usefully outlined how such markets favour buyers by potentially reducing suppliers' profits and their market power. Thus suppliers may oppose the introduction of e-markets as they lead to greater price transparency. Evidence for reduced transaction costs was developed by Strader and Shaw (1997) who noted that internet or electronic markets could eliminate much of the traditional cost of transaction by automating the entire order fulfilment process. This change could bring cost benefits to both buyer and supplier.

Bakos and Brynjolfsson (1993) established that whilst firms may benefit from reduced transaction cost with a wider pool of suppliers, there are alternative 'incentives' which would drive them towards reducing supplier numbers, such as innovation, information sharing and responsiveness. This links to the theory from the procurement literature discussed earlier, which suggests there are benefits to buyers from closer supplier collaboration, resulting in fewer supplier numbers.

The idea of *intermediation* has been discussed in relation to the role of electronic markets. Bailey and Bakos (1997: 12) suggest that their role is to offer important services such as aggregation, ensuring market integrity, matching buyers and sellers, and providing market information. In addition to effective intermediation, Bakos (1998) argues that internet markets have an impact on price through factors such as personalised product offerings, price transparency, electronic payment and improved facilitation such as logistics. These services and benefits can create the basis for a business case for electronic markets.

The articles discussed here considered e-markets from a theoretical perspective or only provided limited evidence, based on examples from industries where there had been electronic transactions, such as airline reservation systems and capital/financial market trading. Clearly the arrival of the internet could not be foreseen, yet the advent of web-based marketplaces became a major phenomenon in the years from 1999 to 2003. Over this period, there were regular announcements of new exchanges, often launched with much fanfare by major corporations (Whitaker *et al*, 2001). Many of these entities failed to get beyond the start-up stage and relatively few survived to become viable businesses (Wise and Morrison, 2000). The reasons for this shakeout in e-markets were evaluated by Day *et al* (2003) including: withdrawal of capital, lack of critical mass in transactions, scepticism of participants, technology problems and excessive competition within market sectors.

As this development in e-markets was taking place, commentators were observing segmentation within the sector and several taxonomies of markets were put forward (Kaplan & Sawhney, 2000; Whitaker *et al*, 2001; Laseter *et al*, 2001). Daniel *et al*

(2004) and subsequently Sharifi *et al* (2006) summarised the marketplace segments as third party/independent (operated by parties independent of buyers and suppliers); consortium/coalition (owned by the participant firms) or private (formed by a single company). Similarly, marketplaces have been classified according to their market focus i.e. vertical - within an industry, versus horizontal - across multiple industries (Kaplan and Sawhney, 2000). Marketplaces from both independent and consortium categories were obliged to establish alliances with competitors and White and Daniel (2004b) identified the key reasons for market consolidation as: the need to increase access to users, to increase the range of services on offer, and the facilitation of trading across tiers in the supply chain.

A further theme in the literature has been the role of electronic marketplaces in managing elements of the supply chain more effectively. Grieger (2003) suggested this concept had been overestimated as much of the initial marketplace literature focused on buying and selling, or on transactional elements only. Levels of collaboration within supply chains are discussed by Wang and Archer (2004) who suggest that the most advanced forms of inter-firm collaboration are not well suited to public e-markets, and should be pursued through private exchanges. Cisco corporation is an example of how a private exchange is used for this purpose (Kramer and Dedrick, 2002). A survey by Eng (2004) revealed that in the food industry, where participation by firms was widespread, e-markets were used for transaction and procurement activities, rather than the more strategic elements of supply chain management. A similar survey by Grey *et al* (2004) established that introduction of supply chain level activities was limited as both buyers and suppliers could not identify sufficient benefits in participation.

In contrast, Rudberg *et al* (2002) propose that e-markets can be suitable for facilitating collaboration in the supply chain and identify several processes which can be managed in this way, including collaborative demand planning, transportation planning and performance management. Electronic hubs such as Elemica have since been established whose role is to assist supply chain managers in optimising assets in transport or warehouse management (<http://www.elemica.com>). Finally, the issue of buyer-supplier relationships has been addressed, with Skjoett-Larsen *et al* (2003) proposing the use of different types of e-marketplace according to the procurement strategy of the buying firm. White and Daniel (2004a) revealed in their cases on deployment of a marketplace in the healthcare sector that the number of suppliers used was reduced, leading to deeper relationships with a smaller group of supply firms.

When my research explored e-marketplaces, literature in this field was still emerging and propositions were yet to be supported with empirical data. Hence a general weakness in the relevant literature was the untested, theoretical nature of many of the propositions. Genuine empirical studies have been few in number as many of the erstwhile marketplaces have ceased trading, or radically reduced the scope of their operations. Papers 3, 5 and 6 explored use of e-marketplaces and those findings are discussed within the thematic structure of chapter 4. Similarly, the theory on markets and hierarchies is considered in the final chapter, in relation to my empirical findings.

### **2.4.3 Reverse auctions**

In addition to facilitating transactions, electronic marketplaces were providers of reverse auction technology, which was seen as one of the more controversial tools to emerge within e-procurement.

In a traditional forward (or English) auction, a product is offered to interested buyers who bid competing, upward prices until a final sale price is reached. In theory there is no upper price limit as buyers will pay whatever they consider an appropriate price. Already widespread in the internet world since the 1990s through sites such as eBay, such auctions are also used in business to business markets for liquidation of excess inventory or unwanted assets. In the online reverse auction (ORA), the process effectively operates from the opposite direction, where the offer is created by a buyer who invites suppliers to tender for a sale or contract using specific parameters. Such events take place online, in real time, where suppliers (the bidders) can participate remotely via a secure web link. These events were feasible prior to the internet and were originally established by the US firm GE, in a limited format, as part of its purchasing policy in the 1990s (van Heck and Vervest, 1998). With the widespread adoption of the web as a communications and purchasing channel during the 1990s, employees from GE went on to set up the first public online reverse auction company, named Freemarkets in 1999 (Emiliani, 2000). From small beginnings, these events have gone on to be used for a diverse range of products and services and have become widely adopted as a buying mechanism in major organisations (Smart and Harrison, 2002).

A number of articles have dealt with the technical or internal process factors such as selection of items, number of bidders, bidding tactics, contract award steps etc. (Emiliani, 2000; Jap, 2002; van Weele, 2007). Whilst these are interesting areas, they are not specific to the issue of relationships between buyers and suppliers. These factors have been ignored in this review, which focuses on the strategic and relationship impacts of auctions.

Benefits and disadvantages of auctions have been widely explored. In probably the first published academic study, Emiliani (2000) established that reverse auctions contribute benefits through time compression and process improvement, by reducing the cycle time for undertaking competitive bids with suppliers: the traditional process can be reduced from months to weeks. This article further suggested there were benefits to buyers through identifying market price, providing low cost access to suppliers and in gaining savings up front. Other important advantages of auctions have been identified such as creating real competition between suppliers leading to lower prices, (Wagner and Schwab, 2004), and the process being easy to reproduce once established (Arnold *et al*, 2005). Similarly, suppliers can be included from global sources at no extra cost (Hartley *et al*, 2004).

One important disadvantage of auctions can be that not all products are suitable – they need to have a clear, simple specification - thus ORAs are unsuitable in supplier-controlled markets or in situations of constrained supply (Smeltzer and Carr, 2003). In this regard, segmentation models have been proposed, suggesting how ORAs can be deployed within a portfolio approach (Van Weele, 2007; Smart and Harrison 2002). Consequently, auctions may have a specific role within procurement strategy rather than being suitable as a broad solution. Amongst other disadvantages, it has been suggested that suppliers may be suspicious of buyer motives (Jap, 2007), that some suppliers will be less committed to the buyer using ORAs (Tassabeheji *et al*, 2006) or they will be forced to drive down quality as a result of lower sales prices (Smart & Harrison, 2003). It has also been found that in some cases, suppliers employed retaliatory tactics against buyers using auctions, such as increasing their prices whenever possible (Emiliani and Stec, 2005), or giving the buyer lower priority in future orders (Tassabeheji *et al*, 2006).

The literature has identified that suppliers also can benefit from the reverse auction mechanism in a number of ways. ORAs provide visibility of competitors prices not

usually available in traditional tender methods, access can be gained to new customers and they may reduce the cost of sales (Smart & Harrison, 2002; Caniels and van Raaij, 2009). Suppliers may gain benefit from the streamlined process and reduced cycle time (Emiliani, 2000; Smeltzer and Carr, 2003). Some suppliers like the 'level playing field' of the ORA, where all suppliers are treated equally (Carter *et al*, 2004, Smart and Harrison, 2003). Conversely there have been several disadvantages cited for suppliers such as major price reductions (Emiliani and Stec, 2002) and the inability to emphasise factors which can differentiate products, leading to potential commoditisation (Jap, 2003). Existing or incumbent suppliers are usually the most antagonistic to ORAs as they have the most to lose from such events, particularly where they are exposed to new, lower cost competition (Jap, 2003, Tassabehji *et al*, 2006).

The issue of relationships between buyers and suppliers has been examined in a number of studies of ORAs and here again the evidence is mixed. In particular Giampietro and Emiliani (2007) have provided evidence where suppliers were seen to be treated unfairly, which damaged the reputation of the buyer. In another study suppliers expressed concern that buyers might insert phantom bids from non-existent suppliers, or that some vendors could be invited simply to drive down prices, when the buyer had no intention of using them (Jap, 2002). Griffiths (2003) outlines how auctions can create havoc with supplier trust through factors such as inviting unsuitable suppliers to the event, using 'dummy' suppliers or not providing full information to all participants. Such fears reflect genuine moral dilemmas faced in ORAs, where the buyer could be accused of unethical behaviour. However it should be recognised that it is not the auction mechanism itself which is unethical, as suggested by Giampietro and Emiliani (2007). In fact Griffiths (2003) suggests that blaming an auction event for a damaging outcome is like blaming a vehicle for a road accident, rather than the driver. Interestingly, Carter *et al* (2004) found that some suppliers continued to suspect unethical behaviour by buyers, even when the issues of concern had been given full discussion and transparency into the process was provided.

In a study in the US automotive industry, Jap (2003) found that using ORAs increased supplier suspicion of opportunism by buying firms. In independent studies by Emiliani and Stec in 2004 and 2005, separate groups of supply firms suggested their relationships with buyers were less cooperative as a result of ORA deployment. Conversely, Smart and Harrison (2003) and Carter *et al* (2004) revealed that most suppliers saw ORAs as a fairer process which gives greater transparency both in the bidding activity, and the awarding of the contract. More recently, Caniels and van Raaij (2009: 14) have suggested that these different findings may be explained by "characteristics of the supply market, the supplier firm and the individual that presumably lead to favourable supplier opinions" (about ORAs). Hence, not all supply markets will respond to auction usage in the same way.

Certain authors have looked at the broader issue of SCM and how auctions affect supply chain operations. Emiliani (2000) suggested that buyers using ORAs did not understand supply chain management and the principles of lean management. Consequently the deployment of auctions by such firms and an inappropriate focus on price factors, could damage their supply chain performance. This was supported in Emiliani and Stec (2001) who found that contracts resulting from ORAs worked against suppliers' ability to develop lean practices, whilst a subsequent paper (Emiliani and Stec, 2002) provided evidence that buying firms' total cost of ownership (TCO) was negatively affected by auctions. To counteract this risk, Jap (2003) suggests that auctions should only be used for indirect or non-production items, where relationships are less important.



There are some common findings in these studies such as the process improvement and time compression created through ORAs; visibility of pricing to suppliers; competitive nature of the events; potential for unethical behaviour; impact on the supply chain and inability of reverse auctions to cater for all categories of spend. However there is contradictory evidence on the impact of auctions on relationships between buyers and their suppliers, and on how suppliers respond to ORA deployment by their customers. In particular the evidence put forward by Emiliani in several papers cited above, appears to be driven by a conviction that ORAs are fundamentally damaging. However, the evidence from a range of studies supports a role for auctions within purchasing management and the complexity of this issue needs further exploration.

The uncertainty about a new and largely unexplored phenomenon at the time of my research created the opportunity for a new vein of investigation and was explored in papers 1 and 2. At the time of the design of that study, there were few publications documenting reverse auctions, but subsequently a body of work has developed. Some of the gaps originally identified have been explored, however investigation of this domain is still at an exploratory stage. The later chapters in this exposition will position the author's work within this continuing debate.

## **2.5 Summary**

From the foregoing review, it can be postulated that what has been missing from the literature is a clear articulation of the nature of the relationship between information technology and purchasing management. There are explanatory theories such as markets versus hierarchies (Malone *et al*, 1989) and the move to the middle (Clemons *et al*, 1993), which suggest how firms will use information technology in relation to the way they procure from suppliers. Similarly there are hypotheses on how such technologies as e-procurement can contribute to integration in supply chain management. There is emerging evidence in particular from cases on e-marketplaces and reverse auctions, but there are conflicting results from these studies in relation to how purchasing management will be affected. In effect, how the range of mechanisms under the heading of e-procurement influence purchasing activity in practice remained an area to be explored.

One particular theme which remains largely unevaluated is the relationship between these applications and purchasing strategy, which ultimately defines relationship types with suppliers. Indeed, many of the papers on e-procurement are written from an IT or systems perspective where the authors do not overtly discuss elements of procurement policy and management. The limitation of such studies is that they treat procurement operations as a dependent variable, which in diverse ways is influenced by the independent variable of e-procurement applications. This approach pays scant attention to the development of theory from within purchasing and supply chain management. Propositions from the e-procurement literature need to be evaluated against the purchasing and supply chain literature domains, where the buyer-supplier relationship is a core thematic principle. This is an important omission and this gap is addressed in this exposition. Hence this work builds on existing propositions by establishing examples from practice, and moving on to develop a model for managing these resources more effectively.

### 3. Methods

The research projects reported in the six papers contributing to this exposition were all undertaken using a case study approach. In this chapter the case method is positioned within SCM research and the rationale for this choice is elucidated.

#### 3.1 Overview

The issue of methods and methodology in purchasing and SCM has been the subject of fierce debate during the 2000s. Journals such as *Supply Chain Management: An International Journal* and the *Journal of Supply Chain Management* have produced special editions on this topic. Particularly in the USA there has been a traditional emphasis on modelling and theoretical research, with only more recently a growth in use of empirical methods. The debate between the two 'camps' has been described as "the Modelling-Empiricism Gap" (Belk, 2009; Meredith, 2009). In Europe, the need for more empirical research, both qualitative and quantitative, has been recognised and this mode of research is now well established, both through the conference circuit and in the academic journal titles. The need for research which contributes to practice is similarly a concern and has been commented on as closing the 'research-practice gap' (Carter, 2008). The emphasis in my programme of research has been on providing empirical results relating to the phenomena being studied, particularly using company exemplars of practice, which as well as developing the academic domain, can in turn feed back useful guidance to practitioners.

#### 3.2 Methodology

It is useful at this point, to clarify the difference between methodology and methods. Ramsay (1998: 163) has described methodology as "concerned with the analysis of how research should be undertaken or how it can proceed, in other words, the study of the means of attaining knowledge of the world, rather than the techniques of research or practice themselves". Thus research methods are the techniques and procedures used within an overall methodological stance, based on assumptions and values the researcher possesses. These assumptions are usually defined within the orthodoxy of ontology and epistemology. Blaikie (1995:6) has defined these terms as follows:

Ontology is "the claims or assumptions that a particular approach to social enquiry makes about the nature of social reality", in other words "claims about what exists, what it looks like, what units make it up and how these units interact with each other".

Epistemology is: "the claims or assumptions made about the ways in which it is possible to gain knowledge of this reality, whatever it is understood to be; claims about how what exists may be known".

In explaining the link between methodology and methods, Hughes (1980: 11) has suggested that the one determines the other: "no technique is self-validating; its effectiveness, i.e. its very status as a research instrument making the world tractable to investigation, is, from a philosophical point of view, ultimately dependent on epistemological justifications". This view has developed after Morgan and Smircich (1980: 491) who suggest that "the choice of a method embodies a variety of assumptions regarding the nature of knowledge and the methods through which that

knowledge can be obtained". Hence, within this orthodoxy, the researcher should state their philosophical position as a basis for developing appropriate research methods.

Despite this widely-postulated prescriptive approach, much published operational research does not state specifically its philosophical position and in the majority of articles published within supply chain management research, it is rare to see an overt discussion of these issues. Methods are often justified in relation to the specific research questions and objectives which have been established, usually from the recognition of a research gap, or as part a continuing research programme, developed from, or within, the relevant domain of literature. In this regard, it has been suggested by Lakatos (cited in Pojman, 2003: 500) that research programmes are necessary, as "the typical descriptive unit of great scientific discoveries is not an isolated hypothesis, but rather a research program".

Similarly, the emphasis on a pre-determining epistemological stance has been challenged. Connell and Nord (1996) have discussed the opposing epistemological positions in the USA and UK and described them as 'paradigm wars'. Their argument suggests that there is "uncertainty on questions of ontology and epistemology and recognition that values play an important role in determining the field's content" (page 408). They propose an alternative *agnostic* approach, which rejects the ontological/epistemological tradition and expresses uncertainty about what represents external reality and our relation to it.

The tradition has been questioned further by Edmondson and Mcmanus (2007) who suggest that rather than follow from an epistemological stance, research should be established based on the state of prior theory. They propose a framework for research methods, based on *methodological fit*, where the research approach is determined by whether the domain under investigation contains theory which is *nascent*, *intermediate* or *mature*. They demonstrate that methods should be established in accordance with this level of maturity and that for instance, at the nascent level, research will need to open-ended, exploratory, and seeking evidence of relevant constructs. This approach is a critique of the route taken in much of the research conducted in North America, where theory testing and statistical verification methods are used at an early stage in development of a phenomenon, when the academic community should be employing qualitative techniques to construct meaning and create a basis for further, theory-testing investigations. In other words, much quantitative research, based on researchers' epistemological convictions, is incorrectly focussed or takes place before there is any robust theory for testing.

Bryman (1989: 253) also questions the relationship of methods to epistemological stance and suggests that "methods do not bring a trail of epistemological presuppositions in their wake. Each method should be appreciated for what it is: a means of gathering problem-relevant data". He goes on to describe the advantages of qualitative research methods over quantitative ones, including: greater flexibility, easier access to hidden areas of organisations, better at generating new ideas and concepts. Finally, Ramsay (2007), looking specifically at purchasing and supply chain management research, discusses the dangers of extremism in methodological debate and suggests both qualitative and quantitative analysis is required. He further states that in this domain, humans have significant input to the processes and therefore phenomenological approaches have a strong role in investigating the field.

My initial research design drew on the grounded theory methods of Glaser and Strauss (1967), through needing to take an open, exploratory approach to a phenomenon where little prior research had been conducted. Subsequently my

orientation has moved more towards the Realist paradigm as described by Bhaskar (1978). According to Blaikie (1995: 98), “the aim of Realist science is to explain phenomena with reference to underlying structures and mechanisms”.

The production of practical outputs from the research has been a further driver. This research has sought to influence practice and provide feedback to the participant firms and respondents through reports, presentations and workshops. Indeed, providing participant firms with outputs from the research which can be of practical benefit has been one of the criteria throughout. It has been suggested that a researcher’s preferred research techniques may well be linked to their underlying beliefs or assumptions (Morgan and Smircich, 1980). Consequently, it is apparent that my own *interests and values* (Connell and Nord, 1996) have played a large part in determining the methods employed.

In this research, the approach to data and theory has been based on abduction, where accounts of organisational phenomena are interpreted from narratives given by the actors themselves (Blaikie, 1995). The role of the researcher in this style of research is to investigate organisational phenomena and to identify relationships and provide explanations. Typically, these type of organisational interactions need to be explored in detail with the appropriate participants and stakeholders, when examining a new or emerging phenomenon (Yin, 2003).

### **3.3 Case research**

When this programme of research began the subject of e-procurement was at a very early stage of development, with almost no published articles in this field. Available reports emanated from consultants and software companies who were usually promoting e-procurement technologies and were therefore unreliable sources. There was an evident lack of empirical evidence in relation to e-procurement and how it was being deployed by organisations. Edmondson & McManus (2007: 1174) state that “work that focuses on validating a new construct and understanding how it functions (a process orientation) is likely to be conducted with qualitative methods.” For this reason, the approach selected in conducting the investigation was qualitative and specifically case based. Case studies are a suitable research approach when undertaking exploratory work or when knowledge is at this preliminary stage (Eisenhardt, 1989). Eisenhardt & Graebner (2007: 26) propose “since it is .....deeply embedded in rich empirical data, building theory from cases is likely to produce theory that is accurate, interesting, and testable”. Hartley (1994) suggests that in truth case studies are not a method but more a research *strategy* which can deploy both qualitative and quantitative techniques.

There are seen to be weaknesses in case study research such as lack of rigour or reliability, and its inability to address issues of generalisability (Hartley, 1994). Equally, case research may fail to adequately explain how data were collected, how they were analysed and what process was used to validate findings (Stuart *et al*, 2002). However, these concerns can be addressed by following published examples of good practice in case research (Dubois and Araoujo, 2007) and by a clear and well documented process (van Weele, 2007). It is also suggested that case studies are one of the best ways for researchers to ensure they make valid observations and contributions to knowledge in management research (Stuart *et al*, 2002). In particular, Yin (2003) observes that case studies allow the exploration of issues of causality in greater detail.

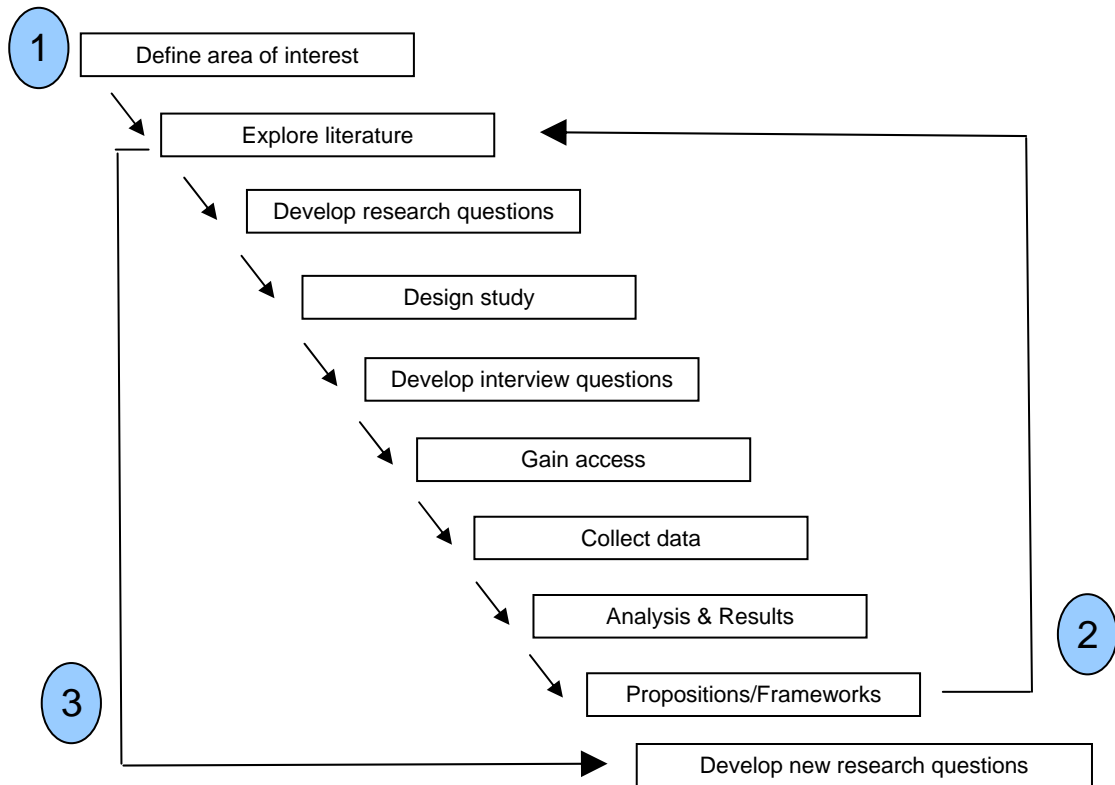
The value of cases is often in the opportunity they bring to explore social phenomena in depth and detail with actors who have valuable experience of the constructs we wish to investigate. However, cases will not provide complete explanations of a function, process or phenomenon, but add to the repository of knowledge and theory within a domain of research. Dubois and Araujo (2007: 178) state that cases “often add incrementally to the provisional and fallible knowledge we have about the world, rather than broad generalisations from one study. In this sense, research tasks are more about leveraging and extending our knowledge as well as revising prior understandings in the light of new knowledge”.

Multiple case studies are seen to be more rigorous than individual cases (Eisenhardt, 1989) as they allow more reliable generation of theory. Similarly, it has been suggested that adding three extra cases to an individual case allows four times the power of analysis (Eisenhardt & Graebner, 2007). However some authors support the single case study as it can be highly revelatory and will stand alone if the findings are sufficiently impressive. For instance, Siggelkow (2007) gives the example of the talking pig – you only need to find one case to prove you have something interesting.

In this programme of research case studies were used to allow an exploratory approach to an emerging or *nascent* phenomenon (Edmondson and McManus, 2007). As knowledge developed, some of the ideas or underlying propositions of the early work were explored further in subsequent papers. In effect, findings early on informed research questions for later exploration. Hence the research presented in this exposition has been case-study based, relying primarily on qualitative approaches.

### **3.4 Framework for research**

The research reported here evolved over time and was based on a number of separate or discrete projects, within the overall theme of e-procurement. Methods used in the initial enquiry were developed or expanded upon in subsequent field research, as discoveries led to further ideas and possible research questions. The Framework in Figure 3 below illustrates the approach taken and is based on a model from Edmondson and Mcmanus (2007), who suggest that field research is an iterative and cyclical process, where the subject is constantly re-visited.



**Figure 3:** Framework for case study research (adapted from Edmondson & McManus, 2007)

### 3.5 Interviews and coding

Case studies can be conducted using a number of approaches, and as suggested by Hartley (1994), they may be seen as a research *strategy* which uses both quantitative and qualitative data. The research undertaken on auctions in papers 1 and 2 was conducted at the introductory phase of this mechanism and so historic record analysis or quantitative data collection were not feasible. As discussed above, (section 3.3) an exploratory approach was required to understand and begin to explain the contextual role of auctions and their impact within the buyer-supplier interface. In this initial study, observation of auction events and interviews were used to obtain participants' perceptions of the phenomenon. In later studies, interviews were supported by additional data collection methods such as Likert surveys, response counting, access to company performance data and presentations, or observation through company training or communication sessions.

Interviews can be structured, semi-structured or open in form according to the objectives of the researcher (Easterby-Smith *et al*, 2009). The approach in my research was to use semi-structured interviews, to enable a focus on specific issues, but allowing the respondents to talk around the subjects, and to create rich data on their experiences. This follows from Kvale (1996) who proposes that information from interviews needs to capture interpretations of events or phenomena, reflecting the worldview of the informant. In approaching interviews, Jones (1985) suggests that researchers will prepare some key questions, which are likely to change and develop as the research moves on, and as new themes are revealed. This reflects my own approach, where each study created greater understanding of the topic and subsequently allowed a more focussed discussion with respondents on core issues.

Interviews may produce problems of analysis, as the interview transcripts may be lengthy. These data need to be subject to careful scrutiny and interpretation, which is largely achieved through the coding process. The approach to cases and interview content was as follows: 1) after completing the relevant interviews, to write up a short case summary, to capture important points and initial insights; 2) once the interviews had been coded in detail, the case would be expanded around the findings from the coding process; 3) these case reports were then refined or edited, in accordance with the focus of each paper; 4) relevant data would be extracted from the cases, according to the research questions or objectives of the specific article.

My approach to coding was strongly influenced by Miles and Huberman (1994) who offer perhaps the most comprehensive account of coding as a means to qualitative data output. Their key observations include: interview data collection and analysis is a selective process; codes are essentially a method of categorisation; converting words into numbers can be dangerous; keep codes semantically close to the terms they represent; it is not the words used, but their *meaning* which matters the most. Effectively, codes are utilised to create order from a large and often unstructured data set. Miles and Huberman (1994) also suggest there are two principle coding types – ‘*a priori*’ versus ‘*inductive*’ codes. The inductive type relates to the grounded approach of Glaser and Strauss, where a set of codes is developed iteratively, through re-investigation of the text and building up of a set of core constructs from the data. The alternative *a priori* type is followed where the researcher develops a set of codes in advance of textual analysis. These codes are employed to look for evidence of specific themes or constructs which are then notated against the pre-defined coding list.

Whilst my cases were largely conducted using semi-structured interviews, each focussed on specific issues, for which I was seeking evidence of pre-determined activities or phenomena. For instance in paper 2, responses to questions concerning the suppliers’ experiences of aspects of the auction process were represented in graph formats. In another example, in paper 6 the respondent question set was informed by the literature review, which identified seven key constructs. These seven constructs were subsequently used in that coding process, to identify critical evidence, which later allowed the formation of propositions from the case studies. Hence I employed an *a priori* coding approach throughout the research, where an initial list of codes was developed and then refined in accordance with subsequent research questions. The codes used evolved over time, as knowledge of the domain increased, and the focus of the research expanded. To some extent, coding is an interpretive process where the understanding or aims of the researcher influence the outcome. However, using *a priori* codes and patterns will make the results more liable to replication, as the constructs to be identified are made explicit from the outset (Miles and Huberman, 1994).

Coding and interpretation of transcripts is an iterative process. During the analysis it was important, throughout the programme of research, to keep close to the origin data and view it within its context. For example, after the coding process and creation of the case histories, when writing up journal articles I would often keep physical copies of the transcripts to hand in order re-visit them, go back to the actual wording used by a respondent and ensure that their observations or experiences were being accurately portrayed. Simply extracting words or phrases in isolation from multiple transcripts and using them to support interpretations across and between organisations and/or cases, can lead to mis-representation of the respondents’ views. An important factor here is how individuals use language and the meaning for them of key words and terminology. Some of the interviewees were not native English speakers, hence their use of vocabulary was not always consistent. Language and its

use can be a barrier, as well as a conduit to successful communication. As an example, when discussing a complex or layered construct with a respondent, it is useful to ask them to explain what they mean by this term, how it is used in their organisation and examples they have experienced. In this way, it can be established if the interviewee has the same understanding of a construct as other participants, and the researcher himself. As an illustration, the research conducted for paper 4 revealed that one of the key problems we have with achieving integration is the fact that there are many interpretations of what this term means, in the supply chain context (Smart, 2008).

### 3.5.1. Validity

There are three key issues to consider in relation to a discussion of validity, namely: internal validity, construct validity and external validity (Gibbert *et al*, 2008).

Internal validity can be enhanced through a clear research framework (Gibbert *et al*, 2008). Figure 2 in the opening chapter provides a framework for the research conducted which illustrates the relationship between key variables, as derived from the initial review of the literature. Yin (2003) states that internal validity is concerned with the value of inferences made by the researcher from case material. One method to address this problem, which was deployed in my research, is using informants to verify inferences and conclusions (Miles and Huberman, 1994). Another approach to internal validity is pattern matching where patterns are compared with those from previous studies (Gibbert *et al*, 2008). The empirical findings in this research have been discussed in relation to a body of literature and findings between papers have been compared and in some cases matched to patterns from other authors. For example, my findings in papers 1 and 2 matched patterns identified by Emiliani (2000) and Jap (2002), in relation to process and benefits in ORAs.

Construct validity is concerned with establishing correct operational measures for concepts being studied (Yin, 2003). This can be achieved in a number of ways; the first of these is triangulation (Gibbert *et al*, 2008). Triangulation was used in the studies where multiple data sources were available, such as company records, performance data, internal reports and presentations, which supported findings from interviews. Where multiple respondents within each case firm were the norm, and where contradictions emerged between interviewees, the author would return to those firms and seek common understanding. Similarly, validity was enhanced through using 'respondent validation' (Bryman and Bell, 2007), where in some instances it was possible to re-interview the participants and obtain their corroboration of the accuracy of the case report and findings.

Construct validity can also be achieved through peer review and/or authorship (Gibbert *et al*, 2008). Both papers 1 and 2 were co-authored. In subsequent research, the papers were sole authored but were reviewed internally by colleagues, as well as undergoing the blind peer review process of the journals. The internal review process often suggested issues for the author to consider, which helped to strengthen the final output. For example, one reviewer of paper 4 suggested a useful integration model from the literature, which could be used as a reference point for measuring the degree of integration achieved in the case firms. This gave greater validity to the findings as I was able to situate the results in relation to an established and widely-cited framework.

External validity addresses the wider implications of empirical findings and to what extent they can be generalised. Achieving external validity within qualitative research can be its primary weakness, however this can be overcome by robust research



design (Yin, 2003). This is partly achieved through a clear enunciation of the methods followed in the research, which the papers cited here and the exposition itself, have sought to achieve. External validity in case research can also be improved through multiple-case sampling as it adds confidence to findings (Miles and Huberman, 1994). All the papers in this research used multiple cases. To some extent the cases used were driven by access, however they still needed to be selected on the basis of offering relevant or comparable units of analysis. In papers 1 and 2, all the buying firms selected were using reverse auctions for the first time. In paper 3 the utility companies involved were operating as customers of the same e-marketplace, with similar technology adoption profiles. In paper 5, the firms chosen were at a very similar stage of deployment of e-procurement and of comparable operational size and scope.

Thus well designed case studies may have good internal validity, but through the problem of generalisation to other examples, may have weak external validity. However, paper 4 produced a finding which could be used as a hypothesis for a statistical sample of organisations, to test its wider, external validity. Eisenhardt (1989) in particular stresses the value of cases in developing such hypotheses and the papers in this research offered some new hypotheses or propositions (see Table 5 in paper 6). My approach to case studies was influenced further by Eisenhardt (1989), who proposes there is validity to be found in empirical findings which contradict the existing literature. As an example, in paper 4 my evidence suggested that e-procurement does not lead to supply chain integration, contrary to the position put forward in much of the literature.

Hence a number of routes were followed to create validity - the methods specifically used in each study are summarised below.

### **3.6 Methods used in each article**

#### Papers 1 & 2 – online reverse auctions

Smart, A. & Harrison, A. (2002). Reverse Auctions As A Support Mechanism In Flexible Supply Chains. *International Journal of Logistics: Research & Applications*, Vol. 5, No. 3, pp. 275-284

Smart, A. & Harrison, A. (2003). Online Reverse Auctions and their Role in Buyer-Supplier Relationships. *European Journal of Purchasing & Supply Management*, Vol. 9, pp. 257-268

As shown in chapter three, the literature on Online Reverse Auctions (ORA) was very sparse at the time the research set out in papers 1 and 2 was conducted. The literature on buyer-supplier relationships provided a context for this study, as one of the concerns expressed at this early stage in their development was the impact of ORAs on relationships between buyers and their suppliers. Hence research questions were created which considered elements of this relationship that could be influenced by ORA deployment.

This study was conducted early in the implementation of reverse auctions and the events used as the basis for analysis in these two papers were amongst some of the first ever held in the UK. Access was obtained through a consultancy which was setting up reverse auctions for some of its clients and which was interested in academic research to extend its own findings. The method used was a mix of participant observation, and interviews undertaken before and after events took place.

Six discrete events were selected as units of analysis; these were auctions scheduled for specific times on behalf of buying firms, with a varying number of participating suppliers. Participation involved observing the auctions in real time from the moment the events were opened for bids from suppliers, collecting data during the events until the close of the auction. This participation allowed the presentation of data such as Table 2 in Paper 2, showing the bidding history in one of the events. This evidence was important as no empirical examples of bidding history within industrial auctions had been published at this time.

The second element of the research approach involved interviews with the buying firms placing the contracts, and with supplier firms who participated as bidders. For the interview process, pilots were conducted with both buyer and supplier representatives and once the validity of responses had been confirmed, the question set was used for the remainder of the interviews.

All the buying firms were interviewed: this was usually the procurement manager responsible for the category being auctioned. Information from these interviews was used to provide context and detail for the cases which were summarised in the second paper. Similarly, these interviews provided important data such as the savings in cost achieved by buyers against the historic price of the contract (as shown in Figure 7 in Paper 2).

Twenty two suppliers were interviewed before the events took place and then once again, after the events. This allowed a measure of their expectations before the event and any change in their opinion, once the event had taken place. The supplier responses were analysed using response counting and tabulation techniques and presented in bar charts. For example, responses were placed in categories to assist the presentation of the response statistics. The range of themes discussed in interviews allowed for the results to be distributed over two separate articles, each addressing different research questions, but within the overall theme of buyer-supplier relationships.

### Paper 3 – electronic marketplace in the Utility industry

Smart, A. (2005). Exploring supply chain opportunities in the UK utilities sector and the supporting role of eMarketplaces. *Supply Chain Management: An International Journal*, Vol. 10, No. 4, pp. 264-271

This article represents a discrete piece of research which was undertaken with the support of a procurement agency which specialises in public sector industries. The project sponsor had set up an e-marketplace specifically for the public sector and the users were primarily utility and energy firms in the UK. The main purpose of the marketplace, as a neutral third party, was to provide a transactional platform through which buyers could undertake purchases with suppliers. The aim of the research was to establish if the public sector users were ready to move beyond the e-procurement functionality of the marketplace towards managing more supply chain activities online.

Initially, participant observation and interviews were conducted with the e-marketplace operator to establish context for the subsequent interviews with users. A number of typical users were identified based on their purchasing transaction volume through the e-marketplace. The users in this case were the Utility firms acting as buyers through the web site. A literature review on e-marketplaces was conducted along with research into the functionality of other e-marketplace operators in other industries, who were purporting to develop 'supply chain' functionality. This produced a short list of nine service factors which could be measured as potential additional

functions for the Utility marketplace. In-depth interviews were conducted with managers in seven UK water and electricity companies, with the subjects discussed being designed to support the three research questions articulated for this study. To measure the responses to the nine marketplace services, a 5 point Likert scale was used. These outputs, and other responses from within the interview process, led to the formulation of a set of barriers to adoption and implementation of further e-business initiatives, as shown in Table 2 in the article, and establishing the proposition that e-procurement is the principal component of e-marketplace functionality, with little opportunity for expanding into other supply chain activities.

#### Paper 4 – integration through e-procurement and e-business mechanisms

Smart, A. (2008). e-Business & supply chain integration. *Journal of Enterprise Information Management*, Vol. 21, No. 3, pp. 227-246

In this article the focus of research is on whether the use of mechanisms such as e-procurement lead to supply chain integration. There is a body of literature propounding the benefits of integration between firms in the supply chain. The emerging literature on IT use in supply chain management supports this view and in broad terms, proposes information technology as a means to advance such supply chain integration. This research arose from exploratory discussions with two firms who were using e-procurement and where the initial evidence suggested that there was in fact little integration taking place. The units of analysis here were the four different mechanisms as shown in Table 1 of the paper – sales order processing (or sell-side e-procurement); buy-side e-procurement; reverse auction; private exchange (the Cisco 'ecosystem').

The method used here was twofold. Firstly, interviews were conducted with three managers from within each firm (twelve in total), covering the range of questions shown on page 231 of the paper. Results were extrapolated and case examples were presented, summarising the findings in relation to each unit of analysis. Subsequently, a measure was made of the extent of integration being achieved in each of the four cases. To establish common standards for comparison, two frameworks from the literature were used. These were taken from widely-cited articles by Frohlich & Westbrook (2001), and Bagchi & Skjoett-Larsen (see pages 233-234 in paper4 for illustrations of the two frameworks). Application of these frameworks led to the conclusion that only one of the mechanisms in use involved any real element of supply chain integration and that additionally, in the three e-procurement implementations, integration was never an identified driver or target within the project specification.

#### Paper 5 – e-procurement and defining the business case

Smart, A. (2010a). Exploring the business case for e-procurement. *International Journal of Physical Distribution and Logistics Management*, Vol. 40, No. 3, pp.181-201

The idea for this research emerged from the work completed in article 4 and became a logical extension of that investigation. The issue of the business case had emerged as an important theme in the analysis of several e-procurement implementations. However a review of the literature revealed that it had only partially been addressed in the academic literature and the evidence was at best, fragmented. The review also revealed that there was virtually no grounded evidence of the origins of the business case for e-procurement and that theoretical propositions had largely been cited from

one paper to the next without verification. Therefore this research was designed to address a specific gap in the literature.

Three firms were selected through contact made in previous stages of the PhD research. In one case I was able to return to a firm I had examined in one of the previous papers. The firms were chosen as they offered similar units for analysis – the e-procurement projects were at similar levels of advancement i.e. between 2 and 3 years, they were all large multinationals and had deployed similar technologies.

The research was informed by a similar project undertaken by Tatsis *et al* (2006) in the Greek food industry, although their article focussed mainly on e-procurement adoption barriers. The interview question set was formulated after examples from Tatsis *et al* (2006) and other recent articles (Angeles & Nath, 2007; Puschmann & Alt, 2005). Typically three to four interviewees were identified in each buying firm. After coding of the interview transcripts, the cases were presented sequentially, followed by synthesis, to address the specific research questions. Two sets of variables were identified from this process: 1) 18 drivers which form a business case for e-procurement; 2) 17 problem factors which militate the case. The 18 drivers were then categorised into five Criteria, with input from the respondents. Finally, a theoretical model is introduced, in the form of a hierarchy, as a means of structuring the process of developing a business case for e-procurement. The hierarchy is based on an example from the literature, developed originally by Min (1994).

#### Paper 6 – e-procurement and supply management

Smart, A. (2010b). E-procurement and its impact on supply management - evidence from industrial case studies, accepted by *International Journal of Logistics: Research & Applications*, Vol. 13, No. 10, (CJOL 486760 – for publication December 2010).

This article is based on four case studies of e-procurement implementation. Three of the case firms were used in paper 5 and a further firm was added, where the business met the criteria for the research. Here, the focus is on the relationship between e-procurement use and supply strategy. A detailed review of the literature identified seven key themes in relation to supply and supplier management. These are not the only themes examined in the e-procurement literature but they specifically relate to the buyer-supplier interaction, as opposed to other factors such as IT type, firm size, rates of adoption etc, and which have largely been analysed within survey instruments.

The approach used was in-depth interviews, where the identified literature themes formed part of the question set. Several respondents were interviewed in each firm to ensure the issues were explored in full. After summarising the case findings, the research question are addressed individually. The findings here came from detailed coding and content analysis of the interviews and led to two separate outputs. The first output consists of a model showing the inter-dependent relationship operating between three variables – compliance, price and supplier numbers (Figure 1 in the paper). The second output is a set of theoretical propositions derived inductively from the cases, which relate to the seven core themes identified from the literature. These are described in table 5 of paper 6 and extend hypotheses from the literature, forming the basis for additional research in the field.

In summary, this section demonstrates a progress in both research design and process of data collection and evaluation. Edmondson & MacManus (2007: 1174) have stated “once data are collected, an effective researcher employs analytic

techniques that match the nature and amount of data. The process of writing up the results of the analyses may trigger additional questions for the researcher, or suggest investigating alternative explanations during data analysis". This statement summarises much of my personal experience as a researcher. The original investigation into auctions was triggered by a research opportunity, however the subsequent projects largely grew from ideas which crystallised during the writing up process for each paper. Similarly as the emergent literature on e-procurement developed alongside my own studies, clear gaps and interesting research questions ensued. Even after ten years of research into e-procurement there are significant knowledge gaps within the domain, and the case approach will continue to offer opportunities for exploratory research design.

## 4. Findings

This chapter introduces the findings from the research presented in the six articles forming this exposition. The structure is to present the results, frameworks and contributions from the research, using a thematic approach, allowing for synthesis of concepts and findings across the different research projects and which consequently references one or more of the papers included in this exposition. This structure was selected, as a chronological approach to the work, or a report of findings by paper, would fail to illustrate the common themes and findings running through the publications. It should be noted that the chapter deals with findings from the research papers, supported by observations from the literature, but where appropriate situates the results within the literature, either as it existed, or as it has since developed.

### 4.1 Buyer-Supplier relationships

The review of the literature demonstrated the buyer-supplier relationship as a key component of purchasing management and a number of separate but related themes have been identified.

#### 4.1.1. Impact of e-procurement on process

Looking first at online reverse auctions, as discussed in papers 1 and 2, the ORA is designed to replace the traditional quotation process in which suppliers respond to an invitation to tender and submit bids by mail, fax or email. Those tender responses must then be compared and evaluated, which can be a lengthy and inefficient activity, often taking weeks. Hence there is a potential process benefit in using ORAs, which can lead to time compression of this tendering procedure for both buyer and supplier. The initial contribution of this research was in providing the first documented evidence in an academic study of the conduct of reverse auctions and demonstrating this time compression in practice. Table 2 in paper 2 illustrates the bidding history, bid by bid, in one of the six auctions examined. This demonstrated the dynamic nature of these events, with 34 individual bids being placed in a period of 48 minutes. This swift and effective bidding process replaces a traditional set of individual supplier quotations or tender responses. Observation of the tender process during the data collection phase also revealed that the this process could be compressed by using online or electronic documentation (this data was not presented in the actual published articles). Consequently the paper confirmed propositions on reverse auctions by Emiliani (2000) and Jap (2002) concerning potential process improvement, versus traditional, paper-based approaches.

The research conducted for paper 3 addressed process aspects of electronic marketplaces. The firms experimenting with buy-side e-procurement via the utility industry e-marketplace were experiencing problems with the transactional reliability of the system in use. It was apparent that the e-marketplace, through using sophisticated technology which was still at a developmental stage, was not delivering the robust solution the users had envisaged. This situation led to the conservative approach most of the utility firms had taken towards extending use of the e-marketplace into managing other supply chain functions. Here, process efficiency was not being guaranteed and it became a pre-requisite for this challenge to be solved before further more complex solutions would be accepted. It is evident that applications failing to deliver the expected process functionality can be a barrier to adoption of this technology.

Through examination of cases in auctions, buy and sell-side technology usage, and a private e-marketplace, paper 4 considered the process issue in four focal firms. The auction example demonstrated some process benefits, although in this case the firm was more concerned with price reduction. In both the sell-side and buy-side examples, the focal firm (implementing the e-procurement application) effectively gained all the process benefits, as there was little evidence of integration of process with those firms' trading partners. Indeed, it was shown that sell and buy-side applications are posited only on benefits for the focal firm implementing the technology. In such cases, the process improvement comes through integrating *internally* the order to payment cycle.

The Cisco ecosystem example however revealed that wider levels of process improvement, perhaps even optimisation, are possible where the benefits of an e-commerce system are distributed amongst the participants. In this instance, suppliers and customers benefit in a number of ways, through information-sharing in real time. The Cisco case stands as a contradiction to the e-marketplace discussed in paper 3, where the lack of adequate functionality, and conservatism of the users blocked supply chain integration. Supply chain, as opposed to local, process improvement is directly related to the degree of integration of processes achieved by trading partners using these technologies and this issue is discussed further in section 4.2 below.

Paper 5 took a broader overview of process, examining the implementation of e-procurement mechanisms by three case study buying firms. The findings in that study relate primarily to the introduction of buy-side/RTP systems, and again identified process benefits for buyers. In addition, significant problem factors were highlighted which militated the original case for deploying e-procurement. Included in the list of 17 factors are several which are process related (see Table 6 below). Firstly, poor legacy systems and data can inhibit a successful transfer to the new process. Second, user adoption may be undermined by poor training or weak change/project management. The roles and tasks undertaken by procurement personnel will adapt and these need to be clearly defined to enable transfer to the new procedures of e-procurement. The paper moreover identified process as one of the five key criteria in developing a business case for e-procurement. In particular, the participating firms cited standardisation and visibility as key drivers in their e-procurement projects. This was due to an absence of these factors in their existing purchasing operations. The paper demonstrated that e-procurement implementations need to focus on process improvement as a means to provide consistency and standardisation across the business, particularly in large, widely-dispersed organisations.

It was concluded that within all the e-procurement options, there are potential process benefits, however these benefits are not guaranteed and are themselves contingent on contextual factors. Factors such as effectiveness of implementation, state of legacy systems, levels of integration achievable, functionality of software will determine the feasible level of process improvement. However, process improvement is a key driver for e-procurement adoption as it can benefit both parties in the relationship and should be situated in a fully developed business case. This point is explored further in section 4.5.

#### 4.1.2. Impact of e-procurement on price

The impact of e-procurement applications on price and price-related factors was initially explored in papers 1 and 2, in relation to ORAs. The study explored the issue of price within auction events through observation and interviews with participants. An interesting early finding was that both buyers and suppliers were still exploring

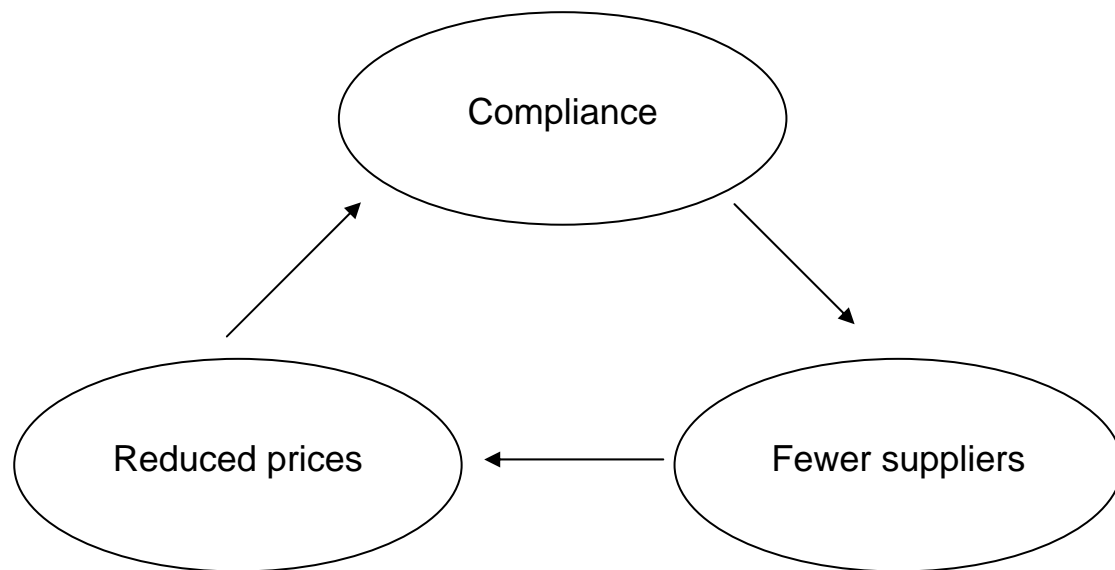
the price impact of this mechanism. For suppliers, the interview response counting showed that the majority (two thirds of respondents) prepared in a systematic way and participated in the events using a consistent, structured approach. These same suppliers were also shown to be the most likely to succeed in gaining business in the events through competitive pricing. The research demonstrated that ORAs require the same preparation as traditional tenders and that suppliers who understand their cost structure and fix in advance lower limits for their pricing will be successful. There was no evidence of the 'gambling' concept suggested by some authors, who see ORAs as a mechanism which encourages suppliers on a dangerous path of buying business at unaffordable prices (Emiliani, 2004).

Moreover, research evidence from paper 2 shows that suppliers do not necessarily have to bid their lowest price in an auction, in order to be the winner (lowest price bidder); they only have to bid the lowest price that wins the event. One supplier revealed in interview that he had not quoted the lowest price he could offer as he was not required to - he had already won the bid with a higher price. This illustrates that whilst auctions may provide price transparency, they do not provide any guarantee of price reductions. (This particular research finding demonstrates the advantage of impartial, academic investigations, as the interviewee did not disclose this information either to the buyer in this event, nor the organiser of the auction i.e. the sponsoring consultancy firm).

Other case examples examined in this study revealed that there were numerous influences which decided the price outcome of the events. In case 1, the contract had been with the same supplier for ten years, operating on a rolling contract, with no recent testing of market price. In case 2, there was little competition in the supply market and the suppliers effectively ignored the ORA as a competitive event and bid their usual prices. In case 3, extra dynamics were introduced such as new market sources, joint bidding by buyers, and multiple, combined contracts. Hence the research made a further important contribution through identifying that reverse auction price outcomes are influenced by many factors such as: number of supplier participants, previous contract price levels, supply and demand fluctuation, new market entrants, contract history. These factors, both internal and external, play a role in determining the ORA outcome.

This result is important because Emiliani (2004, 2005) in particular has attempted to prove that reverse auctions are always detrimental and do not produce acceptable outcomes for suppliers, even for those that have won the events. However paper 2 showed that suppliers are responsible for the outcome of ORAs through the level of professional preparation they undertake and by establishing a bottom line price for the contract being offered. Similarly, Emiliani (2004, 2005) has suggested that auctions can have detrimental outcomes for buyers and suppliers through unsustainable pricing and its resultant impact on quality and business continuity. In truth, bad practices can operate both within and outside of auctions and the fact that they exist in auctions does not make the mechanism intrinsically detrimental. Consequently, the study was able to assert that it is not the ORA mechanism itself which determines results, but *how it is used*, supported by the market factors which pertain in each auction. In effect, each ORA is a discrete event with its own prevailing conditions, where the mix of factors will provide a context for the eventual outcome. Buyers and suppliers are both responsible for conducting the auction under appropriate conditions, just as in any other contractual interaction.

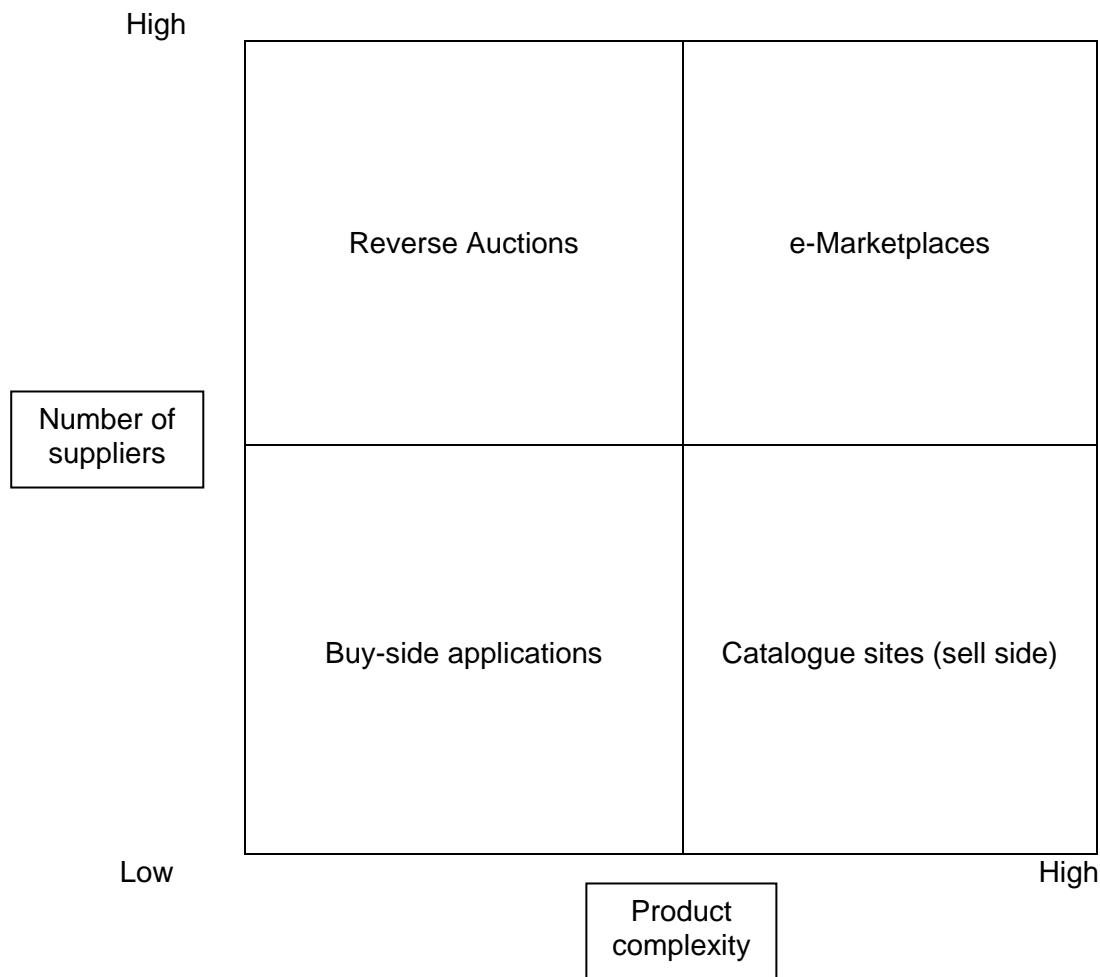




**Figure 4:** Virtuous circle between Compliance, Price and Supplier numbers in e-procurement (Smart, 2010b)

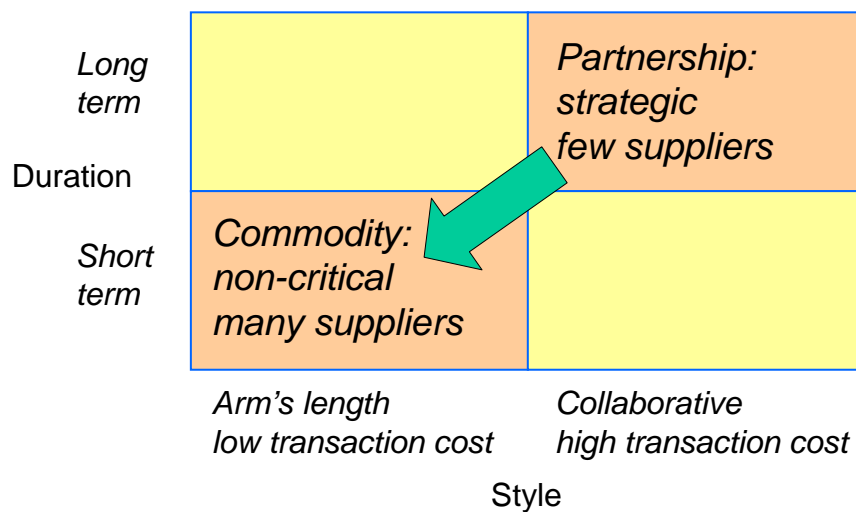
The impact on price within e-procurement implementations in a more general sense was considered in paper 6. Price was identified as one of seven key issues in the article's literature review and was one of the central items discussed with the case firms during this investigation. The research identified a significant relationship between price, compliance and number of suppliers used by buying firms. Compliance refers to the ability of the buyer to ensure that employees adhere to company guidelines and use the preferred suppliers for specific categories of purchase. The finding was that where firms achieve compliance, this will lead to the use of preferred, namely fewer, supplier firms, which in turn leads to reduced prices through leverage with those suppliers. This structure was expressed in a relationship model as shown in Figure 4.

Further to this finding, some propositions were made in relation to these three co-related factors, as shown in paper 6 (Smart, 2010b). The core observation here is that spend leverage can be gained through following the above model; when adopting RTP applications, firms can effectively only reduce supplier prices where they reduce the number of suppliers and drive internal compliance. At the same time, the study demonstrated that reverse auctions are used by buyers as the principal mechanism for driving down supplier prices. In the ORA model, it is a combination of price transparency created by auctions, matched with external factors such as market competition and adequate supply sources, which produce appropriate conditions for price leverage. This finding suggests that ORAs do have a specific role within segments of the overall supply for the firm. This was illustrated through the formulation of a segmentation matrix for e-procurement applications in paper 1, shown in Figure 5.



**Figure 5:** e-procurement segmentation matrix (Smart & Harrison, 2002)

In paper 2, this focus on price-based competition within specific segments led to the proposition that there would be greater commoditisation of products in the low value segments of purchasing spend. This trend is illustrated in Figure 6 (Smart & Harrison, 2003) suggesting a move from partnerships, with few strategic suppliers, to arms-length relationships with more suppliers and a commoditised product. This matrix can be seen in the context of the debate in the literature over markets versus hierarchies, outlined by Malone *et al* (1987). The proposition in paper 2 is that ORAs create a tendency towards use of *market* mechanisms and hence supplier proliferation, with more frequent changes of supply. Paper 2 provided specific evidence of this trend, as the supplier was changed in five out of six auction events observed. Nevertheless it is important that buyers make decisions on pricing within an overall policy or framework for procurement and do not allow their relationships with suppliers to be driven solely by price concerns. This issue is addressed in more detail in the later section on purchasing strategy.



**Figure 6:** Trend initiated by reverse auctions in MRO (Smart & Harrison, 2003)

#### 4.1.3. Partnerships

The research undertaken contributed to another debate within the buyer-supplier relationship, on the issue of partnerships. As discussed in chapter two, the literature is divided on the role of partnerships or collaborative relationships. On the one hand there is a case for closer, integrated, but more dependent, relations with suppliers, including collaboration on a range of issues. On the other hand, it is argued that there are advantages in using market mechanisms to retain competitive advantage and exploit over-supply and/or a powerful spend position. These two different relationship modes were summarised in Table 3 in chapter 2.

The partnership question was explored in detail in paper 2 where, taking a specific example, it was revealed in case firm 1 that the close, partnership-style relationship the firms were involved in was unsuitable for the buyer. Through the ORA mechanism, this buyer was able to benefit from market competition amongst an expanded supply base and to reduce the cost for this category of spend by 30%. The case illustrated that the partnership approach adopted by the buyer was inappropriate because the supply market conditions had changed over time, resulting in a highly competitive supply situation. Consequently, the taxonomy of relationship options needs to be regularly re-examined in the light of market developments and supplier capabilities, as these factors may lead to changes in price structure.

In paper 6, relationships pursued by buyers with their suppliers were examined in another context. It was shown that the four firms examined all used a segmentation approach to supplier categorisation, usually based on the Kraljic (1983) matrix of risk/value. The approach within these firms' strategic positioning was for e-procurement to be subordinate to a higher level procurement strategy. However there were examples, similar to those in the cases in paper 2, where buyers were moving some product categories out of the 'strategic' box, where partnerships are often the

norm, into the 'leverage' box where purchases are more price-based. These movements were usually the result of reverse auction events. At the same time, there was evidence that buyers, through the buy-side/RTP mechanism, are building stronger links with some important, but not necessarily strategic suppliers, which over time could become partnerships if there are benefits to both sides in such a development. In this sense the divide in the literature between adversarial and collaborative types is too simplistic. Results from cases in this research revealed that long term relationships were not necessarily partnerships, nor were short term ones necessarily adversarial. Equally, whether relations are collaborative or arms-length there is still the necessity of negotiating price in any contractual arrangement. The research illustrated that auctions can provide a low-cost method for managing price discussions within all relationships modes. ORAs are suitable both for identifying market rates in competitive-based segments, *and* for testing continued supplier competitiveness in closer, partnership relationships.

It can be concluded that e-procurement opens up visibility into pricing and supplier competitiveness which offers buyers an opportunity to review their relationship status with the supply market, and to evaluate more effectively where partnerships are appropriate.

#### 4.1.4. Power

The literature review demonstrated that the wielding of power has frequently been proffered as one of the principal drivers in the buyer-supplier interface. Cox (2001) describes the buyer-supplier relationship as an outcome of power and dependency factors, and offers a matrix of how such power and dependency is resolved. The exercise of power by buyers over their suppliers has been the traditional purchasing stance, with relationships defined by the factors in the left-hand column of Table 3. Although, by the 1990s academics and practitioners alike were advocating a more collaborative approach, partly driven by the recognition that in managing supply chains effectively, buyers and suppliers have common interests.

The use of power by buyers is typically seen in reverse auctions usage, where supply competition can be exploited to achieve effective disclosure of market price. The ORA removes the need for buyers to undertake individual negotiations, although some buyers do in fact continue to negotiate even after the auction has been completed. However, suppliers may wield a dominant position in certain markets where there is a shortage of supply, or where demand exceeds available capacity. The impact of this situation is that both buyers and suppliers use power strategies to achieve their ends within e-procurement implementation. This was exemplified in paper 4, where case firm A – a seller of office and MRO products – used its online order processing system to capture customer orders and to reduce cost by automating its internal order to payment cycle. The firm has many small business customers and was able to drive adoption of its own e-procurement system. Larger customers were in some cases attempting to force through adoption by the supplier of their own buy-side systems. However firm A was successfully resisting this approach, in its effort to avoid commoditisation of its catalogue.

Similarly it was seen in paper 5 that some powerful suppliers were able to drive adoption of their own catalogue systems, and buyers in that study were in some cases adopting these sell-side systems. Hence it was found that power remains a guiding factor in the buyer-supplier relationship and strongly impacts on the adoption of e-procurement systems. For example, it may be tactically correct for a firm to adopt the e-procurement system of a powerful supplier if it ensures an effective continuation of the business relationship, or where it is critical to the supply chain.

Power therefore needs to be seen in context as a facet of the relationship, which both buyers and suppliers can wield where conditions are favourable to them. However the danger remains that both sides may use this power as a negotiating position, when in reality a more collaborative approach would produce an effective outcome. The difficulty here is that buyers are often driven more by local, functional targets and measures, than by supply chain considerations. It was demonstrated in paper 4 that in three of the four e-procurement implementations there was no consideration of supply chain level metrics and those managers implementing the solutions considered only their specific functional goals. There are clear concerns for the effective pursuit of supply chain management where firms adopt purely parochial tactics, using power as the weapon of choice against suppliers.

#### 4.1.5 Conclusions

The papers have made a contribution to the important and ongoing debate on relationships within purchasing management. The first two papers have become a building block in this domain with, at the time of writing, paper 1 having 25 citations and paper 2 having over 50 citations. Furthermore, findings from paper 2 were used by Caniels and van Raaij (2009) as a basis for their survey investigation on supplier attitudes to auctions. Articles 1 and 2 are today a core part of the reverse auctions literature and are cited in the majority of studies now being published. In this sense, the papers helped to formulate the agenda for ORA studies and to define future research questions and interests.

The papers also demonstrate the continuing relevance of the ideas of Cox in relation to power deployment by buyers and suppliers. Demand and supply within markets have a determining influence on firms' attitude to power and it was shown that power remains a facet of the relationship within e-procurement usage. In turn, this factor influences how and where firms develop partnerships. The research provided empirical evidence that power and partnership issues remain relevant and become more complex where e-procurement is initiated.

## 4.2 Integration

The literature in chapter 2 demonstrates the trend in viewing SCM as an interdisciplinary, multi-functional activity. Much of the literature discusses integration as both desirable and necessary in achieving full supply chain effectiveness. There is significant evidence however that this integration is difficult to achieve and generally absent in most supply chain environments (Fawcett and Magnan, 2002; Storey *et al*, 2006).

In the first three papers presented in this exposition, the question of integration was not addressed. This is interesting as paper 3 deals with the development of an industry e-marketplace where, with the benefit of hindsight, the participant firms should have had some concern for this issue. One of the premises of the e-marketplace concept was its potential to offer deep levels of integration between contracting partners, through the transactional capability of the site itself. Evidence from the literature provided the context for the issues explored in paper 4, where integration was examined in four separate case firms as a key research question.

The findings in paper 4 were significant as they showed that in three of the four cases (reverse auction, sell-side and buy-side e-procurement) there was effectively no integration between buyers and suppliers. Two frameworks from the literature were used as reference points to confirm this finding. By contrast, the Cisco case

example revealed that extensive integration had taken place between Cisco and both its customers and suppliers, via the private exchange mechanism. The fundamental issue identified was that the three conventional e-procurement mechanisms only offered automation of process for the implementing firm, with virtually no integration impact for their trading partners. The automation took place through the functionality offered by the specific mechanisms, which pertain entirely to the implementing firm. As stated in Smart (2006: 237) "Functions beyond procurement may never become involved in any greater data sharing than before and integration benefits at the supply chain level may be limited or non-existent". Paper 4 confirmed earlier propositions by Bagchi and Skjoett-Larsen (2002) that e-procurement implementations are driven by silo-based or functional thinking, rather than by an integration agenda supporting wider supply chain goals.

In paper 6 the issue of integration was explored in four further case histories of industrial firms. It was shown in these cases once again that integration by buyers with their suppliers was barely considered. In reality, external integration in the supply chain was not a driver for the buyers in these firms. The business case was built mainly on functional targets and performance indicators. The research supported the claims in paper 4, that e-procurement addresses transaction efficiency in the purchasing function and not the achievement of external integration.

An important finding in the study was that e-procurement mechanisms lead to automation of process *within* a firm, not integration of processes *between* firms. This is significant as the literature promotes external 'integration' as a factor in IT implementations, including e-procurement, with little real evidence to support this claim. Further, the finding contradicts the idea that firms are aligning their supply chains more closely and effectively through mechanisms such as e-procurement, when in fact their main purpose is to support functional targets, not supply chain level metrics. Indeed one can go further and state that e-procurement implementations may inhibit supply chain integration and alignment, unless they specifically take into account the impact on their trading partners' business. The evidence presented in my research suggests that such integration and alignment are currently not taking place. Since that research was conducted, this issue has subsequently been addressed by Fawcett *et al* (2008) who found that both IT systems and performance measures were barriers to supply chain integration between firms.

Thus the papers cited contribute to the debate on the reality of supply chain integration and provide empirical support to the findings from previous research by Akkermans (1999), Bagchi and Skjoett-Larsen (2002) and Fawcett and Magnan (2002), that supply chain integration is both difficult to achieve and only partially facilitated by information technology.

### **4.3 Purchasing Strategy**

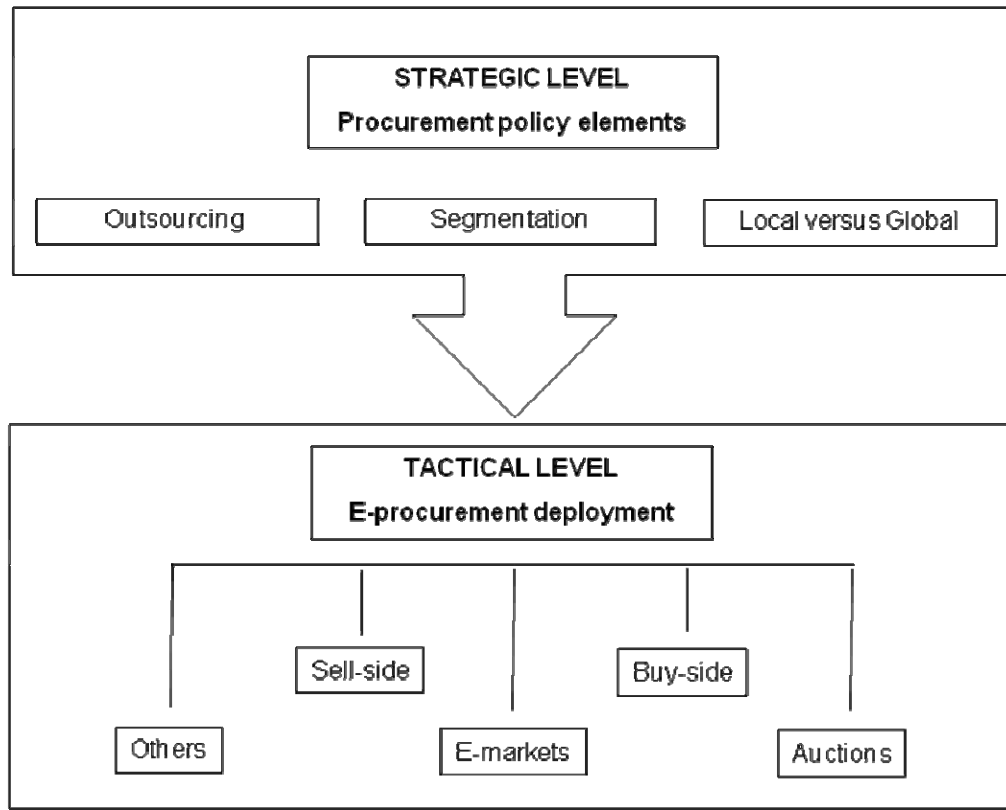
Purchasing strategy has been explored in the literature over two decades or more, with the emergence of the function from a mainly supporting role to a core activity within the supply chain. Moving away from Porter's original value chain model (Porter, 2004), which saw purchasing as a support activity to the primary business of the firm, the development of the SCOR framework places purchasing squarely within SCM as a critical process (SCC, 2003). The early papers in the e-procurement literature barely explored the relationship between strategy and e-procurement and indeed this was identified as a significant gap in chapter 2.

The research in papers 1 and 2 on ORAs began to address questions of purchasing strategy through discussion of the impact on price and partnerships. Selection of appropriate relations with the supply base is a core strategic decision and is implemented through a segmentation approach to the market. (The risk/value matrix of Kraljic (1983) or a variant of this model, as discussed in chapter 2, is used widely by procurement managers and was found to be the standard approach in all of the cases explored in this research programme). The suggestion in paper 2 that products would begin to be moved around in categories was exemplified through the framework shown in Figure 5 above. This finding supports the proposition of Bakos & Brynjolfsson (1993) that firms will use more suppliers, or make more frequent supply changes, through some forms of electronic markets.

In paper 2, the discussion focussed on MRO items which are often not seen as 'strategic' purchases and are therefore less critical to the firm. Nevertheless this research provide evidence that buyer strategy would potentially be influenced by the availability of e-procurement tools, although at this early stage, it was unclear how that impact would play out. Similarly, in paper 1, a segmentation matrix for e-procurement applications was proposed (Figure 5). This model suggested a contextual role for the mechanisms, based on factors such as product complexity and supply availability. An alternative matrix has been proposed by van Weele (2007), using the axes of financial impact and supply risk. At that time, these proposed matrices were work in progress, as there was in effect insufficient empirical evidence of e-procurement implementations to verify their validity.

As this issue had barely been addressed in the literature, the cause and effect relationship between purchasing strategy and e-procurement deployment remained uncertain. This situation suggested new research questions and paper 6 examined strategy in relation to e-procurement in much greater detail, through four cases. That study set out specifically to provide evidence of how buyers establish e-procurement usage and its relationship to overall supply market strategy.

The key finding from paper 6 is that buying firms set out their purchasing strategy according to legacy issues in the business and using a mix of factors such as outsourcing, supply segmentation, and decisions on global to local sourcing. These factors determine the direction and policy to be pursued, once the function has set its alignment with strategic business directives such as the degree of investment in internal production capacity and decisions on use of subsidiaries. The remaining spend which is not directed at internal sources of supply is then subject to this strategic analysis. Consequently, the cause and effect relationship between the two elements was clarified: e-procurement mechanisms can be defined as tactical tools to support strategic decision-making. As stated in the paper: "Ellram and Zsidisin (2001) suggest that buyer-supplier relationships strongly influence the use of IT. This research goes further, and postulates that relationship modes, defined within a strategic procurement framework, directly influence how e-procurement tools should be deployed by the buying firm" (Smart, 2010b :14). This relationship is illustrated in Figure 7.



**Figure 7:** Relationship between procurement strategy and e-procurement mechanisms

It was established through this research that e-procurement does not have a strategic dimension of its own, nor should it be considered separately from the procurement strategy of the firm. Its role is to support strategic sourcing, by facilitating the achievement of its goals, determined by factors such as outsourcing, segmentation and local versus global sourcing.

#### 4.4 Purchasing Roles and Organisation

A theme identified through several cases explored in the papers is the changing nature of the role of purchasing personnel and how the function will be organised in the future. These two factors are affected by e-procurement in a number of ways.

The first issue identified in papers 1 and 2 was the need for purchasing managers to learn new skills in using mechanisms such as ORAs. The new technology was challenging existing paradigms about negotiation, where buyers traditionally deal with suppliers face to face. ORAs remove the personal interaction and replace it with an impersonal process of price disclosure, mediated by the host bidding application. There was evidence from the auction study that ORAs are highly effective at revealing market prices. The role of the buyer thus moves away from price negotiation to designing effective auction events for appropriate products and creating competitive bidding conditions. Hence the sourcing of suppliers, understanding the supply market structure and assessing levels of competition become more prominent for the buyer in the future.



The buy-side mechanisms which principally automate the requisition to pay cycle (see Table 1 in chapter 1) are removing much of the core transactional activity undertaken by procurement departments. This desktop application, supported by catalogues and point and click technology, allows users and internal customers of the procurement department to manage their own orders. The technology is having a deep impact on both staffing levels in procurement departments as well as the job profile of the buyers. Paper 3 indicated a need in the UK utilities sector for more efficient management of the procurement process and the marketplace examined allowed internal users to move towards use of buy-side applications integrated into the e-marketplace. My research also identified significant barriers to adoption due to technical and organisational factors. These factors are shown in Table 4.

<b>Issue</b>	<b>*No. of mentions</b>	<b>Implications</b>
Lack of integration into back-end systems	4	Workflow not optimised; few or no benefits in financial transactions; cost savings delayed
Few incentives for suppliers	4	Supplier resistance or hostility; suppliers need to be more involved at project outset
Concern over unreliability of new IT	3	Users need to experience deliverables first hand
Legacy systems/old IT	3	Difficult to integrate to e-Marketplaces; requires new investment
Some existing procurement methods are adequate e.g. email, EDI	2	Resistance to change; need to clearly prove benefits of new IT
e-procurement needs to be proven before moving to more complexity	2	Reluctance to consider supply chain opportunities; 'softly softly' approach
e-procurement savings have been hyped and are often not achievable	2	Users unconvinced of benefits; need to demonstrate value
Users not ready for new systems	2	Training required before adoption; need to build confidence in solutions available
Lack of funds for new IT investment	2	As above; new projects on hold
e-business failures have raised doubts at Board level over benefits	1	Difficult to make a business case for investment
Lack of standards across e-marketplaces	1	May lead to additional costs for users of more than one e-marketplace
Supplier systems may be better option e.g. RS Components	1	Users can benefit with little investment by the buying firm in e-procurement systems
Utilities sector conservative in its approach	1	Tendency to move slowly; follow rather than lead

\*Note: these figures do not add up to any relevant total as respondents were free to nominate as many or as few factors as they wished.

**Table 4:** Barriers to e-marketplace adoption and implications

By overcoming such barriers, the buy-side mechanism can create productivity gains in the purchasing function. Paper 4 described a case (firm B) where an RTP application was implemented, allowing a reduction in the head office central procurement staff from over one hundred and fifty to around fifty.

The findings from paper 4 were explored further in the research conducted for papers 5 and 6. In the three cases reported in paper 5, the firms had concentrated primarily

on implementing buy-side applications. In all the firms, these implementations had a significant impact on procurement roles and organisation. In firm A there was a particular problem with the change in job function, and the firm had underestimated the importance of training its personnel. Training was necessary at two levels: firstly ensuring local employees were competent to use the new systems effectively; secondly the need to raise the skills of those in the central procurement team who would be moving away from administrative and transactional roles. In firm B, problems were cited with managing change which slowed the planned reduction in headcount and changes in the job profile of its head office staff. In firm C the e-procurement implementation was quite specifically directed at moving the core procurement team towards more strategic activity. As stated in the paper (Smart, 2010a: 192) "the procurement managers needed to be relieved of routine ordering tasks and empowered to direct current and future strategy".

The transformation of the purchasing function has therefore been a major driver for e-procurement projects and paper 6 supported this finding by showing how all four firms used e-procurement deployment to raise the productivity of the function, thereby allowing it to adopt a more strategic role in policy formation and execution. Hence whilst the e-procurement mechanisms themselves are in effect operational tools creating efficiency gains, they permit a move towards higher value-creating activities. The functional focus can therefore move to important contributions such as greater supply market research, relationship development with key partners, and identification of value contributions from suppliers. Interestingly in one of the case firms in paper 5 (firm B) some senior personnel had already been moved from their previous transactional roles to these new outward-focussed positions. In this sense the purchasing function was seen as contributing a more strategic dimension for the organisation.

This change to roles has barely been explored in the literature, but it represents an important outcome of e-procurement for buying firms. The potential to advance the skills and contribution of the function, which has perhaps been undervalued in many organisations, is evident, as is the move towards more value-adding activities. Indeed this research provided evidence that e-procurement has allowed the purchasing function to begin to achieve its potential as a more strategic component of the organisation.

#### **4.5 The e-procurement business case: drivers and barriers**

Much of the early research on e-procurement looked into the benefits and disadvantages of these technologies. These issues have been discussed in section 2.4 of the exposition. At the same time there are clearly barriers and risks which need to be considered as part of the case, as they may inhibit the adoption or success of such a project. These early propositions were explored through case studies to establish some principles for adoption (e.g. Tatsis *et al*, 2006; Angeles & Nath, 2007). However, the issue of the business case for e-procurement had not been explicitly addressed in the literature and this emerged as an interesting opportunity for research.

Some of the inhibitors of e-procurement adoption were explored in paper 3, where a table of barriers was put forward (Table 4). This investigation looked at e-marketplace adoption by buying firms and only provided a partial picture of the issues. The idea of the business case for e-procurement in a broader sense was initially explored in paper 4 where the drivers for adoption were examined in four separate cases of implementation of the different mechanisms. In that paper, it was shown that

the drivers for e-procurement adoption were based on functional metrics within the department hosting the implementation, usually the procurement function. In particular it was demonstrated that the heralded target of inter-firm integration was neither an objective nor an outcome in three of the four cases examined. This initial discussion of drivers for the technology led to an opportunity for specific research on the business case as created by buying organisations.

	Firm A	Firm B	Firm C
Optimise strategic sourcing policy	X		
Support spend savings targets	X		X
Establish common processes	X	X	X
Standard platform for managing procurement spend	X		
Knowledge sharing between BUs	X		
Move procurement managers from transactional to strategic activities	X	X	X
Improving productivity of purchasing personnel	X		
Spend compliance	X	X	X
Visibility of global spend	X	X	X
Improved supplier management and selection	X		X
Integration with suppliers	X		X
Auditable spend management data		X	X
Achieve buying leverage		X	X
P.O. cost reduction	X	X	
Efficient payment & invoice settlement		X	X
Centralise control		X	
Reduce supplier numbers		X	X
Raise standards within procurement function			X

**Table 5:** Drivers for e-procurement in three case firms in paper 5

Paper 5 set out the first fully developed business case discussion in the literature. The literature review for the research demonstrated that this subject had been only partially explored and that evidence from case studies of limiting factors from implementation projects was practically non-existent. Hence this paper provided the first empirical support for how a business case has been developed in buying firms and for the factors which inhibit the achievement of that case.

The paper revealed that the business case was created in a less than rigorous way and that the case in all three firms was speculative due to a number of factors, such as: poor legacy systems; incorrect data on spend; unrealistic expectations of what the technology could deliver. "In all three cases, the firms developed a high level case for investment in e-procurement, based on overall savings exceeding cost

outlays. No evaluation was conducted on how much each application individually could contribute to those savings” (Smart, 2010a: 195). The paper made a specific contribution in establishing five main criteria for consideration when developing a business case, namely Control, Cost, Process, Roles and Suppliers. These categories can in turn assist organisations in establishing the areas of focus in an e-procurement project and enable a more coherent understanding of where resources should be applied to achieve a successful outcome. In total, 18 separate drivers were identified under these five categories. These are shown in Table 5 above.

In addition to the drivers for the business case, the research also investigated the factors which can militate that case. Here, the firms were asked to identify problems which held up their implementation, or which came to light during the roll-out. Across the 3 firms, 17 such problem factors were found, which are illustrated in Table 6 .

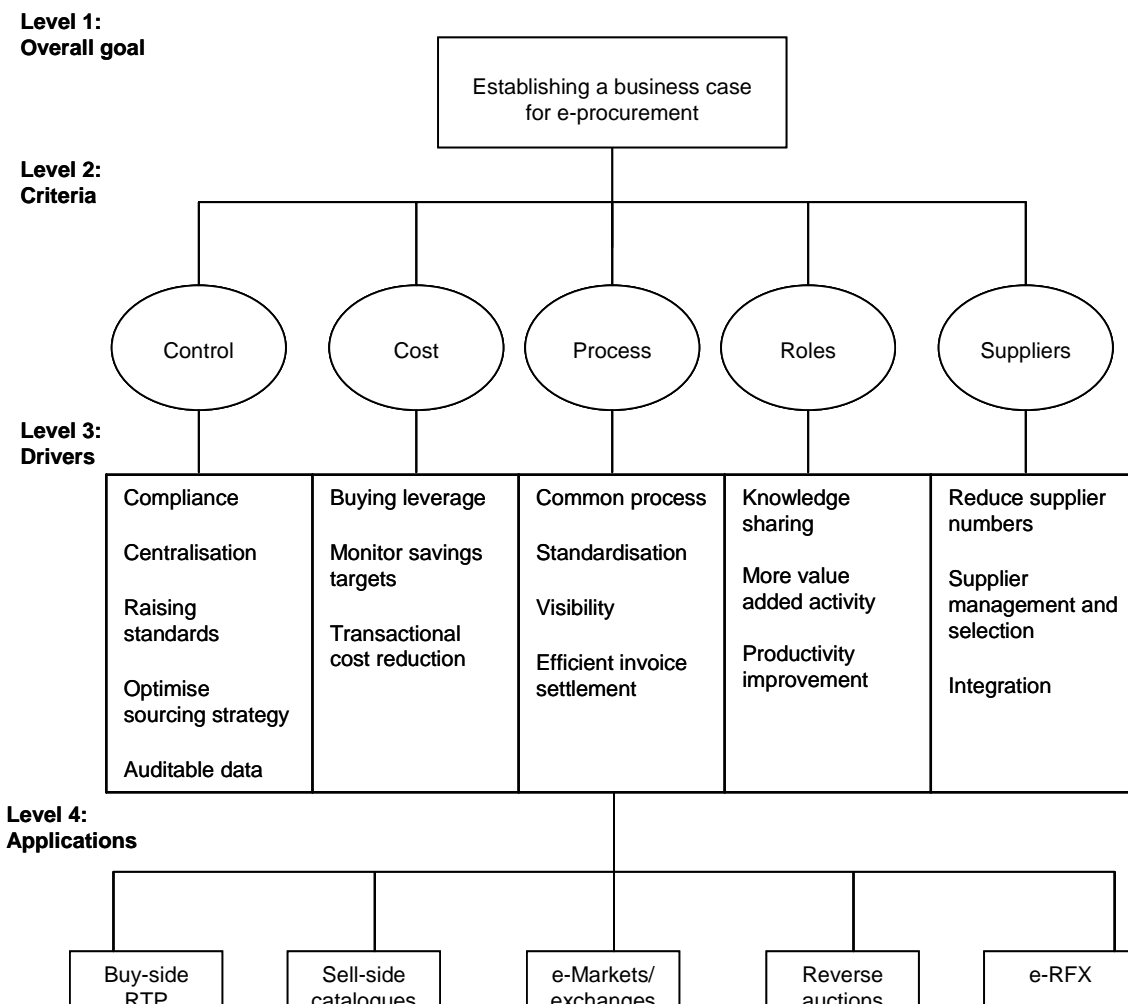
	Firm A	Firm B	Firm C
Unclear original business case	X		X
Poor legacy systems and data	X	X	X
Visibility on spend not solved	X		
Need to use suppliers' systems to get best deals	X		X
Change management	X	X	
Training requirements	X	X	
Different accounting/reporting rules globally	X		
Misunderstanding of what the technology could deliver	X	X	
Finding new people with right skills		X	X
Integration to external platforms		X	
Wrong targets set initially		X	X
Re-defining task and roles	X	X	
Role of internal communications		X	X
Not possible to add all suppliers		X	
Buying systems not user-friendly	X		X
Software needs updating over time			X
Reducing supplier numbers proved difficult			X

**Table 6:** Problem factors affecting the project implementation and development

Perhaps the most significant of these factors is the problem of poor legacy systems and data. All the firms had encountered problems through an inability to accurately assess savings due to weak records or data management in the past. Consequently, the original business case put forward (albeit rather limited) lost its integrity as benefits post-implementation were difficult to prove. Effectively there was too much faith that the technology would deliver a solution, rather than on establishing a sound

case for investment. This finding mirrors earlier disclosures in the literature on the introduction of technology in manufacturing, such as Voss (1989).

The drivers identified were used to create an original model for the business case, based on a hierarchical framework and developed from Min's (1994) earlier work on multiple attribute hierarchy utility theory (MAHU). The model shown below as Figure 8, contributes to the business case debate by structuring the identified drivers in to the five categories (or criteria). This model extends the use of MAHU into a new problem area. Moreover, it makes a contribution to practice by identifying for practitioners the key drivers to be considered in e-procurement adoption, together with the seventeen problem factors also identified in the research. It became apparent when conducting this piece of research that firms need a clearer definition of how the business case should be developed, and this research contributed some core guidelines. A fully developed approach to e-procurement adoption still needs to be established and this is considered more extensively in the final chapter of the exposition.



**Figure 8:** Hierarchical framework of drivers for e-procurement adoption

## 4.6 E-procurement channels

A further theme arising from this research is the issue of e-procurement as a channel solution. Most of the published studies on e-procurement focus on buy-side solutions such as auctions, buying applications (RTP) and e-marketplaces. However the literature has been unclear on the supply aspect, with few commentators discussing the 'sell-side' element of e-procurement. Marketplaces can be seen as both a buy and sell-side mechanism as they are intended to provide benefits to sellers as well as buyers. Paper 4 contained a case in which a distributor of business-to-business merchandise moved its catalogue online and in 1999 began to sell via the web. Such catalogue sites proliferated as new entrepreneurs saw potential in the web as a new channel to market. Indeed in consumer markets, there has been significant infiltration of web business by the major retailers and firms such as Marks & Spencer, John Lewis and Tesco now generate important sales volume through their web channels.

In the B2B sector, the sell-side solution has allowed some suppliers to carve out a strong market position where they have established a powerful web catalogue model. This trend was illustrated in case studies examined in the research programme. In paper 4, case firm A was able to defend against the use of buy-side systems by many of its customers, by refusing to freely distribute its catalogue, and to create valuable electronic content over which it retained control. This approach aimed to prevent commoditisation of its offer by direct and easy price comparison with competitors. In the Cisco case discussed in the same paper, the firm had created electronic links to its key suppliers' sell-side sites as part of its policy of total electronically-facilitated trading. Hence the supplier channel solutions were integrated into the Cisco 'ecosystem'. In paper 5, case firms A and C had found it necessary to use the sell-side systems of some key suppliers and had moved towards creating web linkages with those sites either direct or through e-marketplaces.

Consequently, the research has made a contribution by clarifying the role of channel management within the e-procurement domain. Specifically, it can be proposed that both buyer and supplier organisations use relevant e-procurement mechanisms as a means to gain control of the purchasing channel. In particular it has been shown that wielding of power in the buyer-supplier interface is a strong determinant of what kind of mechanism may be used within the channel. Where suppliers have a powerful position they are able to resist the imposition of buy-side mechanisms by their customers. Buyer firms with channel dominance are increasingly using reverse auctions to drive price benefits. However, if a buying firm has a strong supply chain orientation then it may forego some of this channel power by integrating its suppliers' sell-side solutions. The e-marketplaces solutions are interesting as, in principle, they were designed to offer neutral platforms where suppliers and customers could undertake transactions. In this sense neither buyer nor supplier owns the purchasing channel. Nevertheless it is predominantly buying firms, or industry consortia, who establish e-marketplaces and who therefore take the dominant role in the implementation of such solutions.

Many of the cases in my research provided evidence that firms were not taking a supply chain perspective in relation to e-procurement and this may be partly due to the focus on channel dominance which forms a core part of much of purchasing managers' thinking. The existence of largely functional targets and metrics within purchasing operations enforces this narrow view. The impact of this dominant functional perspective was only nominally examined in this research programme and offers an area for valuable further research.

## 5. Conclusions and contributions to knowledge

The conclusion to this exposition summarises the findings from the research and brings together themes, issues and lessons learned from the foregoing chapters and the papers presented. It outlines the contribution the research makes to both the academic and practitioner domains and identifies areas for further investigation, where gaps exist or where new themes have been identified and not fully explored.

### 5.1 The role of e-procurement in purchasing management

Table 7 summarises the contributions of this exposition under specific themes, showing their relevance to theory and/or practice. Each of these themes is discussed further in the following sections.

Contribution	Type	Theory	Practice
E-procurement leads to improvement in process and price for buying firms	Confirming	✓	✓
Benefits realisation in e-procurement projects remains a problem area	Extending	✓	✓
E-procurement is used by buyers and suppliers as a means to channel dominance	Extending	✓	
E-procurement leads to automation of process, not supply chain integration	Extending	✓	✓
E-procurement is a tactical tool, subordinate to purchasing strategy	Discovering	✓	
Different e-procurement mechanisms result in use of markets <u>or</u> hierarchies	Discovering	✓	

**Table 7:** Summary of contributions to knowledge

#### 5.1.1. Process & Price

The discussion in section 4.1 on buyer-supplier relationships illustrated that in broad terms e-procurement mechanisms have a positive impact on both process and price for buying firms. Process benefits in reverse auctions were proposed early on by both Emiliani (2000) and Jap (2000), although their articles were theoretical rather than empirical in nature. My findings in papers 1 and 2 provided case study evidence of this process benefit. Similarly, in papers 5 and 6 case evidence demonstrated that process improvement could be obtained through the other e-procurement mechanisms, which reduce transaction cost, improve functional efficiency and enable time compression in handling orders with suppliers. However there was also evidence that such process benefits were often limited only to one party to the transaction. Hence, in buy-side applications these are captured by the buying firm, and with sell-side applications, suppliers are the beneficiaries of process improvement. This finding emphasises the need to properly classify and interpret the

different e-procurement mechanisms and their impact, which the literature review demonstrated had been inaccurately handled in many previous articles.

The effect on price was explored across several articles which illustrated that price reductions were not guaranteed, and dependent on contextual factors. My findings challenged certain observations by Emiliani (2004, 2005), who suggests that e-procurement, especially through auctions, leads to detrimental outcomes for buyers and suppliers, such as non-viable pricing. Evidence from later papers indicated how the buy-side and marketplace solutions impacted on price. Paper 6 provided a model showing how reduced price is inter-linked with two other factors: supplier reduction and compliance. Hence the research confirmed and extended earlier propositions and advanced our knowledge of how these constructs interact through case study examples, which had been lacking from the body of literature.

#### 5.1.2. Benefits realisation

It is apparent that benefits realisation has been, and remains today, a significant problem for buying organisations using e-procurement. The issue of benefits had been explored largely in theoretical research, with only a few authors such as Tatsis *et al* (2006), Ash & Burn (2003) and Presutti (2003) providing evidence of such benefits as opposed to theoretical propositions. As discussed in section 2.4.1 a weakness in the literature was the tendency to generalise about e-procurement benefits rather than define them by application. My findings revealed that buy-side RTP and e-marketplace solutions have not been straightforward to implement and a multitude of issues have arisen, as identified in detail in paper 5. The suite of applications within RFX are perhaps an exception as they offer process benefits and are simple to implement. Reverse auctions have been shown to be a valid short term solution and an easy 'quick-win', where firms can identify suitable categories and market conditions favour price competition (papers 1 and 2). Equally, the final two papers revealed that some buying firms are wary of damaging long-term supplier relationships through auction deployment and so have taken a cautious approach in implementation.

Benefits realisation is further weakened by the evidence of resistance from suppliers to buy-side e-procurement. Resistance by suppliers was an issue identified by Deeter-Schmelz *et al* (2001) and Davila *et al* (2003), amongst others. Certain buyers have sought to impose e-procurement solutions on their suppliers and in the case of auctions there has been considerable pushback, particularly from incumbents. The evidence from my later papers showed that buyers were becoming concerned about the potential to alienate supplier segments. Suppliers can also inhibit the success of marketplaces and a problem with the e-marketplace concept has been its inability to offer a long-term value proposition for suppliers, who are often seen as willing accomplices in buyer-oriented solutions. The result of this dilemma is that very few of the original e-marketplaces have survived and those that have survived needed to create benefits for buyers and suppliers alike.

There is a link here to the business case for e-procurement as it was shown in the research for paper 5 that the business case, where it was developed at all by buying firms, barely considered suppliers' concerns. Buyers have focussed on key drivers such as process improvement, compliance and reporting which reflect weak management in the past, or at least an inability to control effectively the purchasing function's performance. In effect, buyers have used e-procurement primarily to improve against their internal metrics and to raise the performance and productivity of the function. The business case needs to become more sophisticated and to move beyond the narrow drivers identified in the research. A more developed case would



consider the positioning of solutions within a segmentation model, to establish a policy for the five key Criteria (see Figure 8) and to engage with known and potential supplier resistance. This is an area which requires further research and is explored in section 5.3 below.

In summary, my research provided more detailed evaluation of the different mechanisms through case study analysis, enabling e-procurement applications to be seen in context and extending our understanding of the problems of benefits realisation.

#### 5.1.3. E-procurement channels

It was shown in the Findings chapter that both buyers and suppliers use e-procurement to gain control of the channel and can do so by imposing their specific solutions in the market. However the ability to impose any solution relies on relative power of the protagonists. Cox (1999, 2001, 2004b) in particular has explored how power determines aspects of the buyer-supplier interface and this thesis confirmed that his ideas are still relevant in relation to e-procurement deployment. Where one party has a dominant position it is easier to force adoption of a solution and suppliers can achieve this outcome in certain situations (as shown in the cases in papers 5 and 6). However it may be equally appropriate to develop attractive solutions such as bespoke catalogue content, to persuade trading partners to adopt your application. Effectively, firms are discovering that power is only one element in the e-procurement debate and traditional power positions are insufficient to drive a successful channel strategy.

An example of how this power has been conceded was seen in paper 4 where the Cisco case illustrated how it is possible to use both sell-side and buy-side e-procurement to create an effective channel strategy which distributes benefits to suppliers and customers.

#### 5.1.4. E-procurement and supply chain integration

An issue identified in the literature review was the lack of coherent definitions of e-procurement applications. Certain authors, including Wang *et al* (2004) and Pearcy *et al* (2008) confused e-procurement with wider supply chain processes such as planning and scheduling or product design. Similarly there were suggestions in the literature that e-procurement mechanisms can be situated within a range of supply chain management applications (Garcia-Dastugue and Lambert, 2003). However an important finding throughout the research programme was the general lack of consideration of a supply chain perspective by buyers when examining e-procurement usage and that supply chain integration was rarely on the agenda.

There was in fact evidence in each paper that supply chain factors were ignored or poorly understood by buyers. This demonstrates the predominance of narrow, functional thinking with the procurement profession and must be a concern for researchers and supply chain professionals alike. Whilst an integrated supply chain philosophy has been promoted by many senior supply chain personnel, and advanced through the SCOR model (SCC, 2003), parts of procurement practice remain isolated due to a silo mentality. This in turn prevents a more integrated approach to technology and its solutions. My research has clearly exposed the inability of e-procurement to address supply chain level integration and it can be concluded that at its present stage of development, e-procurement will not assist in any effective move towards such integration. Indeed the attempts by some of the first e-marketplace operators such as Covisint and Transora to develop integrated supply

chain solutions were abandoned early on and have largely disappeared as aspirations within that industry. There are some isolated successes where e-marketplaces have facilitated physical logistics collaboration such as Elemica in the chemicals industry. However these examples are limited and it is clear that the e-marketplace model has not achieved its original ambitions. Indeed it is only where the proposition moves out of the procurement domain and into areas such as transport, planning and manufacturing that a supply chain solution becomes feasible.

Even within the current functional scope of e-procurement there continues to be debate on the extent of integration linkages. The research has shown that e-procurement solutions lead to automation of process, not supply chain integration. There have been some examples of how technology integration can be extended, again through an e-marketplace. Case firm C in paper 5 had successfully linked its buy-side application with the chemicals marketplace (<http://www.hubwoo.com>) and was able to transact with core suppliers via this exchange. However the study on the public sector marketplace in paper 3 revealed there were considerable barriers to such technical integration, even within the buying firms themselves. Whilst e-procurement solutions remain the sole responsibility of purchasing, they will not contribute to supply chain level integration. Hence the research, particularly in paper 4, extended our understanding of this issue in relation to previous frameworks (Frohlich & Westbrook, 2001; Bagchi & Skjoett-Larsen, 2002) and provided case examples of the barriers to such integration. It is also an important finding for practice, as it is evident that e-procurement mechanisms need to be addressed within a more holistic context if they are to have any useful impact on broader management of the supply chain.

#### 5.1.5. Purchasing strategy

A somewhat surprising finding from the literature discussion was that there were no existing, coherent explanations of the relationship between e-procurement and purchasing strategy. This theme was explored in the findings chapter (section 4.3) which led to the establishment of a model explaining the relationship between the two constructs (Figure 7). An important conclusion of the research therefore is that there are no fixed, pre-determined impacts on purchasing management as a result of e-procurement deployment. There exist important endogenous and exogenous factors, explored across several of the papers, which influence areas such as pricing, trading outcomes, roles and relationships. Therefore the role and impact of e-procurement mechanisms in purchasing management depends on *how they are used*, both by buying and supplying organisations. But for the buying firm, e-procurement tools are a means to enforce policy more effectively, through facilitating issues such as supplier reduction, compliance and price visibility (shown in Figure 4).

Thus e-procurement acts as an important enabler of purchasing strategy implementation. This is supported by the emerging evidence that e-procurement adoption allows the procurement function to redeploy key personnel to focus on identifying value-adding solutions from its supply base. In this sense, successful buying firms will develop a clearer strategic relationship with key suppliers. We should therefore be optimistic that over time this focus on the importance of value-based relationships will facilitate a move towards a stronger supply chain orientation within the procurement function, as it becomes more interested in the longer term SCM potential of its main suppliers. Although it should be recognised in the short term that most of the purchasing managers interviewed in this research program had a narrow, departmental perspective on e-procurement and saw it as a means to achieve their *functional* goals or targets. Thus it is clear that e-procurement supports purchasing, rather than supply chain strategy.

## 5.2 Markets versus hierarchies and e-procurement

The literature reviewed in chapter 2 identified explanatory theories which have been applied to supply market structures. Drawing on the work of Williamson (1975), Malone *et al* (1987) define buyer-supplier trading within the framework of markets and hierarchies. Markets are based on multiple interactions between buyers and sellers where market forces offer buyers choice and competition, leading to a price focus, with potentially frequent changes of supply as price fluctuates. Hierarchies are based on managerial decisions to procure from pre-determined sources, which may be vertically integrated or externally owned.

Taking the markets versus hierarchies concept further, Clemons *et al* (1993) established the 'Move to the Middle' hypothesis. This hypothesis supports the concept of greater outsourcing in electronic trading, as suggested by Malone *et al* (1987) but suggests that buying firms will establish a longer term relationship with a smaller cohort of suppliers, in other words a middle way to the 'markets versus hierarchies' model.

Bakos and Brynjolfsson (1993) introduced a different dimension to this argument by establishing that whilst firms may benefit from reduced transaction cost with a wider pool of suppliers, there are alternative incentives which would drive them towards reducing suppliers. These include supplier innovation and/or technology resources, information sharing and responsiveness. This argument links to theory from the procurement literature which suggests there are benefits to buyers from closer supplier collaboration, resulting in fewer supplier numbers. Indeed the concept of SCM is broadly founded on the notion that firms in the chain need to co-operate, both in order to achieve operational efficiency and effectiveness, and to compete with rival supply chains (Christopher, 2005).

The procurement literature established in the 1980s that a segmented approach to supply markets was necessary (Kraljic, 1983). The research in this exposition found that firms typically use segmentation as a basis for procurement strategy and the Kraljic model, or a variant of it, was in use in all the buyer firms examined. It is important that e-procurement and its mechanisms are analysed in relation to the procurement and supply chain-related bodies of literature, in order to understand their true impact. A significant core of the e-procurement literature uses an IT or systems lens and misunderstands how buying firms make decisions on supply and therefore how such mechanism are actually deployed. My research confirms that e-procurement (like many other technology solutions) is primarily an enabler. In this case, an enabler to achieve procurement or supply chain goals. In reality it was shown that the supply chain was barely a consideration in these cases and the perspective was dominated by procurement functional targets.

Hence, through this research, the cause and effect relationship between e-procurement use and procurement strategy has been clarified. Paper 6 concluded that e-procurement does not pre-determine strategy and its role is to support strategic decisions made on managing external resources acquired from suppliers and third parties. The drivers for adoption were examined in paper 5 and few of them related to the technology itself, only what it could deliver, such as process improvement, control, productivity and visibility. These are tactical issues which relate to how suppliers are managed within a procurement policy.

These findings would suggest that e-procurement should be seen as a technology which supports a move to *hierarchies* (Malone *et al*, 2007). However, that itself is an over-simplification. Garcia-Dastugue *et al* (2003: 261) state that "it is unlikely that the

internet will change the reasons why firms maintain close relationships with other supply chain members". My research confirms this view and provides evidence to support the claim from Bakos and Brynjolfsson (1993) that buyers work closely with suppliers because of incentives to do so. This was demonstrated in papers 5 and 6 where it was shown that buyers were using e-procurement mechanisms broadly to reduce supplier numbers and to cement closer relationships with those that remain. However, reverse auctions as a specific mechanism have a different outcome – several cases in the published papers revealed that auctions are being used selectively as a *market* mechanism. These case firms were prepared to change suppliers, add new ones and diversify the spend in categories where they could exercise leverage over the market. This role of ORAs as a market mechanism which reduces co-ordination cost was not foreseen until the 2000s when internet auctions were created for the first time.

The conclusion from the arguments above is that e-procurement does not have a *generic* influence on the use of markets versus hierarchies and that this decision follows firstly from strategic sourcing elements. This was illustrated in Figure 7 in chapter 4. It can be posited that different e-procurement mechanisms are used in support of a market or hierarchy approach, according to the defined sourcing strategy. Any sourcing strategy will develop over time and it is common for it to change in accordance with external supply factors. For instance, if a bottleneck (constraint on availability) emerges for a product, then firms will look to establish a hierarchical relationship with the suppliers, who now hold the power in the transaction. Hence, categories move between market and hierarchy solutions based on prevailing supply conditions. The dimension of power is another important element in the deployment of e-procurement, as it was shown in papers 1, 2 and 5 that buyers can not always impose terms of trading on suppliers who may have a more dominant position. This results in buyers using their suppliers' sell-side systems (such as case firm C in paper 5). The consequence is that buyers need to maintain a flexible approach to sourcing, which can be supported by appropriate e-procurement tools.

Hence, the e-procurement mechanisms need to be understood as separate solutions which should be deployed in appropriate ways, defined by purchasing objectives and market factors. The matrix shown in Figure 5 illustrates one way of segmenting these applications. This approach also challenges some of the literature which defines e-procurement generically and which produces the inappropriate definitions seen in Wang *et al* (2004) and Percy and Guinipero (2008), as discussed in chapter 2. This exposition has contributed therefore by clarifying the relationship between e-procurement usage and purchasing strategy, and in defining the positioning of e-procurement mechanisms. More specifically it provides empirical support to the proposition of Porter (2001) that strategy must be defined in advance of internet deployment.

### **5.3 Diffusion of Innovation in relation to e-procurement**

A further perspective can be offered on the research in this thesis by reflecting on its contribution in relation to Diffusion of Innovation theory. Diffusion of Innovation (DOI) was originally introduced by Rogers (2003) and developed from research into how innovations in agriculture were diffused. DOI theory suggests that actors have different degrees of willingness to adopt innovations and that the way in which a population adopts an innovation over time is approximately normally distributed (Rogers, 2003). Following the publication of Rogers' ideas in the 1960s, DOI became an influential theory within a number of research domains. In a subsequent paper, Rogers (1976) illustrated in a review of DOI developments that the concept had

expanded beyond research in specialist science and technology fields into the marketing domain. Robertson (1967) was one of the first to discuss Dol within marketing and it has now become a widely used explanatory theory in marketing science. More recently, the theory has been applied in relation to modern technology introductions such as business computing (Attewell, 1992).

The model for Diffusion of Innovation was based on a diffusion curve, similar to a normal distribution or 'bell' curve. Based on 100% adoption, the curve is separated into categories as follows (Rogers, 2003):

Innovators .....	2.5%
Early adopters...	13.5%
Early majority .....	34.0%
Late majority.....	34.0%
Laggards.....	16.0%

Robertson (1967: 17) does suggest that not all innovations will be adopted by everyone (or all potential users) and therefore we have 'an ever-incomplete curve' for many products or services. The different e-procurement mechanisms examined in this research could be hypothesised as producing differently shaped adoption curves. However as no specific historical data was available to support this hypothesis, it has been assumed in this discussion that the mechanisms all follow the normal distribution curve, as originally proposed by Rogers (2003). Further analysis can be undertaken to examine the diffusion curve shape, as historical data becomes available.

Within SCM research this theory has been barely considered. A review of the literature by Russell and Hoag (2004) found that only one article on technology in SCM had utilised diffusion theory, that by Williams and Rao (1998). Russell and Hoag (2004: 105) suggest their contribution is important as it demonstrates that 'questions in the supply chain and logistics research agenda could be addressed with adoption theories'.

One complication with examining e-procurement is that the applications discussed in this research all appeared more or less simultaneously in a short period in the late 1990s. That situation presented buyers with a confusing choice of technology and it is certain that many adoption decisions were influenced by IT firms and consultants who were selling e-procurement. This exposition has stressed the need to understand each of the e-procurement mechanisms as having discrete attributes and contextual roles, therefore in considering Dol in relation to e-procurement, it is useful to examine the impact for each of the four main mechanisms in turn. The observations in this section have not been based on survey or statistical data, which are not available, but on the research findings across the papers. However there are some specific concepts from Rogers' work which are considered here, which are: relative advantage, compatibility and complexity.

Reverse auctions have shown to be useful in specific purchasing situations and primarily have a role in relation to categories defined by Kraljic (1983) as 'routine' or 'leverage'. Similarly my own research suggested a role in relation to products with large supplier numbers and low product complexity (Figure 5). As buying firms recognised this specialist role early on, auctions were quite quickly adopted, although this adoption was almost exclusively in North America and Western Europe, where the vendors focussed their sales efforts. My early research illustrated that there have been both successes and failures in experiments in ORA usage as seen in the cases in paper 2. Later findings in papers 5 and 6 revealed that buyers were much clearer on where and how ORAs could be used and were applying them with discretion to

appropriate categories. It is evident that the fast-growing research on ORAs allied to considerable business media coverage has made ORAs widely adopted in large corporations. Similarly they are becoming more accepted within the public sector (Croom and Brandon-Jones, 2007). Recent discussions by the author with ORA vendors who are expanding their operations into Asia and the Middle East, in both private and public sectors, allied to survey research in the literature, indicate that ORAs can now be classified in the category of early majority, in the Dol model.

Buy-side or RTP applications have been applied in many industries, as well as the public sector, as explored in papers 3, 4, 5 and 6 and the literature review in chapter 2. The evidence from my research has shown that there were, and remain, some barriers to adoption of this mechanism, but that organisations have made a case for the technology based on factors such as supplier reduction, compliance and spend leverage. Here, firms have used e-procurement to address 'relative advantage'. In Rogers' (2003) definition this refers to how much more effective, efficient or economical the innovation is, than the system it replaces. Before the advent of e-procurement, the purchasing function was characterised by poor information and systems and low productivity. Indeed much of the rationale for buy-side systems has been the drive to improve the productivity of the purchasing function. This situation mirrors the role of an earlier technology such as EDI, where Russell and Hoag (2004) proposed that relative advantage was positively related to innovation adoption. The state of development of this technology, which still has many challenges to successful implementation (see papers 4, 5 and 6), allied to its narrow geographical adoption in developed nations only, suggest it lies in the early adopter category.

Sell side mechanisms have a much longer history than the other re-procurement mechanisms as they date back to the first interactive web-sites set up by B2B suppliers. They can also be seen as part of channel strategy within the marketing domain, as huge numbers of retailers, suppliers and manufacturer have taken their offering online in business to business markets. Sell side applications are classified as part of e-procurement in this research as they are one of the viable channels for online purchasing by industrial buyers. Although in some cases they are set up to defend market position and nullify buyer control, as seen in paper 4, they provide an important element of catalogue content for buyers. As shown in several cases in this research, buyers often continue to use the sell side systems of important suppliers in order to maintain relationships developed over time. Alternatively the powerful position of some suppliers means buyers may not be able to force acceptance of their own buy side applications. Here we see the effect of what Rogers (2003) determined as 'compatibility' within Dol theory. Compatibility is the degree to which an innovation is perceived to maintain consistency with a firm's existing past experiences, values and needs. In their research referred to above, Russell and Hoag (2004) identified that perceived compatibility was positively related to adoption of innovation. Due to their global use on the web within most industrial markets, sell side systems should be seen as near the top of the Dol curve, in either the early or late majority.

Electronic marketplaces provide an interesting comparison to the other e-procurement mechanisms as they have been the least successful in terms of adoption. This mechanism was certainly subject of another factor, described by Fenn (2010) as the 'hype cycle'. This suggests that after a peak of 'inflated expectations', firms move through periods of disillusionment, enlightenment and then achieve a plateau of productivity – providing that the technology proves viable. The shape of this curve resembles a bimodal as opposed to normal distribution. The literature review explored how early expectations of marketplace sophistication were disappointed by a number of factors. Reasons for failure cited by Day *et al* (2003)

included withdrawal of capital, lack of critical mass in transactions, scepticism of participants, technology problems and excessive competition within market sectors. Paper 3 provided empirical evidence of the barriers to this technology in the public sector. Subsequent research showed that adoption of e-marketplaces was limited, as both buyers and suppliers could not make out a valid business case for the mechanism. Interestingly, Rogers (2003) proposed a further factor within DoI which is 'complexity'. Here complexity refers to how much an innovation idea was perceived as difficult to use or understand. In their research on EDI, Russell and Hoag (2004) suggested that complexity had a negative effect on innovation adoption and it is evident that this attribute, amongst others, was a factor in the failure of e-marketplaces. Nevertheless, a small number of e-markets have survived, usually providing a simplified service offering. At the same time, rival technology such as EAI and direct SAP connectivity, discussed earlier in this thesis, could replace some of what e-marketplaces offer. Thus this mechanism should be seen as having largely run its course and is probably at the laggard stage in DoI theory, or in relation to the product life cycle should be seen as in the 'decline' stage (McDonald & Christopher, 2003).

Despite the different stage of adoption of these mechanisms, the evidence in this exposition suggests that organisations have broadly derived benefits from them, and provided the limitations and contextual roles of each mechanism are understood, e-procurement is likely to continue to extend its adoption, as further innovations in the technology are introduced.

#### **5.4 A model for e-procurement**

The findings in paper 5 included a hierarchical framework illustrating important factors which organisations need to consider when introducing e-procurement (see Figure 8). That framework, derived from case evidence, identified relevant *Criteria* and *Drivers* in developing a case for e-procurement. The framework focussed on the business case aspect of e-procurement, and analysis of the literature revealed that what was missing is a broader set of guidelines which firms could follow when considering e-procurement deployment. One particularly important issue is the relationship of e-procurement to procurement strategy, which was identified as a gap in the literature and was explored during my research for paper 6. Similarly, firms need a process for selecting which e-procurement tools are relevant to their buying situation. Hence, gaps in the literature and the earlier findings from the research led to the idea of developing a further model which would combine a wider range of issues. The model proposed in this section is not based fully on empirical findings, nor has it been tested in practice through further research. This proposal is an extension of existing work, with additional elements, which were suggested during the writing up of this exposition. The model can provide assistance to practitioners in how to introduce e-procurement in a more systematic way, by outlining a process which can be followed.

##### **5.4.1. Constructing the model**

The figure shown below (Figure 9) is designed as a flow model with a number of steps, describing how an e-procurement solution could be developed, giving consideration to key, relevant issues. The starting point in this model is the relationship of e-procurement to strategic purchasing decisions. The discussion in section 4.3 clarified the cause and effect between these elements: e-procurement mechanisms are tactical tools to support strategic decision-making, and should follow from the organisation's purchasing strategy. In that section, a model was introduced

(Figure 7) which illustrates this relationship. This proposes that e-procurement introduction is a method to achieve the purchasing function's goals. Consequently, the start of the process and the first step in the model is to express the procurement strategy for the business and Figure 7 re-appears in the new model. In the discussion in the findings chapter it was suggested that strategy is based on three typical core factors of outsourcing, supply market segmentation, and local versus global sourcing. Thus the definition of strategy is included as the first step in the model (Figure 9), supported by e-procurement applications. After the strategic level described in step 1, the model moves to the execution level and steps 2 to 6 outline the process to be followed in executing an e-procurement strategy. These steps are highlighted in the shaded area of the Figure.

The second and third steps in the model are derived from the hierarchical framework presented in Figure 8 (chapter 4), which was originally published in paper 5. Step 2 in the new model introduces the Criteria to be considered. These five headings - Control, Cost, Process, Roles and Suppliers - were taken from the framework in Figure 8. The Criteria represent summary categories for the relevant Drivers of e-procurement adoption, which were also included in that framework. The logic of introducing the criteria and drivers here is that organisations should identify the issues in the purchasing function which need to be addressed. In effect, e-procurement is a solution to a set of problems, and the nature of the problems identified may require different solutions. Hence the Drivers (step 3) need to be classified for each buying firm and the examples shown in the model were published in paper 5. The principal drivers were identified as compliance, supplier reduction and control of spend, but these naturally vary from organisation to organisation according to how well legacy issues have been managed.

Understanding of the drivers within the purchasing function allows the firm to move on to selection of appropriate mechanisms, which is step 4 in the model. The literature revealed that segmentation of markets has been an important element of purchasing practice since Kraljic (1983) introduced the first such model. Similarly e-procurement mechanisms need to be examined and selected according to appropriate criteria and a segmentation matrix is used for this purpose. The model thus incorporates the segmentation matrix developed in paper 1, which was adapted from the earlier work of Kraljic (1983) on supply markets. The matrix from my research identifies a role for the four main e-procurement modes in relation to the criteria of number of suppliers and product complexity, and was discussed in section 4.1.2. RFX solutions consist of a range of tools which have a more general application. These are not dependent on specific supply or market conditions and are therefore relevant to all segments. Evidence to support this was provided in papers 5 and 6. The segmentation of e-procurement is important as it enables buyers to focus on the solutions which address the drivers previously identified. Organisations may seek to improve on one or more of the criteria categories shown in step 2. Thus in most cases, a mix of applications will be used in order to support the achievement of the criteria and drivers. This observation is supported by a range of case evidence such as in papers 5 and 6 where the firms explored used a number of e-procurement tools. Step 4 therefore represents the execution of the e-procurement options shown at the tactical level in step 1 of the model.

Identification of relevant drivers leads on to the development of a business case in step 5. This issue was explored in paper 6 of the research, where it was established that firms had not been overly thorough in establishing a case for e-procurement. The business case needs to consider such factors as internal drivers, benefits and organisational prerogatives including financial metrics i.e. return on investment, payback etc. These again will be individual to each firm, based on custom and



practice, and the literature does not specify one financial approach as superior to the others. The key issue here is an understanding that return on investment will be affected by the type of application(s) to be implemented. Hence, once a mechanism has been identified which can theoretically provide benefits for the organisation, a case needs to be established to justify the investment.

As shown in papers 4 and 5 of this research, the business case has been poorly developed for e-procurement projects. Organisations need to ensure they build a case to effectively implement the mechanisms selected. For example, auctions are an efficient tool for short term price reduction, and have some process benefits but will not lead to longer-term efficiency gains across all supply segments. Sell-side sites improve efficiency of transaction but usually offer fixed-price catalogues and are unlikely to produce price reductions. An understanding of the price and process impacts of these mechanisms, as explored in various stages of this research, is vital to the business case. It was clear from the case studies examined in papers 4 and 5 that some buyers did not understand the subtleties of this debate, leading to postponement or diminution of benefits in their projects. A sound business case is a method to formulate the delivery of benefits from the technologies.

Finally, operational elements need to be considered (step 6). The factors introduced here were extrapolated from various stages of the research. Although none of the published papers discusses these operational factors in detail, they emerged during the research as issues of concern for managers involved in e-procurement implementation or management. These proposed factors can be validated through further research.

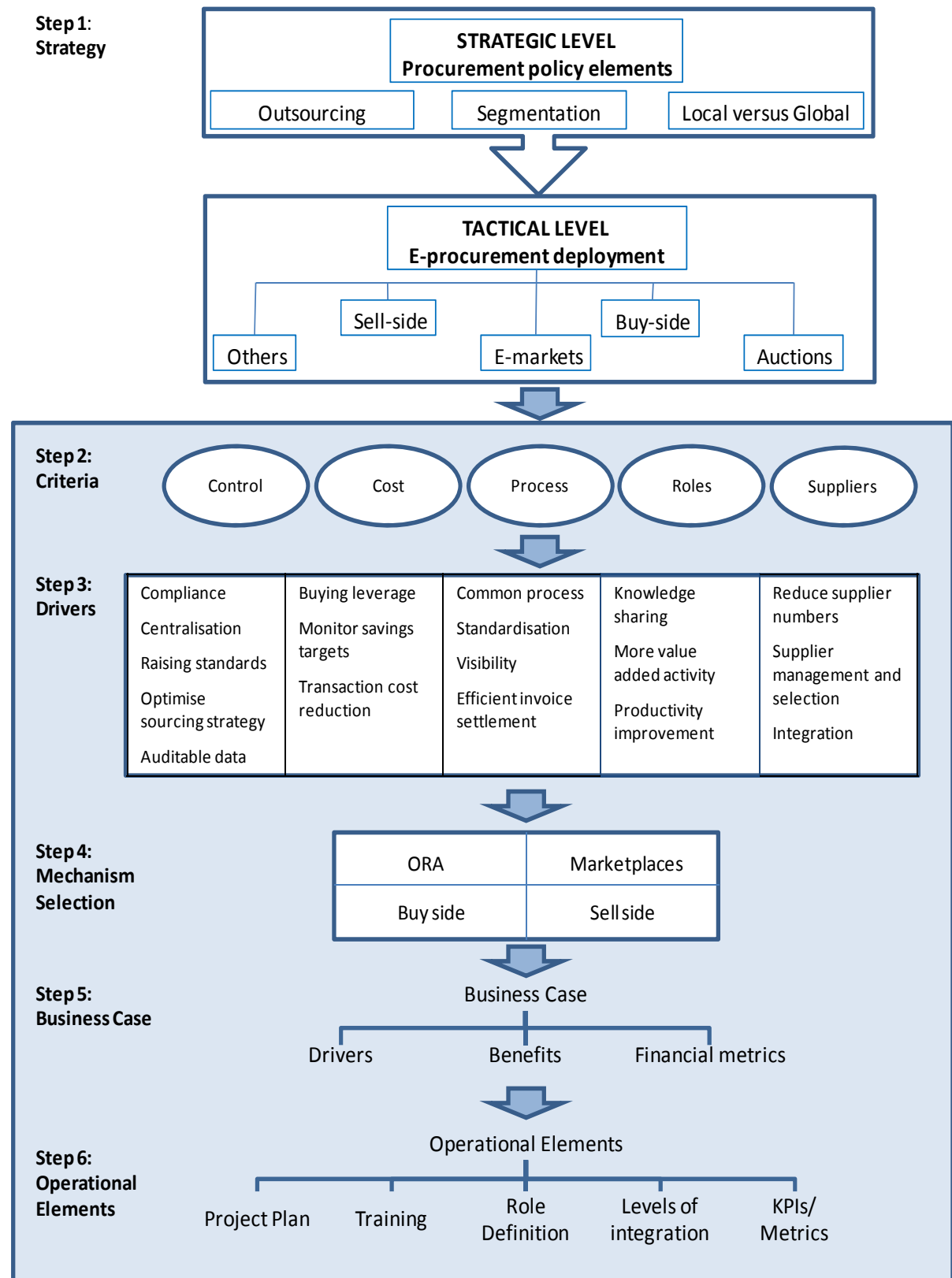
Under step 6 the model suggests a project plan should be developed. Although this element of the model was not explicitly discussed as a theme in the papers, there was evidence throughout the research programme that project planning was vital to successful implementation. This is really no more than good practice, but the choice of application will influence timescales due to the varying lead times in achieving benefits between, for example, auctions and e-marketplaces. Other issues to be addressed at this level include role definitions, training and metrics. It was evident from the research in the final two papers that roles need careful consideration, particularly where the firm is seeking productivity gains which allow a move towards more value based activities by buyers. One challenge is in managing the transfer of staff from transactional to relationship roles whilst the project is still being implemented. This is likely to take longer than many firms anticipate as even after two to three years of e-procurement usage, most organisations examined in this research were still working towards this re-skilling of their personnel. Importantly, such re-positioning will have a vital impact on the future effectiveness of the purchasing function. The operational elements support the achievement of the business case, as well as establishing timescales, outputs and measures of success for the project.

#### 5.4.2. Observations on the model

The complex supply markets in which buying firms operate today require them to regularly review their strategy in relation to categories of spend. Although not made explicit in Figure 9, this creates a tendency for such models to be dynamic in nature, as firms respond to external, market factors. Hence there is an iterative nature to this model, where firms will need to re-visit their approach, based on prevailing environmental conditions. For instance, if a buying firm intends to introduce more global sourcing, this may affect the viability of using reverse auctions in countries where the application is perhaps unknown, or there are no established auction hosts.

Equally the limitations of internet access or capacity in some developing countries may restrict the effectiveness of online RTP applications. So more traditional techniques may be required in such markets until e-procurement technology and infrastructure are established. In effect there are limitations on the diffusion of this technology, which slow or prohibit its global expansion, as discussed in section 5.3 above.

This model extrapolates findings from multiple stages in the research, carried out over several years, and represents significant learning for the author. It remains work in progress as some of the proposals need to be empirically validated, but through marrying together findings and frameworks from various papers, it provides a reference point for where we are in understanding the role of e-procurement within purchasing management.



**Figure 9:** A model for e-procurement

## 5.5 Summary of contributions

Using empirical evidence from a range of industrial case studies, this exposition makes a contribution to knowledge in three areas.

Firstly, the work has illustrated how e-procurement contributes to management of purchasing. It has clarified that the impact of e-procurement mechanisms is not pre-determined and is contingent on how such technology is deployed, both by buyers and suppliers. For buying firms, e-procurement mechanisms can be used *inter alia* to exploit market competition, improve processes, support supplier rationalisation programmes, enforce compliance and support a segmented approach to supply markets. In effect, e-procurement is an enabler of the purchasing firm's supply strategy. Similarly, it has been shown that e-procurement allows the purchasing function to re-invent itself as a more strategic component of the firm, by moving buyers away from transactional activities into value-creating roles. However there remain challenges, as it was demonstrated that integration with suppliers is not greatly enhanced by e-procurement deployment and that firms need a broader, supply chain perspective if they are to gain the benefits of integration of activities and processes with upstream trading partners.

Next, the work contributes to the theory on markets and hierarchies in relation to electronic trading. The clarification provided is that e-procurement does not have a generic influence on whether buying firms move to using market or hierarchy solutions in the supply market. This outcome is different according to the type of e-procurement mechanism deployed. Reverse auctions are price-focussed solutions which seek to exploit market competition and price transparency. Buy-side and sell-side applications tend towards hierarchy outcomes as they usually enforce interaction with fewer trading partners. The impact of e-marketplaces can vary according to their orientation – private marketplaces such as Cisco lead towards hierarchies as the mechanism is deployed to facilitate trading with existing vendors. Conversely, public or consortium exchanges allow diversification of sourcing, through access to a wider base of supply firms. However it is not the mechanism itself which creates this outcome, but the pre-defined purchasing strategy of the buying firm. This itself is influenced by supply market conditions such as unrestricted competition, or supply bottlenecks. Thus e-procurement mechanisms do not determine the supplier relationship mode, but support implementation of relationship decisions within a purchasing strategy. Through this clarification, the research provides a missing link between 'markets and hierarchies' theory in e-commerce and the purchasing management literature.

Lastly, the exposition introduces a model for e-procurement, extrapolated from the research findings, in the form of a flow diagram. This model offers some guidelines to buying organisations on the process for implementing e-procurement, with particular attention on understanding the drivers and criteria for adoption of the technology. Recognition of these factors in turn enables a more structured business case for investment. Similarly the model stresses the need for a segmentation approach to e-procurement mechanisms, on the basis that each of the applications has different, contextual roles. This model incorporates frameworks from the research, but remains a theoretical proposal as it has not been empirically tested. Hence further work in this domain could include verification of the model and its components.

## 5.6 Future directions

In looking ahead to future research, there remains a question as to what extent e-procurement can still be seen as a 'nascent' area of knowledge (Edmondson and McManus, 2007). My research began when e-procurement was just appearing in the industrial arena as a viable solution. There has been a significant growth in research into this subject, however our understanding of its impact and role, in both purchasing management and the wider supply chain context, needs to evolve. This exposition and the papers presented within it have advanced our knowledge of elements of e-procurement but gaps relate to the longer term impact of this technology, the potential of rival technologies such as enterprise application connectivity (for example, SAP systems speaking to each other) and how, if at all it can support a genuine supply chain integration agenda. The latter issue is a major concern as the evidence presented here suggests that currently e-procurement does not support genuine integration between trading partners. Indeed the present method and process of deployment of this technology results in a focus on process automation, rather than supply chain integration.

This point was supported with the finding in several cases throughout the papers, that purchasing management is still dominated by silo-based thinking and that procurement personnel are often removed from the wider supply chain goals of the organisation. This narrow, functional mentality leads to a business case which is based predominantly, or in some instances exclusively, on departmental metrics. Hence examination of how the function can move from this narrow perspective to a broader participation in supply chains is worthy of further exploration.

Equally, the individual or human barriers to successful adoption of these new mechanisms need greater consideration. Recently, Stanley Fawcett and colleagues have outlined the problems of the individual or personal barriers created by people within organisations when addressing the introduction of technology in supply chain contexts (Fawcett *et al*, 2007). The human dimension and its impact on successful e-procurement implementation has partly been explored in my research, in relation to the changes that e-procurement initiates. However it is a key issue in many SCM projects and offers an important research agenda for the future. Similarly, the issues of roles and the changes in responsibilities of purchasing managers have been explored here, but remain critical for the procurement function as e-procurement becomes more widely established. A deeper evaluation of the impact of this technology on managers' roles and changes to their job profile would prove valuable to the profession itself.

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## **Appendix A: List of publications submitted**

1. Smart, A. & Harrison, A. (2002). Reverse Auctions As A Support Mechanism In Flexible Supply Chains. *International Journal of Logistics: Research & Applications*, Vol. 5, No. 3, pp. 275-284
2. Smart, A. & Harrison, A. (2003). Online Reverse Auctions and their Role in Buyer-Supplier Relationships. *European Journal of Purchasing & Supply Management*, Vol. 9, pp. 257-268
3. Smart, A. (2005). Exploring supply chain opportunities in the UK utilities sector and the supporting role of e-Marketplaces. *Supply Chain Management: An International Journal*, Vol. 10, No. 4, pp. 264-271
4. Smart, A. (2008). e-Business & supply chain integration. *Journal of Enterprise Information Management*, Vol. 21, No. 3, pp. 227-246
5. Smart, A. (2010a). Exploring the business case for e-procurement. *International Journal of Physical Distribution and Logistics Management*, Vol. 40, No. 3, pp.181-201
6. Smart, A. (2010b). E-procurement and its impact on supply management - evidence from industrial case studies. *International Journal of Logistics: Research and Applications*, Vol. 13, No. 10, pp. 423-440.

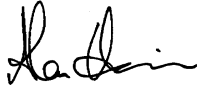
## **Appendix B: Signed declaration of contributions of authors**

**Smart, A. & Harrison, A. (2002). Reverse Auctions As A Support Mechanism In Flexible Supply Chains. *International Journal of Logistics: Research & Applications*, Vol. 5, No. 3, pp. 275-284**

The contribution of each author to the overall paper was as follows:

A. Smart                      75%

A. Harrison                  25%

Signed:  \_\_\_\_\_

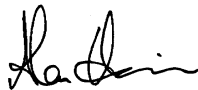
Date: 2 June 2010

**Smart, A. & Harrison, A. (2003). Online Reverse Auctions and their Role in Buyer-Supplier Relationships. *European Journal of Purchasing & Supply Management*, Vol. 9, pp. 257-268**

The contribution of each author to the overall paper was as follows:

A. Smart                      75%

A. Harrison                  25%



Signed: \_\_\_\_\_

Date: 2 June 2010

## Appendix C: Example of coding from interview transcript

Extract from INTERVIEW WITH SOP of XYZ plc, Thursday 7<sup>th</sup> August 2008.

AS: I want to go back a step as what I'm trying to understand is what sort of business case, if there was a business case, existed in XYZ for e-procurement.

SOP: Yes, so there were multiple things that were put forward in the business case which has since proved to be slightly out of kilter. We tried to reduce the number of resources we have working on the transactional side of procurement to try and free up resources to **concentrate on strategic sourcing**, what we've actually found is that a lot of the resources are looking after the systems, and training the business in how to use the system, so in terms of how many resources we've got, it's probably not that huge. **Another thing was having control**, so SRM has a very good kind of approval work flow which enables the right budget holder to be able to approve and the right procurement person to be able to approve. I should say by the way that any of these kind of controls only work if you've got the right process, the tool itself probably won't or will stop you – you know retrospective purchase orders and all kinds of things like that, that can put us behind work, so the process has to be right. One of the big things that we thought we'd be using e-procurement for but haven't, is **spend analysis** because somewhere along the line someone made the assumption that 100% or close to 100% of our buying would be going through a purchase order system which SRM is, but it hasn't worked out to be anything like 100% and rightly so in my opinion, so that's probably where it hasn't done as well.

ALA: Was there anything else you can think of?

SOP: Yes with the spend analysis came opportunities, like **improved supplier management** in that we could keep an eye on delivery dates, how long it took to get items coming through. **Contract management** I think would have been part of it, being able to have the visibility to see our people buying off-contract – that goes back to procurement control.

ALA: Thanks. The other point that goes with this question is whether there were any other kind of business drivers for doing this.

SOP: Yes well the **compliance** – again that was sorted by the approval work flow I suppose and that was definitely one driver, I think the main one was trying to free up resources to concentrate on more strategic activities, so yes compliance, and then **visibility**, all factors. As far as procurement goes the e-procurement provides two main things: it provides the ability to ensure **compliance to contract and compliance to process**, by means of the correct procurement channel and we also have a strong interest from the data side because that's the point in which the data is put into the system, so that's how it impacts spend analysis. So I guess our strategy is to put everything through our e-procurement tool by which I mean a PO tool, I'm not sure if you want to touch on stuff like T&E tools because potentially they could also be considered e-procurement.

Comment [m1]: eP1 Business case – item a

Comment [m2]: eP1 Business case – item b

Comment [m3]: eP1 Business case – item c

Comment [m4]: eP9 Process improvement – item b

Comment [m5]: eP9 Process improvement – item c

Comment [m6]: eP2 Drivers – item a

Comment [m7]: eP1 Business case – item d; eP9 Process improvement – item d

Comment [m8]: eP8 Strategy – item a





# Reverse Auctions as a Support Mechanism in Flexible Supply Chains\*

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**ABSTRACT** *The Internet offers buyers a number of solutions for automating purchasing activity through e-procurement mechanisms. Some of these solutions have yet to prove their worth, requiring long lead times to implement and achieve payback benefits. Online reverse auctions are a tool which can be rapidly adopted and which are producing price reductions for direct and indirect purchases. They also offer process benefits to participating buyers and suppliers. As supply chains learn to become more flexible and responsive in the face of shorter product life cycles and faster-changing markets, auctions offer a viable mechanism for situations where there are many suppliers and product complexity is low. They also offer an early payback for electronic marketplaces and exchanges.*

## Introduction: The Changing Nature of Supply Chain Management

Within the field of supply chain management, many industrial firms have moved towards more collaborative relationships with their suppliers. This approach was driven initially by the adoption of practices such as total quality management, lean production and just-in-time manufacturing. Such relationships have been based on longer term commitments, designed to deal with relatively stable and predictable demand, supported by advance

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scheduling in the manufacturing process. Today, one of the major challenges of supply chains is to become more responsive to changes in demand, shorter product life cycles and an ever-increasing level of product innovation and variety. A recent trend in supply chain thinking has been the concept of agility (Harrison *et al.*, 1999). Agility is concerned with supporting the need for responsiveness through the capability to adapt quickly to large-scale, unpredictable changes in the business environment. Agile supply chains need to remain flexible and adaptable through constantly shaping and reshaping themselves to optimise the specific requirements of the chain at a point in time.

The agile supply chain needs to be supported by a network of supplying firms who co-operate in minimising inventory build-up whilst ensuring product and service quality. In recent years, supply chain integration has been achieved by a policy of supplier reduction, designed to facilitate management of suppliers, embed quality and contain costs (Goffin *et al.*, 1997). Some commentators suggest, however, that the partnership philosophy is not always appropriate and that the alternative, "competitive" approach to supplier relations is suitable in some circumstances (Burton, 1995; Leavy, 1994). The competitive approach can be executed by switching sources of supply as and when required to take advantage of lower prices or better designs, when supply and demand factors are favourable. This fluidity in supplier selection has been seen as a problematic feature of agile supply chains. But the advent of the Internet changes the rules for managing suppliers. Through web technology it becomes easier to trade with a larger number of suppliers, as new sources of supply can be more easily located, integration of processes (even with overseas suppliers) is facilitated and the cost of transactions with all trading partners is reduced. Hence, whilst some observers have suggested the Internet will introduce a new paradigm of technology-enabled collaboration, firms may equally choose to remain more flexible towards supplier selection and management, in support of an agile strategy.

A major issue facing industrial firms who wish to make use of web-enabled procurement is which mechanism to adopt: sell-side, buy-side, exchanges or auctions? This paper evaluates the role which reverse auctions may have in this context, in particular in support of a more flexible supply chain solution.

### **The e-Procurement Landscape**

During the 1990s, the adoption of the Internet as a means of communicating, disseminating information and transacting created the opportunity for firms of all sizes to participate in e-commerce at much lower cost than was previously possible, through economies of scale and of scope (Kalakota & Whinston, 1997). The ubiquity and ease of use of the World Wide Web has enabled many firms to establish new communications networks through the use of e-mail systems, Intranets and Extranets, creating a platform for new web-based software.

One of the first areas of supply chain management to be transferred into the Internet arena was purchasing, through the use of e-procurement

applications. A range of tools and mechanisms is available to buying firms, enabling them to take control of purchase activity, to obtain price reductions, lower transaction costs and manage the supply process. The earliest form of e-procurement came through the development of sell-side web sites established by suppliers, where buyers could browse in electronic catalogues, select products and place orders. Companies in the IT sector such as Dell and Cisco have been particularly successful at developing this model, having moved their sales and marketing and customer ordering processes into the online world. Dell, for example, now sells exclusively over the web and in doing so has become the world's biggest seller of PCs. For buyers, this approach offers an initial step into e-procurement, through the automation of the ordering process, however it has some serious limitations for the industrial buyer dealing with hundreds of suppliers. Apart from the obvious requirement for the buyer to visit many supplier-owned catalogue sites, the data transfer takes place over a web page and does not allow for the capture and integration of purchase order information into back office systems such as ERP (Enterprise Resource Planning).

This limitation led to the development of buying applications by companies such as Ariba and Commerce One. A new generation of web-enabled requisitioning systems was created, handing control to buyers, through the ability to search multiple catalogue sites, compare prices and place standard-format purchase orders electronically. These applications have the potential to streamline the ordering process, provide requisition access to employees at very low cost and reduce the cost of purchasing transactions. However, the growth of these systems has been stalled by the costs and complexity of implementation, lack of suitable catalogue formats from supplying firms and the difficulty of gaining supplier acceptance of a mechanism which effectively reduces differentiation to price alone. In addition, they have proved suitable mainly for products with low complexity such as office equipment, standard replacement parts and low-risk MRO (maintenance, repair and operating) supplies and not the full range of materials and services purchased.

Alongside the development of buy-side applications has been the advent of electronic marketplaces and exchanges. These are web sites offering access to multiple buyers and suppliers, enabling online trade through a third party-hosted mechanism, where firms can search for trading partners and conduct transactions electronically, in real time. Many of the early exchanges established were independent of any supplier or buyer ownership, offering access through fees per transaction or via a membership subscription. During late 1999 and 2000, many "old economy" firms began to establish a foothold in the online marketplace by setting up their own exchanges, in conjunction with industry competitors. One example can be seen in CPGmarket.com, initially given birth by three of Europe's largest food companies—Nestlé, Danone and Henkel—to serve the consumer packaged goods industry. These ambitious developments have not been without their setbacks. Some of the early exchanges to appear, such as Chemdex, a chemicals-industry site, have gone into liquidation due to lack of support. In addition, there are problems with establishing standards for electronic catalogue formats and some of the technology has proven unreliable or difficult to implement. Many of the

marketplaces announced in 2000 in a fanfare of publicity have been unable to generate regular transaction capability and the future of some of these collaborative ventures may be in doubt. Exchanges are businesses and must be run as such. It is essential that they deliver value to the end customer, and that this value is apparent to their other stakeholders. One e-procurement mechanism that offers exchanges an early "win" in their evolution towards collaborative planning and master data synchronisation is the online reverse auction (ORA).

In reverse auctions a buyer offers a tender to invited suppliers who bid for the right to fulfil a contract at the lowest price, usually in a very short time span of hours or, in some cases, minutes. Commentators have suggested that the popularity of this tool with buyers is due to its success in driving down prices and its use will be short-lived. However, it allows buyers an alternative and more flexible approach to establishing an e-commerce foothold and can offer a fast and efficient mechanism for managing some areas of procurement spending online. Electronic marketplaces, which have survived, often use reverse auctions as their major selling point, even if their overt business proposition is somewhat different. For example, the move towards an ostensibly collaborative model at Covisint (an exchange that combines the purchasing clout of Ford, GM, DaimlerChrysler, Nissan, Renault and Peugeot) has not prevented the adoption of competitive tendering using ORAs, which some observers have suggested is the main form of transaction that the exchange has managed to stage. Between October 2000 and February 2001 auctions were held to a value of US\$350 million. Other exchanges such as GlobalNetExchange.com and CPGmarket.com are similarly concentrating on reverse auctions as a key service offering (*Financial Times*, 2001).

One of the problems behind the pursuit of the marketplace option is that large corporations have jumped into an online solution for fear of being left behind. As illustrated by Porter (2001), firms need a strategic evaluation before entering the Internet arena. The lack of a strategic analysis, supported by ease and low cost of entry and a media feeding frenzy on the need to be "on the web", have led many firms along the me-too route, which in turn resulted in many of the early dot-com casualties. Against this background of uncertainty about the future of B2B (business-to-business) e-commerce, the reverse auction has become an attractive and legitimate method for successful online trading in the eyes of buyers. However, it does have a potentially more strategic dimension.

## Research Methods

This paper draws on a recent Cranfield study (Smart, 2000) on the limited amount of academic research existing in the field and on relevant media reports and articles. The Cranfield study was a piece of empirical research of a largely exploratory nature. Six case studies of live reverse auction events were selected opportunistically from buying organisations in the aerospace, utilities, oil and food industries. The access provided by the buyers allowed a researcher to be present during the auction process, including whilst the bidding took place. This enabled live data to be collected during the auction events themselves. [The buyers participating in the study requested

TABLE 1. Auction Case Study Results

Auction	Industry	Auction item	Value (£)	% Reduction
1	Aerospace	Office supplies	800,000	30
2	Aerospace	PC consumables	1.6 m	37
3	Utility provision	Metering equipment	4.2 m	3
4	Oil and gas	Industrial chemicals	130,000	5
5	Aerospace	Courier services	200,000	6
6	Leisure	Frozen foods	1.5 m	22

anonymity and their identities have not been disclosed. For further details on the cases studied see Smart (2000).]

Two-thirds of the participating supplier firms also agreed to be interviewed before and/or after the auctions had been completed. This approach allowed the auction process to be tracked in detail from the beginning to the end and from multiple perspectives. Through the semi-structured interviews conducted with the buyers and suppliers, data were collected on: the ORA process; supplier bidding tactics; the savings achieved by the participating buyers; the views of the buyer and supplier firms of the potential benefits and disadvantages; how auctions would impact partnerships; and the nature of transactions in the future. The overall objective of the study was directed at understanding the likely impact of reverse auctions on price and buyer–supplier relationships.

This paper is primarily concerned with the impact of auctions on price and partnerships and the role ORAs can play in the pursuit of a flexible supply chain approach. Details of the ORA process and the tactics used by suppliers during the auction events are the subject of a separate paper by the authors (Smart & Harrison, 2001).

## Research Findings

Table 1 illustrates the results from the six case studies used in our research. Three auctions were for direct purchases and three for indirect purchases. The value column shows the previous price paid to the incumbent supplier. The percentage reduction figure shows the price reduction achieved in relation to the existing contract value.

### *Price*

The tools introduced under the umbrella of e-procurement were directed initially at indirect or MRO purchases, as this represents the area of spending traditionally given least attention. The research conducted at Cranfield revealed that savings of between 6 and 37% were achieved on indirect (MRO) purchases in the reverse auctions studied. Savings as high as 45% have been reported in events staged by auction hosts such as Freemarkets and eBreviate ([www.freemarkets.com](http://www.freemarkets.com); [www.ebreviate.com](http://www.ebreviate.com)). In the case of direct materials,

significant savings were also achieved within the six case studies, ranging from 3 to 22% against historic cost. In a separate study, Ford reported average savings on direct materials of 15% in its auctions held on Covisint; and the consumer products market-place, CPGMarket.com, declared savings of 15 to 20% for buyers involved in a combination of direct and indirect purchases ([www.cpgmarket.com](http://www.cpgmarket.com)). GE put US\$6.4 billion worth of goods and services through online auctions in 2000, achieving an average price reduction of 16% (Hannon, 2001).

One of the reasons that such levels of savings have been achieved, in some cases over and above the expectations of buyers, is that reverse auctions add a new dimension to the tendering process. In traditional, sealed-bid tenders, suppliers do not know the price levels of competitors and must effectively take a calculated guess at what their lowest price offer should be. In a reverse auction, bids appear on a screen accessed by all participants and all the bidders are able to see the value of their rivals' bids (although the actual bidders' names are not revealed). This situation creates a degree of price visibility which is normally absent from the sealed-bid tender. Effectively, through price visibility in real time, reverse auctions act as a mechanism to reveal true market prices and, in this respect, may serve to create more perfect markets for some products and services, particularly commodities. Although some clearly had reservations about its impact, some suppliers interviewed suggested that this price transparency was a useful benchmarking exercise, allowing them to see where they stood in relation to rival suppliers. In some cases it could lead to an analysis of their competitive position and a price re-evaluation by higher cost producers.

Both direct and indirect materials prices are influenced by this process and there may be higher retained profit margins in some purchases than buyers had anticipated. Indeed, some buyers interviewed suggested they would need to review contracts for other direct materials after achieving lower prices than expected in some of the auction events. One buying executive interviewed commented that procurement officers traditionally have spent only 20% of their time on purchasing negotiations, with the rest taken up by administration tasks. It is possible therefore that buyers have not achieved the best purchase prices in the past due to a lack of appropriate tools. These results also support evidence from other studies that, in close, partnership arrangements (which existed before some of these contracts in the study went to tender by auction), suppliers may be able to retain the margin benefit in a market of reducing price levels, or to increase prices more easily (Cousins, 1999). It may well prove the case in certain industries or product sectors that a downward step change in pricing will result from the deployment of reverse auctions as the standard method for tendering.

### *Partnerships*

The supply chain is often described in terms of the integration of processes between firms to achieve greater levels of efficiency and much of the literature on supply chain improvement has extolled the need for partnerships with suppliers. However, the growing need for flexibility in the market-place may challenge this tenet. One problem is that the term "partnership" is poorly

defined in the literature. Indeed, it has been used in so many contexts with different implications as to have no real meaning (Cox, 1996). There is good evidence that the case for closer, collaborative relationships or partnerships has not been adequately proven, and the benefits, assumed to be automatic, often have not been realised for either party (Cousins, 1999). In some cases, the "partners" in the relationship continue to conduct adversarial negotiations on important issues such as price level, irrespective of the supposed collaborative directive (Burnes & New, 1997). Importantly, it has been demonstrated that there can be a better understanding between buying and supplying firms in the "competitive" transaction and that in some circumstances market mechanisms may be a more effective means of conducting negotiations between contracting firms (Forker & Stannock, 2000).

Several authors (Burton, 1995; Cox, 1997; Roberts & Mackay, 1998) have suggested that a combined or composite strategy in supplier management is required, in order to take advantage of the different kinds of relationship that are possible (Parker & Hartley, 1997). Indeed, the segmentation approach to purchasing strategy proposed by Kraljic (1983) provides a continuing, valid framework. A mixed portfolio of relationships with suppliers, varying in accordance with supply and demand conditions, will continue to be necessary to support supply chain flexibility. Consequently, a competitive or price-based purchasing policy has its place in supply chain strategy and reverse auctions can provide an efficient mechanism for supporting such an approach.

Within the Cranfield study a majority of both buyers and suppliers interviewed identified benefits in the reverse auction mechanism in terms of reduced manual involvement, lower transaction costs, faster completion of the tender cycle and being a more efficient method for decision-making in tendering of contracts. These have to be offset by the potential disadvantages, such as costs of running the auction, training participants, pre-qualifying new vendors and potential costs of switching. However, properly executed, the reverse auction will still have a role within so-called partnership relations where tenders become due, simply as a method for process improvement. Two buyers in the study indicated that they would transfer more tenders to the ORA route for this specific reason.

## Discussion

The reverse auctions studied here reveal that price reductions are possible even in low margin businesses such as industrial chemicals, which were the subject of one of the auction cases followed and where the buyer achieved a 5% reduction against historic price. Freemarkets has facilitated savings for buyers of as much as 40% on printed circuit boards. The reverse auction allows true market prices to be revealed for both direct as well as indirect materials, and buyers have the opportunity to obtain savings on original equipment manufacturer parts, particularly where the product has commodity characteristics. Potential limitations of the ORA have been identified elsewhere, along with the suggestion that only firms who do not understand their costs will make use of this tool (Emiliani, 2000). This seems to be contradicted by the fact that it is being widely used in the automotive and other manufacturing sectors, where lean production has been in place for



some years and supplier management has been a key strategy. The evidence from the limited studies and media reports of this phenomenon suggest that even experienced buyers have something to learn from reverse auctions. In reality, if this mechanism can produce double digit percentage price reductions in the short term then buyers may ignore it at the cost of their firm's future competitive positioning.

Taking a broader perspective of the world of web-enabled business, firms need to assess which mechanisms they will use to support their purchasing and where these fit with the wider issue of supply chain management strategy. Firms have been caught up in the rush to adopt e-procurement solutions and may find that they need to change direction as new, improved tools are developed. The underlying problem with most e-procurement applications is that they do not offer a genuinely integrated supply chain solution. Ideally, any new procurement mechanism should develop from, or integrate electronically with, ERP systems which large firms have spent years implementing. Progress in this area is stalled by the need to develop more effective "middleware", which provides the integration capability for different applications. Currently, for the majority of global firms, integrating processes in and out of tools such as buying applications and online exchanges has proved to be too difficult and is on the back burner. Given the evident difficulty firms have in realising benefits from buy-side tools and exchanges, reverse auctions which require no long-term commitment and are quick and simple to implement offer a more attractive and risk-reducing option.

## Conclusions

If the above implementation problems can be overcome effectively in the future, then firms will require a framework for help in assessing the use of the alternative approaches to e-procurement. An approach to evaluation of the various e-procurement mechanisms can be seen in the matrix shown in Figure 1. The selection matrix suggests criteria for choice based on the axes of product complexity and number of suppliers. For routine purchases such as office supplies, defined by Kraljic (1983) as "non-critical", buying tools offer the logical solution, providing cost of implementation will not exceed the potential cost transaction benefits. More complex product purchases can be made through suppliers' own catalogue web sites, thereby avoiding the expense for buyers of converting complicated content into electronic format. A benefit of exchanges is the ability to hold information on many suppliers and they offer a solution for the segment containing many producers of complex products, not suitable for purchase through auctions. In this model, reverse auctions will be most effective where product complexity is low and supplier numbers are high, producing commodity-like conditions.

Our empirical evidence from this exploratory study suggests that there is indeed a role for ORAs for purchasing products with low complexity where there are many suppliers with suitable capabilities in terms of quality and delivery reliability, and where the switching costs from one source of supply to another are relatively low. Significant price reductions for buyers in both direct and indirect purchase segments have been achieved where suitable

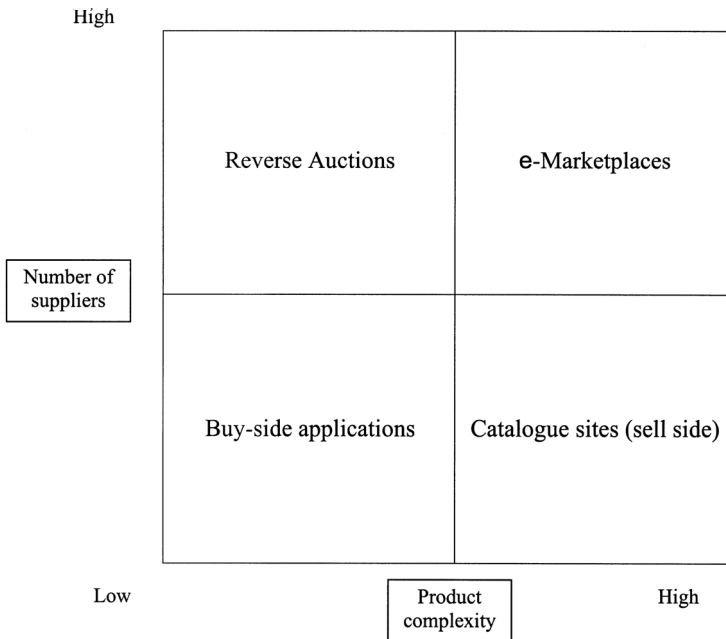


FIGURE 1. e-Procurement Solutions Segmentation Matrix.

market conditions prevail. However, the issue is not simply one of price reduction, as both buyers and suppliers can benefit from process improvements through ORAs and use them as a low-cost foothold in e-commerce.

Our study and evidence from auction service providers and large organisations illustrate that firms in a range of industries have adopted auctions as a viable solution. There are demonstrable benefits over other, as yet unproven, e-procurement mechanisms, such as requisitioning tools and online exchanges. The need for a more flexible and responsive supply chain is evident as firms face the challenges of adapting to demanding customers and more turbulent markets. The ORA can be located within a continuum of relationships ranging from transactional to relationship-based [for an example of the procurement continuum see Parker & Hartley (1997)]. Recognition of the broad range of supply mechanisms and the role of ORAs and other emerging methods of e-procurement within that range is helping to create the capabilities needed to operationalise the agile supply chain.

Partnerships may suit the supply of certain critical items in the production process but firms may become constrained in longer term relationships and lose the necessary degree of flexibility to source elsewhere when supply conditions are suitable. Equally, companies need to recognise that web-enabled mechanisms will offer lower transaction costs for dealing with many more suppliers than was possible in the past, allowing for a broadening of the supply base at no extra cost. Many direct and indirect purchases fit the reverse auction process. ORAs offer cost savings, speed and ease of use, and assistance in switching between sources of supply. These are all potentially valuable contributors to an agile supply chain strategy.

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# Online reverse auctions and their role in buyer–supplier relationships

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## Abstract

Despite the move in recent years towards supplier partnerships, buying firms need at times to make use of competitive procurement strategies for certain purchases. This study examines the impact of reverse auctions on buyer–supplier relationships through six case studies, analysing primarily the supplier perspective through participant interviews. The authors identify that there are potential benefits for both parties in a reverse auction, which can offer tendering and transactional cost advantages. For buyers, it offers a competitive procurement process. The effect on relationships will depend on the extent to which buyers employ the auction as a price weapon, or whether it is used primarily as a process improvement tool.

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## 1. Introduction

Increasingly within practitioner circles, the Internet is being recognised as the mechanism which will have the greatest impact on how companies operate in the next decade. Growth of Internet business through fast access to the World Wide Web has been exponential in the last few years, led by the USA, with Europe and the Asia Pacific region following close behind (Boston Consulting, 2000; Forrester, 2000a). Despite some recent, initial casualties in the ‘dot com’ economy, both Business to Consumer (B2C) and Business to Business (B2B) sectors continue to grow, with established industries and market sectors adopting new web-based channels to market. However, it is in the B2B sector that e-commerce has the greatest potential for growth and impact on company performance, through the opportunities it presents for: faster entry into new markets, expansion of global business models, lower transaction costs, and improved supply chain management (Kalakota and Robinson, 1999; Chopra and Van Mieghem, 2000).

Within the B2B sector, many firms have recognised the opportunity to focus on cost reduction opportunities, in particular through the use of electronic

procurement (eProcurement) mechanisms. The first eProcurement tools launched were designed to facilitate online search, requisition and ordering, through applications providing access for buyers to suppliers’ electronic catalogues. These applications had little initial impact on supplier relationships as they were set up in co-operation with an established supplier base who provided an electronic product catalogue linked to a price list. The eProcurement model forecast to have greater impact has been the electronic exchange or marketplace (Kaplan and Sawhney, 2000; Yankee Group, 2000). The early eMarketplaces established were either horizontals, such as mro.com offering one-stop shopping for commercial buyers across many industries through access to a wide variety of products, or verticals such as plasticsnet.com, with a specific industry offering designed to attract buyers and sellers from within the same sector. A further mechanism which has grown in use alongside these eMarketplaces has been the online reverse auction.

Online reverse auctions (ORAs) are exactly the way they sound: traditional auctions in Reverse (Smart and Harrison, 2002). Instead of a seller offering a product for sale to the highest bidder, a buyer offers a tender or contract for the supply of specific goods or services. Suppliers compete for the right to the contract by bidding *reducing prices*, until a final price—the lowest—brings the auction to an end. Reverse auctions are hosted by many eMarketplaces as a means to enhance

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the site's product offering. Auction software companies have appeared, such as Freemarkets, Moai Technologies and eBreviate, using examples of substantial price reductions achieved in recent auctions, to tempt industrial buyers. Forrester has predicted that the online B2B auction market would reach \$52 billion in 2002 (Forrester Research, 2000b). This has produced a raft of media articles suggesting that huge cost savings are available if companies merely move their tenders into the auction model. Similar speculation has suggested that partnerships and long-term supplier relationships are a thing of the past and that buyers must move to a more aggressive price negotiation model in order to compete.

This paper describes research that was commissioned by a major consulting firm into ORAs carried out in six case examples. It was possible to interview both buyer and seller parties to the auctions, and hence to develop conclusions about the role of ORAs in buyer–supplier relationships.

## 2. Background and research questions

The literature on supply chain management and buyer–supplier relationships has highlighted the two procurement strategies available to buyers, which a number of commentators have bracketed as either 'competitive' versus 'collaborative' or 'adversarial' versus 'partnership' (Leavy, 1994; Burton, 1995; Patterson et al., 1999).

Despite the move within many industrial sectors towards closer, longer-term relationships with suppliers, a growing body of research has suggested that partnerships can create problems of their own, and that their success depended upon clear implementation criteria (Burnes and New, 1997; Krause, 1997). There has also been a tendency to consider partnerships as the most appropriate strategy without considering the difficulty of managing them, or to view them over-optimistically (Cousins, 1999; Burnes and New, 1997). Forker and Stannock (2000) have demonstrated that there can be a better understanding between buyer and supplier in the 'competitive' exchange and that market mechanisms may be a better method of satisfying the needs of contracting firms in many buying situations. Similarly, Parker and Hartley (1997) suggested that within the procurement continuum (ranging at one end from competitive purchasing on spot prices to fully integrated ownership of suppliers at the other) many different types of relationship are possible and illustrate that under partnership agreements, suppliers can end up with lower prices than in competitive bargaining. Olsen and Ellram (1997) have indicated the need for more specific research into the dangers of the partnership approach versus the benefits of opportunism. In the case of Marks & Spencer

in the UK retail market, many of the long standing partnership arrangements with UK suppliers were abandoned in favour of lower cost sourcing from overseas and a more flexible approach to supply sources. These changes have been driven by the need to adapt to changing market conditions and to improve competitiveness through diversified sourcing.

Leavy (1994) has highlighted that firms need to be aware of the advantages of the different procurement strategies whilst Cox (1997) and Gibbs (1998) have suggested that buying firms should not pursue partnership relationships alone, but select the appropriate strategy, either competitive or collaborative, in accordance with industry and market conditions. It is possible therefore to pursue a composite strategy (Burton, 1995) taking the best from both approaches and applying them in accordance with the competitive needs of the buying firm. Furthermore, as the growth of Internet-based business creates the opportunity for lower transaction costs between firms, e-commerce will reduce the cost of integrating larger numbers of suppliers, allowing for a more versatile approach to supplier relations (Roberts and Mackay, 1998). One key aspect of partnership sourcing has been the reduction in supplier numbers (Lamming, 1993) and firms need to assess, in a world enabled by e-commerce, how and when supply sources can be extended by adding more competition, with no additional transaction cost to the buyer.

This debate provides a context in which to examine and understand the role of reverse auctions in supply chain relationships and the questions our research sought to address are:

In what ways do reverse auctions impact on price levels for suppliers?

How do reverse auctions impact on buyer-supplier relationships?

## 3. Research design

In emerging, new situations where an exploratory approach is required, case studies are one of the more attractive options available to researchers (Yin, 1993). The case study method was chosen by the authors for the following additional reasons:

- desk research indicated that there was virtually no literature on this subject apart from a small number of journal and media articles on USA online auctions (as at May 2000),
- no previous academic studies on the specific research subject could be found.

The project sponsor was able to provide access to two cases of reverse auctions which were active or at the planning stage. With their assistance, it was possible to

Table 1  
Auction research cases examined

Company	Industry	Auction item	Value	No. of suppliers
1. Airco	Aerospace	Stationery	£800,000	9
2. Airco	Aerospace	PC consumables	£1.6 m	9
3. Utilityco	Utility provision	Metering equipment	£4.2 m	4
4. Oilco	Oil & Gas	Industrial chemicals	£130,000	6
5. Airco	Aerospace	Courier services	£200,000	10
6. Foodco	Leisure	Frozen foods	£1.5 m	7

undertake four further case studies in short succession. Given that access would be provided directly to senior personnel in the firms selected, the authors chose to use interviews as the main method of data collection. Both buyers and suppliers were interviewed, although the research focussed primarily on the role and opinions of the supplier firms, as a larger sample was available and as it was considered that the attitude of suppliers represented a new area for research which was previously unexplored. A total of twenty-two supplier organisations were interviewed from the six auction case studies. The respondents were senior executives ranging in status from Managing Director to Sales Manager who were actively involved in managing the relationships with the buyers and who were engaged in the auction events as they took place. The names of the participating buying firms have been disguised at their request (Table 1).

*Note:* 'Airco' held three separate auction events during the course of this study which are treated as individual cases.

In order to illustrate the progress of a bidding sequence, Table 2 tracks bids in the auction of stationery at Airco, showing auction parameters and bidding history.

#### 4. Analysis & results

After transcription of the interviews, a qualitative analysis of the data collected from interviews was undertaken. Data was initially coded in order to identify themes, recurring comments and parameters which could be analysed in relation to the research questions using an iterative process (Miles and Huberman, 1994). Within specific interview questions, responses from suppliers were analysed in order to be able to create appropriate categories. For instance supplier attitudes towards the auction, prior to the event, were categorised as 'positive', 'negative' or 'unsure'. This enabled the authors to create analysis of percentages of respondents in relation to some key questions. Data arrays of responses also were set up in order to identify common

threads or comments repeated by more than one respondent.

##### 4.1. Supplier responses

The interview questions were developed in conjunction with the sponsor, who had a particular interest in understanding attitudes of the suppliers towards aspects of the ORA process. The initial question set developed was piloted in the first case study and found to provide suitable responses and data for analysis, and was continued through the following five cases. The twenty-two suppliers were asked some specific questions which allowed analysis on the basis of percentage of respondents and these responses are illustrated in the numbered figures.

Only 18%, or four respondents, had any previous experience of *reverse* auctions prior to these case study events and three of these were from within the office equipment business (as bidders on the first Airco auction). This particular industry, being within the MRO<sup>1</sup> spend, has been one of the first to see auctions introduced as a means of tendering. For most of the suppliers, the auction was a new experience and many of those saw their participation as an opportunity to learn about this new approach by buyers. This attitude explains the result in Fig. 1 where 45% of suppliers were positive towards the events, a higher figure than had been expected.

The suppliers who were strongly negative included the incumbent supplier in five out of the six auctions—only one of the incumbents considered the auction as an acceptable way to do business. This is unsurprising as the incumbents are those with most to lose, and in certain cases, the auction was held before the usual annual review period for the contract, so normal conditions with the buyer were under threat. A majority of 55% were either strongly negative or unsure of the suitability of the auction mechanism.

The level of preparation of suppliers was tested, as shown in Fig. 2, which reveals the percentage who carried out a cost analysis based on the tender details.

<sup>1</sup> Maintenance, repair and operating supplies.

Table 2  
Bidding history for Airco stationery auction

Auction 1: Stationery supplies

Nine suppliers were invited to bid (here named as Suppliers A to J)

Start price: £820,000  
Historic price £775,000  
Bid decrement : £5000 (minimum amount by which bids can be lowered)

Incumbent : Supplier A

Auction opened at 12.00 with following bids placed:

Amount (£ 000's)	Supplier	Time of bid
810	C	12.01
805	J	12.04
800	D	12.09
795	G	12.12
795	A	12.12
790	D	12.13
790	G	12.14
785	B	12.18
785	D	12.20
770	F	12.21
750	D	12.22
745	C	12.23
700	B	12.23
695	G	12.24
675	F	12.25
650	D	12.26
630	B	12.28
625	F	12.28
610	B	12.28
600	D	12.28
600	C	12.28 Auction extended
590	F	12.31
590	C	12.33
580	B	12.32
575	C	12.34
570	D	12.34
565	F	12.34
560	B	12.34 Auction extended
555	F	12.36
550	C	12.36
550	D	12.37
550	B	12.37 Auction extended
545	D	12.42 Lowest accepted bid
545	B	12.43 Auction extended

No further bids

Auction closed at 12.48

Suppliers: Pre-auction attitude

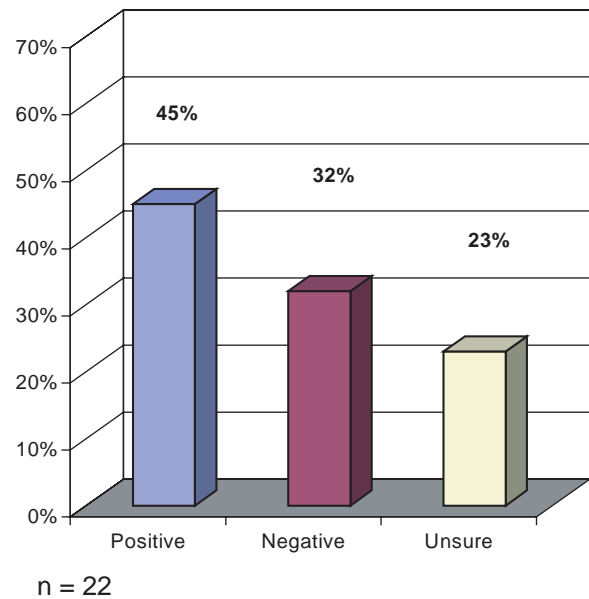


Fig. 1. Supplier attitude pre-auction.

Suppliers: Did you prepare a cost analysis in advance?

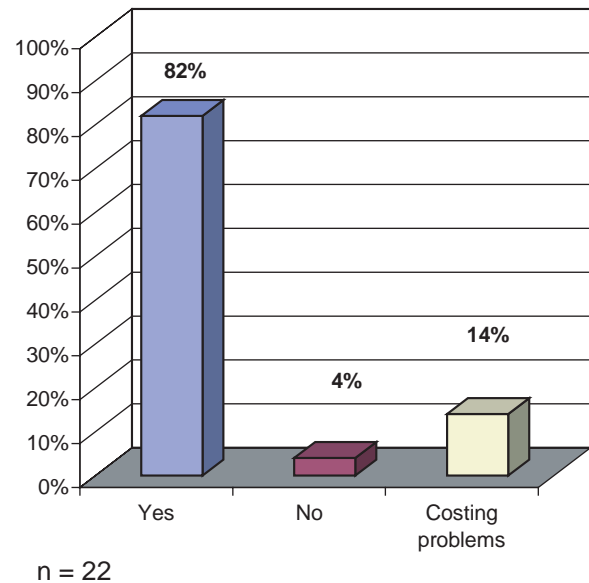


Fig. 2. Supplier approach to cost analysis.

This reveals that 82% did such a cost analysis, some of which, from the information given in interviews, were highly sophisticated. The supplier preparation varied in accordance with the tender or contract details—some bids were for a specific product only, whilst others covered a complicated basket of goods. Those suppliers who experienced costing problems were new bidders in

those tenders and said they did not fully understand the costs involved. All three of these suppliers advised they would have done a complete costing if more time or information had been available. The only supplier (4% of respondents) who did not prepare a costing for the auction was an incumbent who assumed he knew the market price for this product tender and



who proved to be complacent about the impact of the auction.

Some respondents were concerned before the event that it might turn into a ‘free for all’ with suppliers aggressively cutting prices to see off their competitors. However the overall level of supplier preparation suggests that fear was unfounded. Most suppliers went into the event with a clear understanding of their costs.

Furthermore, most suppliers advised they approached the auction in the same way as any other tender opportunity. This response raises questions about the precise role of the auction and whether the auction event genuinely contributed to the cost savings achieved, or whether those were the effect of other causes. Some of the supplier interview comments illustrate the level of realism in the attitude of the majority:

‘we had a walk away price.....’ (quoted by two suppliers); ‘everyone has a bottom line and if you go below it you have blown it’; ‘we could have been more aggressive in pricing the contract but decided against it’.

Attitudes to the bidding process were tested, with respondents asked to confirm if they had clear tactics before the auction, and whether these changed during the event itself.

There is a relationship between Figs. 3 and 4 where 68% of suppliers polled had established an approach to bidding for the auction and did not alter their tactics. Similarly 23% did not start with a pre-conceived idea of

Suppliers: Did you have a pre-auction bid strategy?

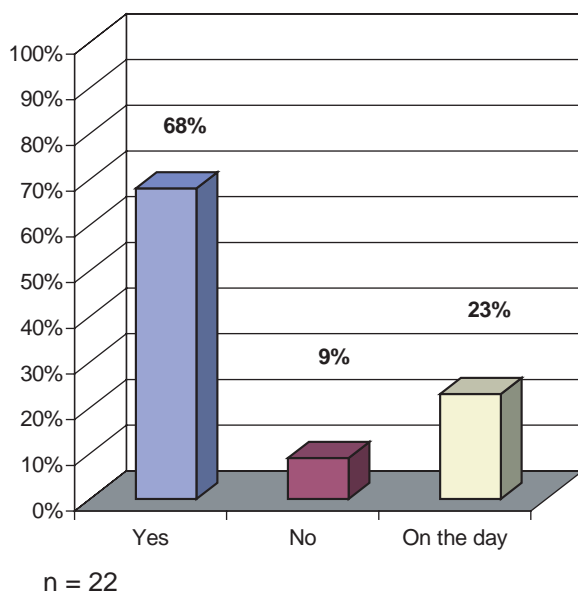


Fig. 3. Pre-auction bid strategy.

Suppliers: Any change of tactics during the bid?

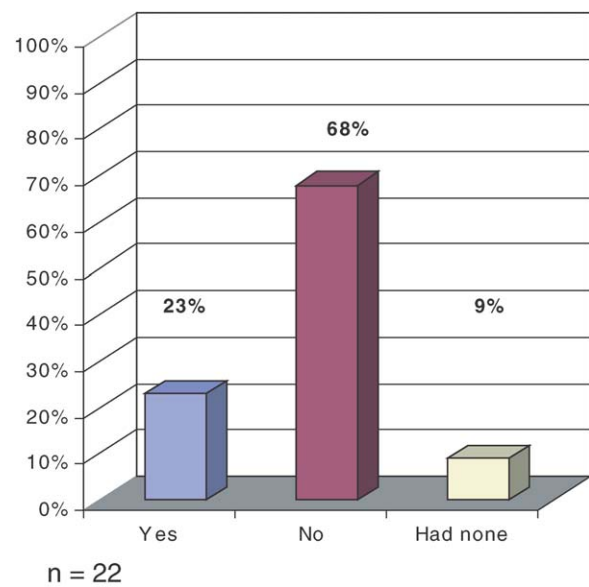


Fig. 4. Did suppliers alter bid tactics during the auction?

how to bid, and decided to follow events on the day. Only 9% (two respondents) had no clear tactics. Some of the 82% of suppliers who prepared a cost analysis decided to see what unfolded in the bidding events, even though they knew their bottom line. The bid tactics of suppliers varied and include:

- setting one price and bidding it at the appropriate level in the auction,
- working down to their bottom line via a number of reducing bids,
- watching what competitors would do before placing their own bid(s),
- entering an early bid to test the system and to set a marker for others to follow.

These results demonstrate that over two-thirds of the suppliers took a detached view of the events in the auction and entered into it with a clear idea of when and how much they would bid. Two suppliers volunteered that they went very marginally below their bottom line figure but stopped bidding when competitors' prices continued to drop.

More interestingly, two different winning bidders in Airco auctions advised that they did not have to bid their lowest calculated price as the bidding did not reach that level. In effect they had lower bids in reserve which were not offered once they were in a winning position. This evidence suggests that wild, uncontrolled bidding by suppliers was not a feature of these events. Only two respondents went below their pre-auction bottom line, and those two suppliers did not affect the final price level in either of the auctions in which they were bidders.



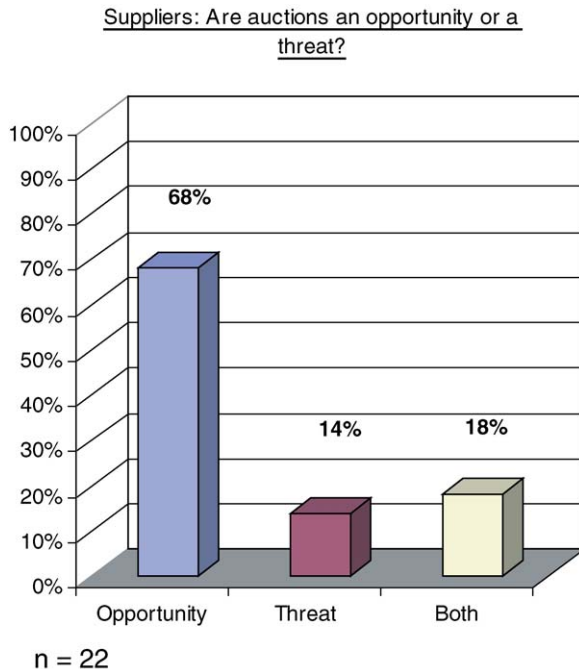


Fig. 5. Are auctions an opportunity or a threat?

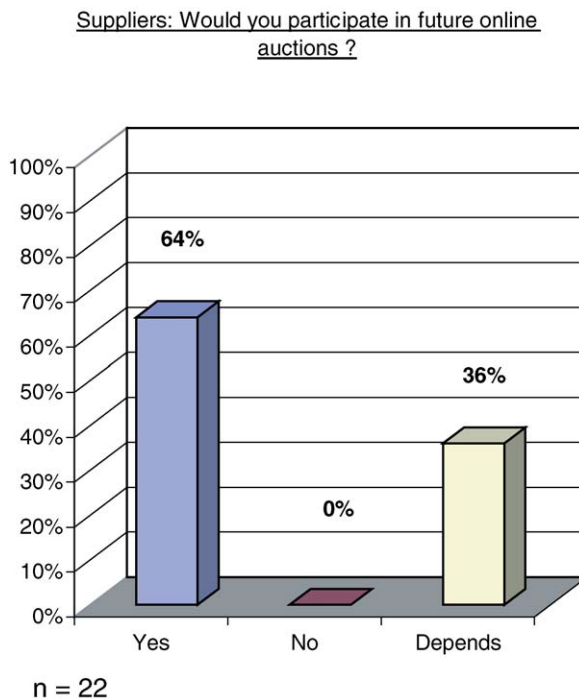


Fig. 6. Supplier attitude to future auction participation.

As shown in Figs. 5 and 6, suppliers interviewed after the event are equally in the majority in seeing auctions as more of an opportunity than a threat, with 68% responding 'opportunity'. Incumbent suppliers either see the auction as a threat or both threat and opportunity, as they recognise they have the most to lose from these

events, particularly where the buyer invites new suppliers to bid for the business for the first time. A supplier response given more than once is that auctions create a new sales channel and as such must be seen as creating opportunities, particularly for those companies who participate regularly and understand the process. Two suppliers who expected auctions to become more commonplace within their industry, suggested they would create a bid department within their sales structure to specialise in auctions to become experts in dealing with them. Other issues mentioned were that auctions might lower the cost of sales if more widespread, and that sales people would need to adopt new skills in order to handle tender by auction, or perhaps become redundant.

When suppliers were asked after each auction about their attitude to participating in further events, 64% were certain they would take part if invited. Several suppliers advised that the reason they had participated in these specific bids was to learn how the process worked and to understand the technology and were now more confident in the mechanism and its usage. However, over one-third were more guarded in their response suggesting there were some hidden disadvantages and that participation would depend on issues such as the identity of the buyer, length of the contract, the value of the tender and how interested they were in the business on offer.

Many suppliers elaborated on their experiences by describing what they saw as the risks of auctioning, although a majority of suppliers also freely observed some benefits to the process. Overall, the incumbent suppliers were broadly negative to the auction process. In Table 3 the authors have summarised the benefits and disadvantages of reverse auctions for suppliers, based on experiences and supplier comments from the case studies and observations from literature sources (Appel et al., 1999). The table demonstrates the issues suppliers need to consider when approaching ORA participation, and the supplier interpretation of these issues will almost certainly influence their participation over the longer term.

#### 4.2. Case study analysis

The discussion of results indicated that the auction bidding events were not the sole factor in determining the outcomes. In order to understand the issues that influenced and shaped the outcomes, we have selected three of the auctions to analyse in detail. Only three cases were selected for space reasons, but more specifically they provide useful insights into the dynamics of ORAs and highlight key issues for both suppliers and buyers when entering into preparation for online bidding events (see Fig. 7).

Table 3  
Benefits & disadvantages of ORAs for suppliers

Benefits for suppliers	Disadvantages for suppliers
<i>New opportunities</i>	<i>Price</i>
Potential access to new buyers <sup>a</sup>	Market prices likely to decrease <sup>a</sup>
More open tender process	Reduced profit margins <sup>a</sup>
	Price becomes the only differentiator
<i>Price</i>	Some business may become unprofitable or non-viable
Visibility of competitor pricing	Contract periods may be shortened
	Some products become commodities
<i>Information</i>	<i>Risk</i>
Knowledge of competing bidders	Exposure to new competition <sup>a</sup>
Overview of market activity <sup>a</sup>	Non-participation may mean exclusion from future tenders <sup>a</sup>
Learning opportunity for suppliers invited to tender—can apply to own purchasing	
<i>Administration</i>	Pressure on time—no second chance
Compresses time for dealing with RFQ <sup>a</sup>	Uncertainty of demand creates instability in business plans
Reduces manual/paper based effort	Payment issues for unknown buyers <sup>a</sup>
Reduces costs of handling tenders	Trust and reliability of new, unknown buyers <sup>a</sup>
Creates new low cost sales channel <sup>a</sup>	<i>Relationships</i>
Potential reduction in existing sales costs	Potential new relations with buyers based only on price
Lower overall transaction costs with buyers	Sidelines personal interface with customers
	Sales personnel may become redundant or need to acquire new skill sets
<i>Decision making</i>	Difficult to maintain partnership commitment if price likely to lead to regular supply changes
Sales order cycle time is compressed	
Faster knowledge of contract awards	

<sup>a</sup> Identified by Appel et al. (1999).

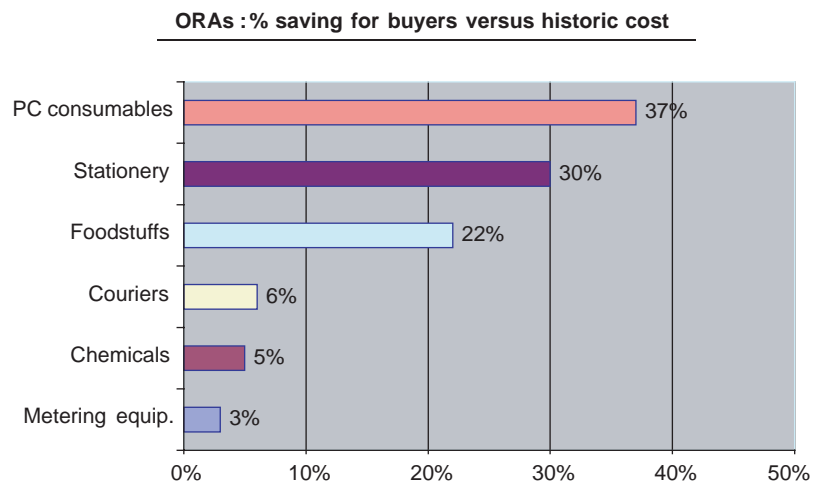


Fig. 7. Savings achieved in the auction case studies.

*Case 1. Airco: stationery.* The auction achieved a reduction against historic price for the buyer of 30%, which was far in excess of their expectations (a subsequent event for different products with the same suppliers bidding realised a 37% cost saving). However, there are some important contributing factors to this result which arise from the previous contract conditions, and were highlighted in the supplier interviews:

- The contract had been with the same supplier for 10 years and had not been put out to tender during that period.
- Several new suppliers have entered the UK market during recent years and it is possible that Airco was paying more than the current market price for a contract of this size.
- Within the online auction, four suppliers (not the incumbent) stayed in the bidding virtually until the

close; it seems highly improbable that all four suppliers had miscalculated their costs.

- The winning supplier advised during an interview that he had an additional lower bid in reserve, and did not actually go to his bottom line price.
- Airco conducted a detailed strategic sourcing exercise before the auction in order to invite in the major suppliers of this product. This exercise created significant competition for the business.

In the light of these facts it can be reasoned that the auction itself was not the main contributing factor in the resulting price reduction. Indeed, more than one supplier advised that they would have quoted the same price in a sealed bid tender. The auction may have contributed to the competitive element, but clearly the major factor in the substantially reduced price is that a number of new suppliers were bidding for the first time on a valuable piece of business, which was almost certainly being charged at well above the market price (or at least what a major industry supplier was prepared to offer). Under such circumstances it may have been possible to achieve a similar outcome through traditional methods.

*Case 2. Utilityco: metering equipment.* The product in this auction had a value (based on the historic contract supply price) of £4.2 million which is considerably higher than in the other auctions. Only four companies, all previous suppliers to Utilityco, were invited to bid. Two of them were competing divisions of the same organisation. The principal issues surrounding this event were:

- The price reduction achieved in the auction of 2.7% was below the buyer's expectations.
- The suppliers in this bid were sceptical about the benefit of the auction approach, and remained the most negative after the event.
- Two of the suppliers attempted to influence the outcome of the tender by submitting written quotations in advance of the auction.
- There was no strategic sourcing exercise by the buyer and no new supplier competition was introduced.
- Interviews with the suppliers revealed that they had calculated before the auction, based on market intelligence, what their competitors were likely to bid, which limited the bidding activity.

Considering the above points, it is evident that this auction lacked an element of genuine competition. The suppliers treated the auction in the same way as a traditional tender and the lack of new suppliers or 'wild cards' permitted an existing supplier to retain the business with only a modest discount. The auction was not considered a success by the buyers who believed they could have achieved the same result, or

perhaps better, through a round of traditional negotiations.

*Case 3. Foodco: foodstuffs.* This auction was more unusual as the buyer decided in advance to join together with an industry competitor to create a combined tender. The contracts were for the supply of frozen foods which had an identical specification and so were easy to place together. Several other factors resulted from this situation which influenced the auction outcome:

- The joint action by two buyers doubled the usual value of the contract.
- The product was a genuine commodity such as is often bought and sold on the commodity markets.
- Two incumbent suppliers were bidding against each other.
- New suppliers were invited to bid on the business for the first time.
- Some new suppliers had foreign sources of supply (within continental Europe) and consequently had rate of exchange benefits against UK-based suppliers.
- Five separate bids were run consecutively in one day for different products and the suppliers had varying strengths in relation to supply of these items.

These elements combined together to create a highly competitive environment within the auctions. The result was that the average price reduction over the five bids was 22% against a target set by the joint buyers of 10–12%. This auction was considered to be highly successful and the unusual, competitive supply conditions which the buyers managed to create within this tender directly influenced the outcome.

These three cases were selected in order to illustrate the highly varying market and competitive conditions which pertained in the auctions investigated. Given the significant differences in products auctioned and the industry sectors in which these events took place, it is inappropriate to make broad claims of generalisability for these results. This study has attempted to understand some of the dynamics of ORAs which are certainly influenced by conditions in which buying and supplying firms operate at a point in time. The following section considers the implications of our findings and discusses the impact of this new mechanism in the context of the research questions.

## 5. Discussion

The cases analysed here have helped to identify that several factors can have a major influence on the outcome of auctions. How these are employed by buyers can determine the result of an auction, its

use in various buying situations, and the impact it is likely to have on relationships in the future. We first return to the research questions posed earlier in this paper, and end with other observations based on this study.

### *5.1. The impact on price levels*

It is apparent from the three case studies examined in detail that the auction alone is not necessarily a mechanism for reducing price. The key influencing factor in each case was whether competition was introduced through including new suppliers, or a larger sample of suppliers than would usually bid for the business. Other factors such as joint tendering and removing the opportunity for differentiation played a part, but the price visibility in the bidding process allowed genuine market prices to be revealed. It is significant that supplier bidding tactics were usually established before the event and in most instances did not change. In effect buyers should not expect the bidding event alone to be a guarantee of lower prices.

However, a critical factor in the cases examined is that they were all ‘first strike’ auctions. It would seem highly improbable that Airco will achieve another 30% reduction on its stationery when the contract next goes to tender. Indeed, the price may need to rise if the supplier has been unable to provide the required service levels—an issue mentioned by some suppliers during interviews. Looking forward, a key question to ask therefore is: what happens to prices the second time around in a reverse auction? The answer to this question may determine whether online auctions are a short or long-term phenomenon. This study demonstrates so far that reverse auctions can have an impact on price, subject to certain conditions being introduced, but they may not be repeatable nor sustainable over the longer term.

### *5.2. The impact on buyer–supplier relationships*

Many firms have moved towards closer ties with a smaller supply base, but the literature suggests that in many instances partnerships or long-term relationships are not appropriate. The assumed or predicted benefits for both parties have not always materialised and there is evidence the firms continue in the old adversarial mode when it comes to discussions about price (Burnes and New, 1997). A number of authors (Cox, 1997; Roberts and Mackay, 1998; Burton, 1995) have suggested that a portfolio approach is necessary within a firm’s procurement strategy, not least to take advantage of the fluctuating supply conditions which apply in different market sectors.

This study leads us to the conclusion that reverse auctions have the potential to be used in both the collaborative and competitive relationship as a means of tendering contracts. Firms who have established long-term relationships with key suppliers still require to check on market prices from time to time, or to invite new or alternative sources of supply to bid, particularly in areas of continuous technological development. This is generally done through a competitive tender or by RFQ to a range of suppliers. A majority of both buyers and suppliers interviewed in this research believed that the auction is an efficient method for conducting tenders which can save time, cost and resources. From this perspective, the buyer could consider using the reverse auction as a process improvement tool. Online auctions may simply prove to be a more efficient way of conducting business, even if price reductions are not the main objective.

### *5.3. Other observations*

Similarly, reverse auctions have an important role as a price revealing mechanism. The Airco tender for stationery demonstrated that the buyer did not know the current market price for supply on this product, and the invitation of new suppliers to bid revealed a price difference of 30% against their current supplier. Both buyer and incumbent supplier in this contract believed they had operated in a ‘partnership’ (although both were very unclear about precisely what that term meant in reality). Partnerships and close, long-term relationships may lead to insulation from market forces, and it has been seen that some suppliers may be able to increase prices more easily within such relationships over time (Cousins, 1999). Auction events can provide insight into how costs in an existing relationship have been managed. In the Airco example, the company had become trapped in a high cost relationship, without being aware of it; with Utilityco there was little opportunity for price reduction from the known sources of supply; Foodco used volume and new supply sources to uncover a lower price for its purchases. Once a true market price has been revealed, buyers still have the option to choose whether to adopt a competitive approach by tendering regularly for cheaper prices, or to enter into a partnership with the new, lower price supplier.

Hence, these changes of supply may prove to be one-off occurrences. A major question, already posed, concerns whether the reverse auction is a long or short-term phenomenon. If it acts to reveal market prices, as in the Airco stationery case, then unless there is a dramatic change in market conditions from year to year, further price gains are limited for the buyer. Interestingly, after its courier services auction, Airco decided to change suppliers, and the buyers advised that

they expected to develop a new, ongoing relationship with that supplier. Conversely, Foodco concluded that the savings achieved through combining volumes with another buyer had been so successful that they would increase their auction foodstuffs contract the following year from 5000 to 20,000 tons of product. They were also prepared to change supplier again if a lower price could be obtained through this method.

Of the six case studies reported by the authors, five resulted in a change of supply source, as a result of the auction. It would be interesting to see how many of them are changed again at the next round of tendering. An issue which may affect this is of course the ongoing attitude of suppliers to ORAs. In these early events, some of the first held in the UK, suppliers were still feeling their way and the majority demonstrated a willingness to participate in the future. However, some were either reluctant or even antagonistic to the process and if key suppliers in certain industries develop a resistance to such events, then their viability for certain product categories will be questionable.

## 6. Future directions

The significant cost savings in MRO purchases seen in this study suggest that more indirect purchases are likely to move into auctions. This may have the effect of commoditising more products and services, a challenge many suppliers in the office products industry are already addressing, as they are targeted for reverse auctions by buyers. Within the MRO sector, there may be a push towards the short term by buyers if large scale, first strike, price cuts become widespread. Where suppliers are pushed beyond what may have been considered reasonable prices in the past, they will need to develop competitive responses, such as reducing sales costs, or actively managing the online bidding process through specialist auction bid managers. Further moves towards the use of e-commerce across the business will create the opportunity to lower operating costs further. A number of suppliers suggested they would need to address these issues in the immediate future.

Buyers need to employ a tendering process in many procurement situations and the arrival of reverse auctions may not of necessity lead to a fundamental change in purchasing practice. This research has illustrated that ORAs are capable of producing benefits for both sides, particularly in terms of the process improvements this tool offers (Emiliani, 2000; Wyld, 2000).

This subject needs to be examined further in the wider context of the opportunities created by e-commerce. Firms are utilising e-commerce in order to lower the cost of transactions and improve control over elements of their supply chain such as procurement. The tools to do this are becoming widely available and software is being

developed which eventually will allow firms to integrate their ERP systems with other Internet-based applications through generic software solutions known as middleware. In turn, connections to electronic marketplaces may increase the use of networked systems within industry sectors. The purpose of this networking effect is to be able to create a seamless flow of information with other firms in the supply chain which previously has been inhibited by cost and communications infrastructure.

At the centre of this approach there is a serious contradiction, however. In the past, firms have sought to work with a smaller number of suppliers for a host of reasons based on partnership arguments, and often because the cost of networking with larger numbers, through available IT systems, was prohibitive (Kalakota and Whinston, 1996). The Internet, and new e-Procurement applications, allow companies to trade with an almost infinite number of suppliers online at very low cost. Equally the Internet is becoming an important tool in identifying new sources of supply. Tucker and Jones (2000) have explored how Internet search engines can be used for optimal supplier sourcing. Similarly it has been observed that for many industries, e-Procurement tools remove the traditional geographical constraints between buyers and suppliers for the first time (Appel et al., 1999). These developments suggest that buyers in many industries will be able to identify and trade with, rich new supply sources, which were previously unknown or unexplored.

The logical consequence of these changes is that it will be possible, perhaps necessary, for firms to locate and deal with new sources of supply as a means of improving, or even maintaining, their competitive position in the market. By using the new e-Procurement tools, transaction costs can be reduced, even with a much larger supply base.

The contradiction then, is that whilst firms are using the Internet for greater networking effects and closer collaboration through sharing information, they may also, in some procurement situations, be able to take advantage of a more competitive approach, involving the use of many more suppliers, at no additional cost. This will mark a movement away from the partnership strategy, which has been widely adopted in recent years, for some types of procurement. Conversely, companies who need to check on the success of their collaborative arrangements can use auctions to verify market prices, and depending on the outcome, choose either to remain with the long-term partner, or switch source of supply. We envisage this as a trend to increase the attractiveness of short-term, arm's length relationships as a result of the low transaction and market price visibility offered by reverse auctions. This trend is illustrated in Fig. 8.

Furthermore, in the world of Internet commerce, firms need to give more thought to the form which their



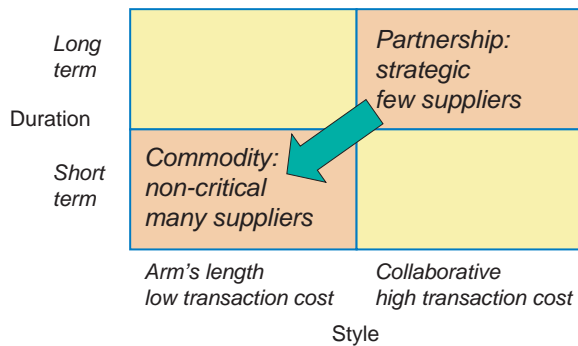


Fig. 8. Trend offered by reverse auctions in MRO.

relationships with suppliers will take in the future. The literature suggests that both collaborative and competitive supplier relationships have a place within the procurement strategy of the firm, and may co-exist within a portfolio. Firms following a largely collaborative supplier strategy will find that reverse auctions provide a means of creating greater diversity in supplier relations. In this respect, a composite relationship strategy—supported by e-procurement tools—will create a mechanism for buyers to achieve better prices and lower transaction costs from a potentially much broader supplier portfolio.

## 7. Further research

This paper has taken a largely exploratory view of an emerging phenomenon—the online reverse auction. It suggests that the true impact of this mechanism will only be seen over time, as firms are able to assess the success of auctions either as price weapons or as process improvement tools. Various scenarios can be envisaged, such as increasing enthusiasm and deployment of reverse auctions by buyers—yet increasing concerns on the part of suppliers who have to cope with the price and relationship impacts of global price transparencies. Since this research took place, many more firms have begun to use auctions in their procurement operations, often within the context of e-marketplace participation. Further studies are required to understand which areas of procurement are most suited to reverse auctions, what additional, new success criteria will emerge and how, if at all, firms are employing this mechanism to adapt to the use of competitive strategies, alongside their existing partnership arrangements.

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# Exploring supply chain opportunities in the UK utilities sector and the supporting role of eMarketplaces

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### Abstract

**Purpose** – Since the privatization of UK utilities, few studies have examined supply chain management (SCM) in the sector. This paper aims to investigate the state of development of the SCM concept and the role of the emerging internet-based electronic marketplaces in supporting this.

**Design/methodology/approach** – Using a case study method, interviews were conducted with managers in seven UK electricity and water utilities. Areas explored are the firms' supply chain priorities, how eMarketplaces can support their supply chain goals and the barriers to adoption of eBusiness solutions.

**Findings** – The research reveals a strong orientation in both the electricity and water industry firms towards controlling cost inputs. Consequently, their focus is on managing procurement as the primary supply chain activity. The key barriers to eBusiness adoption identified are the problem of providing genuine benefits to suppliers, and the technical difficulties of marketplace implementation.

**Research limitations/implications** – This is an exploratory study of the domain and further work in this area needs to focus on how utilities will develop their supply chain competences and how eBusiness solutions can support them.

**Originality/value** – The research concludes that operators of electronic marketplaces have not yet delivered a convincing case for wider participation in management of the supply chain online. A stronger SCM orientation will need to emerge in utility firms before that can occur.

**Keywords** Private sector organizations, Supply chain management, Electronic commerce, Procurement, United Kingdom

**Paper type** Research paper

### Introduction

This paper examines the extent of the development of supply chain management (SCM) in UK utilities firms and the opportunities for extending the SCM concept within the sector. The research reported here focuses specifically on the electricity and water industries. The purpose of the paper is to evaluate the status of SCM in these industries, the opportunities for further supply chain integration and the supporting role of eBusiness mechanisms such as electronic marketplaces.

This is a preliminary study of the sector and reported here are the results of an initial project carried out with a number of utilities firms, which will in turn contribute to a wider research study being undertaken into the impact of eBusiness mechanisms in a range of industries.

### Background to the UK utilities sector

The process of privatisation of nationally owned assets began in the 1980s under the Conservative government of the period and the utilities sector was one of the last in national ownership to be put through a programme of privatisation. This study concentrates on the electricity and water industries, all of whose assets and activities used to be in national ownership and which were privatised from 1989 onwards through stock market flotations. This programme created the concept of competition in these industries for the first time with the objective of leading to choice for consumers and business users and improving standards of performance. A regulatory structure was put in place to provide a legal framework and to oversee planning, pricing and financial practices in the industries, through bodies such as OFWAT, the water regulator (OFWAT, 2002).

Despite the emergence of a structure of competition in these industries, the EU maintains a regulatory stance towards businesses in the old "public" sector. For example, the rules for purchasing practice in the sector as a whole are covered under the EU Procurement Directives which detail the obligations public sector organisations must follow in relation to tendering of business and the awarding of contracts to suppliers (SIMAP, 2002).

As the formerly privatised UK utilities are subject to regulatory frameworks, much of the academic literature in this area has focused foremost on the resulting strategic components and economics of the sector industries. The

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principal themes that have been addressed are: competition and regulation (Markou and Waddams Price, 1999; Kunneke, 1999; Waddams Price and Bennett, 1999; Parker, 1999) and power structures/ownership (Newbery, 1998; Morse, 2000). As opportunities for enhancing market share and increasing prices are at best limited, one of the few remaining strategies for utilities to improve financial performance is cost reduction. SCM has been recognised in many industries as an important area of cost reduction opportunity.

## Literature review

### Utilities and SCM

SCM and its importance as an integrating function have been extensively documented in the literature (Stevens, 1989; Bowersox, 1997; Lambert *et al.*, 1998; Christopher, 1998). The focus of much recent supply chain research has been the beneficial effect of supply chain members working together in a co-operative manner in order to improve overall effectiveness and reduce costs as a whole for the supply chain, particularly by process alignment (Christopher and Juttner, 2000; Croxton *et al.*, 2001; Hammer, 2001). It is now recognised that at the level of the individual firm, improvements can be made in logistics activities, however, it is at the network or supply chain level that many organisations now look for quantum leaps in performance (Christopher, 2000; Kraemer and Dedrick, 2002).

In regard to utilities, at the operational level, areas which have been examined include industry benchmarking (Parena and Smeets, 2001), BPR (Jacob and Sioshansi, 2002) and asset management (Hoskins *et al.*, 1999). In addition, Jennings (1999) has examined issues surrounding corporate planning, while prices have been discussed by a number of authors including Branston (2000).

SCM in the utilities sector and the formerly privatised industries has received relatively little attention. Procurement is the exception here as there have been a number of studies, following UK privatisation, examining the impact of the EU Procurement Directives (Furlong *et al.*, 1994; Cox and Furlong, 1995; Cox and Furlong, 1997). More relevantly for this study, Cox (1999), Cox *et al.* (1999, 2001) and Anderson (2001) have discussed purchasing and supply management techniques and strategy, noting the improvements which have been made, and still need to be made, in purchasing and supply professionalism. However, the focus of this latter work has been predominantly on supply management, as opposed to the broader concept of supply chain management, which encompasses *inter alia* materials planning, forecasting, inventory management, production scheduling, warehousing and transport, and reverse logistics. This paper seeks to widen the debate in relation to UK utilities and to contribute to an understanding of supply chain issues and priorities in the sector.

## Supply chain structures in the utilities sector

The two industries studied here have distinct and different structures to their supply chains and need to be examined individually.

### Electricity

The present day supply chain structure in the electricity sector is illustrated in Figure 1.

**Figure 1** The supply chain for electricity



Source: Adapted from Sanderson (1999)

Fuel consists of a number of sources of raw materials and the primary fuel inputs are coal, gas, oil and oil derivatives, nuclear fuel and renewable sources (Sanderson, 1999). Generation is the process which converts the various primary fuels used into electricity. The privatisation programme of the 1990s brought a degree of competition into this segment of the supply chain for the first time when the former monopoly of the Central Electricity Generating Board was divided up, initially between three private firms. Subsequently, more competition has appeared in the UK sector as additional generators have entered the market.

The transmission function is the only part of the supply chain which has not been subject to competitive activity and remains under the control of the National Grid. The high costs of maintaining the infrastructure and a guaranteed, safe method of transmission were some of the reasons for keeping this activity in a controlled monopoly (similarities exist here with Railtrack in the UK rail industry). Distribution of electricity is carried out by a number of players including privatised regional distributors, previously known as the Regional Electricity Companies, as well as some of the national generators such as Powergen, who following privatisation, have bought outright parts of the regional distribution network. Distribution involves taking electricity from the transmission system and connecting it to consumers and business users at the point of consumption.

The final link in the chain, supply, is effectively the retail activity within the industry. The supply firms buy electricity from the generating companies and provide a service to the end customers. The supply firm is who we deal with as consumers and with whom we have the trading relationship. This may be the regional business in our area of domicile, or equally one of the national or independent operators who have purchased interests in this part of the chain[1].

It can be seen from this brief overview of the industry that there is today a complex structure of production, distribution and supply, with some firms operating exclusively in one section of the supply chain and others such as Powergen who operate in several segments at once.

This structure of separation in the industry has led to the creation of a non-integrated supply chain, where the product sold has come to resemble a commodity which can be traded on open markets. Indeed, some power distributors have experimented with the purchasing of electricity through the reverse auction mechanism, as a means of purchasing at most competitive rates. (Reverse auctions are a means of tendering whereby suppliers are invited by a buyer to bid prices online, in real time, with the winner being the firm offering the lowest price (Emiliani, 2000; Smart and Harrison, 2002)).

One of the implications is that firms in the sector are less likely to take an end-to-end supply chain approach and will concentrate on maximising their individual power. As stated by Sanderson (1999, p. 200):

Rather than looking at a flow of goods and services, and a parallel flow of value, which is almost exclusively within the boundaries of one organisation

... we are now faced with a series of transactions between separate firms operating at one or more of the key functional stages in this supply chain.

### Water

The UK water industry offers an interesting contrast to the electricity sector as, since privatisation, it has manifested a quite different arrangement of structure and ownership. Despite the de-nationalisation of the assets of the water business, in effect what is now in place are a number of regulated regional monopolies. The role of the water regulator is set out in Section 2 of the Water Industry Act 1991 and includes price reviews, protecting customers, promoting economy and efficiency, facilitating competition and enforcing licences (OFWAT, 2002). The industry is divided into ten regional operating water businesses which offer a full water and sewerage service to consumers in defined geographical areas, plus twelve additional local firms offering water supply only.

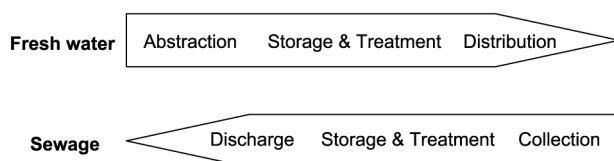
Figure 2 illustrates the supply chain in the water industry for the water and sewerage companies where it can be seen that there is a much more integrated structure, with all activity being carried out within the one organisation.

The primary difference between the supply chain in water and most industrial situations, is that the product is subject to little processing or alteration during its lifetime in the chain. Water is both the raw material and the product of final consumption. The role of the supply chain is to add value to the product through the processes of abstraction, storage, treatment and distribution in order that the customer, either private or business, receives the product in a suitable condition for consumption. The flow of value here remains almost exclusively in the hands of one organisation, except where third parties and contractors are utilised to perform specialist functions.

### Electronic marketplaces

One element of this research is its interest in the potential role of eBusiness mechanisms and in particular B2B (business-to-business) electronic marketplaces. Online marketplaces were launched at a prodigious rate between 1998 and 2001, during the short period of the internet bubble economy. Much has been written about the online marketplace model, its transforming role in business and its potential as a vehicle for achieving industry-wide standards and supply chain integration (Wise and Morrison, 2000; Raisch, 2001; McKinsey/CAPS Research, 2001; Copacino and Dik, 2001). However, little empirical evidence has been provided to suggest that those aspirations have been achieved, or whether indeed they are achievable. From 2001 a sharp shock was delivered as many of the early marketplaces failed to get operations off the ground or were unable to achieve viable revenue streams and so were deserted by their investors. Indeed, during 2002 a number of prominent eMarketplace promoters such as Barclays plc and GE decided to disinvest

**Figure 2** The supply chain for water



from their projects (O'Connell, 2002). This has not signalled the end of the eMarketplace initiative but those which have survived are faced with difficult decisions about how to shape themselves into viable business propositions (Dodge, 2002). A typology of marketplaces has been developed which suggests three levels of ownership and functionality, usually defined as independent, consortia and private (Krammer *et al.*, 2001; Laseter *et al.*, 2001; Lawrence, 2001).

In the utilities sector, a number of independent (or public) marketplaces have come into existence, serving the USA, European or Asian market. This research project was carried out with the assistance and sponsorship of one of the European marketplaces (the company has requested anonymity). Its internet marketplace became operational in mid-2000 and provides information and transactional services for utility companies and other formerly privatised industries. The main activities in the marketplace related to procurement which has been the company's core business, having developed through offering information and support to public sector firms involved in tendering under the auspices of the EU Procurement Directive. The company was interested in which additional supply chain products and services would be of benefit to utility firms in the future.

### Research methods and objectives

A number of potential research issues were considered and given the lack of research into both SCM and eBusiness opportunities in this sector, three research questions were selected:

- RQ1. What are the supply chain priorities of utility firms?
- RQ2. How can an electronic marketplace support the supply chain needs of utility firms?
- RQ3. What are the barriers to eBusiness adoption in this sector?

The aim of the research was to explore and evaluate how the supply chain operates within each industry sector and the priorities of the participating firms, with a view to identifying services within an electronic marketplace which would meet the needs of participants. The study was targeted at the buying firms who participate in the marketplace (using online procurement services) as these firms were considered to be the principal future customers of the marketplace for SCM products.

As this was an exploratory study of a largely under-researched sector where the focus was on a new and developing IT mechanism, the approach taken was to use structured interviews to explore a number of themes with the respondents. Access was obtained to senior managers in several firms participating in the marketplace who were actively involved in eBusiness projects. Three firms were in electricity and four were in water. The subjects discussed included, but were not limited to: supply chain structures and policy, procurement strategy and structure, eBusiness adoption issues, the role of marketplaces and their impact on supply chain relationships. Respondents, who were situated in the supply chain, procurement and IT functions, were interviewed either individually or in groups of two or three (company and manager names have not been included as anonymity was requested). In addition to the structured interview questions, respondents were asked to score nine potential marketplace services on a Likert scale. Where more than one respondent was interviewed, the representatives

from the company were asked to agree on a score and return it after the interviews were completed.

The data collected from interviews was initially transcribed and coded and for analysis a number of matrices and arrays were used to tabulate responses using the approach suggested by Miles and Huberman (1994). As more than one firm from each sector was interviewed, a comparison of responses and results could be made in each sector, on a cross-case basis. Similarly, common or contrasting replies could be identified within or between industry sectors. For example, the responses from the electricity industry were examined as a group, followed by those from the water firms. Similarities and differences were noted, then the tables of responses from each sector were compared and contrasted. In this way a picture of each industry was constructed, leading to identification of the issues which were either common to both or which differed between them. The results presented below are structured around the three nominated research questions.

## Results and analysis

### RQ1

In the electricity industry there is no visible product to be delivered to the end consumer in the form we would normally recognise such as a pallet, container or vehicle unit load. In effect, there is no physical logistics activity at the retail end of the supply chain as power is delivered to users through networks of transformers, switchgear, cabling and metering, although this delivery network (the channel of distribution) requires ongoing investment, construction and maintenance. Most physical logistics activity relates to support of engineers and other specialists working in the field.

In the three electricity firms studied, there was no distinct department operating under the name of supply chain, but each had identifiable logistics and procurement functions. One of the electricity firms operates its own stores system for controlling inventory whilst the other two have outsourced the logistics activity such as transport and warehousing to third party logistics providers. The primary focus for all three of these organisations is on the acquisition of materials, products and services and consequently they see their supply chain priority as procurement. The procurement objectives in these organisations were also driven by different agendas as in one case the procurement manager reports to finance and in the other examples to either operations or engineering.

By comparison, the water industry supply chain, as illustrated in Figure 2, is controlled from end to end by individual organisations. The water firms operate within strictly defined geographical UK territories but in this case do have a physical product delivered to the end consumer. The structure resembles electricity in that supply chain responsibility is once again fragmented. In one of the firms purchasing and logistics are part of Engineering; in two of them the purchasing function reports to Finance; in only one is there a specific supply chain department which controls all related activities. Interviewees reported that the supply chain priority is the in-bound acquisition and movement of externally sourced products with procurement being the key activity.

Outsourcing has been adopted as a solution, similar to electricity, with three of the four water companies having outsourced their stores activity to third parties, who manage inventory levels, transport and delivery of bought-in materials.

The utility firms interviewed here had elected to keep a limited range of supply chain activities under direct control and in most instances have chosen third parties to run the logistics operations such as warehousing and transport. For example, one water industry executive interviewed suggested, “we should concentrate on our areas of expertise such as product specification and acquisition, as inbound logistics can be managed better by third parties”. One exception to this view can be seen in the case of GPU Power (one of the participants in this study) which undertook a review of its UK distribution system for emergency service components (Darban and Lewis, 2002). In this case, the firm took the view that control of its stockholding policy and closer co-ordination of inbound materials with suppliers would provide benefits to the business and retained these activities in house.

Analysis of this stage of the interview process revealed a common approach towards the supply chain, in both electricity and water sectors. In all instances except one there is no identifiable supply chain function within the organisation. In industries with a history based on private competition and little regulation – automotive, chemicals, food and beverages – supply chain thinking has become a major influence in the business, having developed from a base in logistics or distribution, and often designed to support the impact of global trading and to obtain greater operational efficiency. The utility firms examined here are generally UK domestic businesses with a focus on the home market, in many cases within a defined and limited geographical region of the UK. They have not to date experienced the kind of competitive pressures which have driven, for example, the adoption of lean techniques in certain industries (Womack and Jones, 1996). The operational focus in utilities is on issues such as waste reduction, yield management and updating of networks and facilities. Consequently, these organisations currently see a limited need for the more advanced supply chain tools which have been adopted in other industrial situations.

Cox *et al.* (1999) have demonstrated that since privatisation many of the organisations formerly in the public sector have made significant strides forward through more strategic approaches to purchasing and supply. This was necessary as in the days of nationalisation there were few pressures on cost reduction and generally little understanding of advanced supply management techniques. In the intervening years, procurement has remained the key supply chain priority for the utility sector firms. This finding has important implications for electronic marketplaces and is explored in the next section.

### RQ2

The electronic marketplaces operating in a number of industry sectors are grappling with the question of how to attract both buyers and suppliers into adopting services which move beyond procurement. The earliest eMarketplaces were primarily procurement portals, but were quickly followed by sites seeking to offer tools for operational management and supply chain integration. Even at the early stage of development of the internet marketplaces there is already concern that transactional procurement alone will provide insufficient revenue streams to ensure survival for the eMarketplaces (Laseter *et al.*, 2001). Some of the consortia marketplaces stated their intention, from very early in their life, to provide a platform for SCM across the industry. Their



aim was to set common standards, provide common software and support collaborative initiatives both vertically and horizontally in the industry sector (examples of those who built their product with these objectives were [www.covisint.com](http://www.covisint.com) and [www.cpgmarket.com](http://www.cpgmarket.com)).

Similarly, the project sponsor, while having started the eMarketplace as a transactional procurement portal, had its sights on providing a much wider range of services and solutions to its members. One element of this study was to ascertain the potential for delivering supply chain solutions to the buying organisations in the marketplace. Buying firms are the focus of this study as they drive the extent of transactions and use of facilities within the portal. To obtain structured responses, all the firms interviewed were asked to rate a list of features which could be offered in the marketplace, indicating their importance on a Likert scale. The nine services were derived from an analysis of features offered by eMarketplaces from other industries and included two additional services suggested by the sponsor. Further, respondents were invited to suggest additional products or services which might be of interest. These responses were recorded in the interviews or taken from written replies submitted after the interviews occurred. Table I shows the list of headings and the mean response to each.

The service which scored the highest on this scale was payment and reconciliation which is not specifically a supply chain activity. It was included as most eMarketplaces are making a play of the potential for online reconciliation to support the purchasing transactions already in place and thereby complete the transactional cycle for the purchaser. By definition this requires a level of integration with the buyer's back-end systems such as ERP, which the majority of respondents were keen to pursue. Contract management is a procurement service offered to many utility buyers by the sponsor and most respondents saw a benefit in extending this facility into the marketplace online.

The responses to this list were obtained at the same time as the information was being collected from interviewees on supply chain structures in the sector. During those interviews it became increasingly clear that many of the supply chain services and facilities which have been promoted in other eMarketplaces would be of limited interest to buyers in utilities. The services which received the lowest scores were: inventory management; supply chain planning tools such as those offered by i2 and Manugistics; reverse logistics and logistics and

**Table I** List of potential marketplace services and scoring on Likert scale

Heading	Likert score
Payments and reconciliation	4.2
Contract management	3.4
Collaborative initiatives (horizontal)	3.3
eProcurement; auctions	3.2
Forecasting tools	2.5
Inventory management	2.0
Supply chain planning tools	1.8
Logistics/transport management and reporting	1.2
Reverse logistics	1.2

**Notes:** Based on a Likert scale of 1 to 5: 1 = unimportant; 5 = very important. Results are based on replies from six of the seven firms in the study as one was unable to complete the scoring

transport management. Evidence, presented above, suggests that these will remain areas of low priority for utilities whilst they see outsourcing of most of their logistics activity as a viable solution. Forecasting was perceived by three of the utilities as an area for potential improvement, whilst the other four considered it of limited value. This attitude, to some extent reflects the reporting structures in the organisations studied, where those who maintain a role in logistics management see a need for better forecasting of future materials flows, while procurement departments driven by cost agendas are more usually concerned with achieving the best price for materials bought during the reporting period.

eProcurement solutions (software and applications hosted on the portal) such as automated buying tools and reverse auctions scored higher and a number of buyers were experimenting with eProcurement at the time of the research. Several firms were very cautious in their approach to reverse auctions as a means of purchasing, citing concerns over EU procurement rules and supplier resistance as potential obstacles. However, three of the utilities interviewed had already begun using auctions and planned to extend them further. Most buyers agreed that auctions would become more prevalent in the industry and it was probably only a matter of time until they were used by all the utility firms, for at least part of their tendering. Utilities firms have recognised the potential benefits of automating procurement activity, documented among others by Aberdeen Group (2001), Croom (2000) and Giunipero and Sawchuk (2000) which can be summarised as follows:

- creating efficiencies in the acquisition of both operating and non-operating goods and services;
- transaction cost efficiencies: reducing purchase order costs;
- reduction of maverick spending;
- tighter control of “on contract” spend; and
- potential price reduction through spend leverage.

The subject which produced a high score and which provoked more discussion during interviews than almost any other was collaborative initiatives. These have been notated horizontal as the suggestion was that utilities firms might find benefit in joint approaches, in specific areas such as tendering, sharing supplier information and exchanging experiences on technology. A few respondents were cautious about this approach, fearing anti-competitive practice, however a number of others saw the opportunity to learn from the experiences of similar businesses and to carry out industry benchmarking on procurement and logistics activities. In one particular example, one of the water utilities had conducted a successful reverse auction for the provision of on-site services and another of the water companies intended to take a similar approach, having only recently learned of the success of this experiment.

These results reveal that the respondents in the study were unclear on what benefits they could obtain through supply chain-focused applications and virtually all those interviewed regarded as irrelevant any comparisons with retail or industrial supply chains. This attitude is perhaps unsurprising as it is not uncommon for actors within an industry to claim that theirs is different or unique in some way. It is evident that the sector is not impacted by many of the market and competitive forces which have driven change in other industries, leading to a focus on supply chains as an area for gaining competitive advantage (Christopher and Peck, 2003). However, it may overlook the benefits for

important operational and engineering activities such as power generation which involve the management of complex installations using vast resources. A more developed supply chain approach may well be relevant when firms are involved for example in the commissioning of new power facilities and other major asset construction projects.

In summary, the priority of the sector is clearly procurement, and purchasing and supply considerations drive their decision making. The conclusion is that there is at present limited potential for an extended range of supply chain services and applications within the online marketplace. The answer to the research question posed above appears to be that online marketplaces in this sector need to:

- deliver a suite of procurement-related services which meet the needs of buyers;
- provide a forum for exchanging industry best practice and eBusiness successes; and
- demonstrate the potential benefits to utilities of online-supported contract management, forecasting, and inventory management tools.

### RQ3

After the boom period of the late 1990s when electronic marketplaces and eBusiness were proposed by many commentators as necessities which no organisation could afford to ignore, there has been a slump in confidence in the concept, following many well-publicised internet failures. The rate of adoption of eBusiness in utilities has been slow as in many other sectors and this study sought to understand the reasons behind it. Respondents who took part in this study very willingly discussed the barriers to eBusiness and were invited to suggest issues for consideration which affect eBusiness adoption and the resultant implications. The issues raised and the response count are summarised in Table II.

The interview respondents had little difficulty in identifying adoption issues and barriers to progress as many of them were living with those concerns as part of their daily business.

Virtually all of the interviewees were involved in using eMarketplace or eProcurement systems and had experienced a range of frustrations. Within the utilities sector there is clearly a major issue of IT-preparedness as several utility firms are still in the early stages of implementing, or even specifying, ERP systems. Only two of the firms interviewed had fully operational enterprise systems and for the remainder not surprisingly their emphasis is on technical and integration issues, as legacy IT is a hurdle to progress.

Although only mentioned explicitly twice as an adoption issue, an important theme which arose during interviewing was the issue of procurement versus supply chain functionality. Due to the difficulties with legacy systems, integration, user adoption, and proving real benefits, most firms were reluctant to progress beyond eProcurement functionality into the more complex areas of SCM. Some typical quotations in this respect were: “we want to walk before we can run...”; “utilities are not yet ready to sign on to some of the new [supply chain] areas...”; and “we need to see clear progress on the current issues before we move to the next stage”.

Two of the water companies advised that they had planned at the outset of their involvement with the marketplace to explore other logistics activities but had put that on hold until the major adoption issues for purchasing users and suppliers had been addressed. The majority of firms were clearly looking for a complete solution in the area of eProcurement before moving into any other areas and this explains their reluctance, in the Likert scoring exercise, to consider most of the supply chain elements in an eBusiness environment.

The other major concern in this list, which prompted extensive comment by the respondents, is supplier benefits. Four of the firms nominated supplier resistance as an area of regular ongoing discussion and as a critical part of future eBusiness development. It has been shown in some studies on eProcurement that the benefits tend to be in favour of the buyers and that insufficient thought has been given to creating a valid adoption business case

**Table II** Barriers to eBusiness adoption and implications

Issue	No. of mentions	Implications
Lack of integration into back-end systems	4	Workflow not optimised; few or no benefits in financial transactions; cost savings delayed
Few incentives for suppliers	4	Supplier resistance or hostility; suppliers need to be more involved at project outset
Concern over unreliability of new IT	3	Users need to experience deliverables first hand
Legacy systems/old IT	3	Difficult to integrate to M/PS; requires new investment
Some existing procurement methods are adequate, e.g. email, EDI	2	Resistance to change; need to clearly prove benefits of new IT
eProcurement needs to be proven before moving to more complexity	2	Reluctance to consider supply chain opportunities; “softly softly” approach
eProcurement savings have been hyped and are often not achievable	2	Users unconvinced of benefits; need to demonstrate value
Users not ready for new systems	2	Training required before adoption; need to build confidence in solutions available
Lack of funds for new IT investment	2	As above; new projects on hold
eBusiness failures have raised doubts at Board level over benefits	1	Difficult to make a business case for investment
Lack of standards across eMarketplaces	1	May lead to additional costs for users of more than one eMarket
Supplier systems may be better option, e.g. RS Components	1	Users can benefit with little investment by the buying firm in eProcurement systems
Utilities sector conservative in its approach	1	Tendency to move slowly; follow rather than lead

**Note:** These figures do not add up to any relevant total as respondents were free to nominate as many or as few factors as they wished

for supplying firms (Emiliani, 2000). The buying executives raising this point suggested that the solution was to develop a genuine value proposition for suppliers, which on the whole was still absent. An alternative suggested was that in extreme cases they would simply have to be told to adopt the new eBusiness solutions or be excluded in future.

As a qualification to discussion of *RQ2* and *RQ3*, it is recognised that the respondents may have replied to the interview questions through a distorted lens. Most of those interviewed were from Procurement and Logistics functions or IT departments, actively involved in eBusiness implementations. Their focus, driven by their management, is on the delivery of systems which improve operational performance and reduce purchasing costs. The fact that these benefits have not yet been delivered at adequate levels may have prejudiced their view of further involvement and investment in more advanced applications. In a scenario where a set of fully operational and integrated eProcurement solutions was in place, their attitude towards supply chain applications may have been more positive. Hence, the current problems of solution delivery experienced by the eMarketplaces may have slowed their rate of adoption for some time to come.

## Summary

This study has demonstrated that in the UK electricity and water industries the short-term focus is on procurement and the delivery of viable and sustainable eBusiness solutions which support it. The barriers to progress and to eBusiness adoption have been identified and are not insurmountable. Indeed, there was consensus amongst the firms involved that they need eBusiness initiatives to succeed to support their own objectives within procurement. The position over the potential for supply chain integration in the longer term is less clear. Studies by Cox *et al.* (1999) and Harris *et al.* (1998) have demonstrated the changes in purchasing and supply professionalism and strategy which have come about in the newly privatised industries. However, the utility firms examined here do not currently see a compelling case for a stronger SCM culture in their industries. As several pointed out, they are not subject to the forces operating in other industrial sectors such as globalisation, volatile demand, obsolescence and changing consumer trends. Consequently, there are few forces driving the sector towards more advanced supply chain integration, or even the adoption of techniques such as lean production.

This scenario presents a challenge to the eMarketplace operators. Within only two or three years of start-up, the eMarketplace economy is littered with failures, with only a few online ventures having so far proved their ability to survive the slump in confidence in the eBusiness concept. One of the issues driving eBusiness speculation at the outset of eMarketplace development was the focus on leading edge, technically configured facilities. As a result, eMarketplaces in a range of industries set about an ambitious and far-reaching agenda based on a long-term supply chain vision. The problem has been that very little was delivered of real value and that which was delivered had a tendency to not work very well. In almost every sector of eMarketplace development, participant firms have complained of the technology lagging expectations, problems of integration and a lack of a clear value proposition for the participants. Marketplace operators must therefore address how they can best meet the needs of their target customers, profitably. Both a long-term and short-

term view of this issue can be taken and they need to tailor their cloth to address those short- and long-term needs.

In the short term, users need integrated eProcurement solutions to support their target of creating further cost efficiencies. The adoption of reverse auctions for suitable product segments may assist this process (evidence on this point is mixed with Smart and Harrison (2002) outlining the opportunity for savings, and Emiliani and Stec (2002) indicating the problems inherent in realising savings). The longer term potential will perhaps depend on a change of culture, with SCM and some of its component elements coming to the fore. In the industries examined, the forces of competition and customer orientation are still in their youthful stages. Hence, the current focus on procurement and management of inputs may be necessary to give the industries examined here a stable cost base, but moving to the next stage of cost reduction may well require a re-examination of some, or all, of the elements of SCM. As and when that proposition becomes a reality, the future of eBusiness initiatives such as eMarketplaces will pivot on their ability to fulfil those needs in the sector and help drive the adoption of more advanced SCM practices.

## Future research

This paper has reported on an initial, exploratory study of SCM and eBusiness in the UK utility sector – an area where little academic research has been conducted. The direction of supply chain thinking in the medium- to long-term has not been fully explored and an understanding of where the utility industries see SCM on, for example, a five to ten year horizon needs to be established. The further step in this project will be to analyse and interpret the future needs of sector firms in relation to the broader supply chain functions. That stage of the research will help inform how eMarketplaces and eBusiness service providers should shape their business to respond to the demands of the sector.

## Note

- 1 Since this research was undertaken, there have been further changes in ownership, particularly in distribution and retail operations, within the electricity sector.

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# eBusiness and supply chain integration

eBusiness and  
supply chain  
integration

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## Abstract

**Purpose** – The purpose of this study is to examine how four large organisations have approached the implementation of new eBusiness mechanisms: namely online order processing, eProcurement, reverse auctions, and a private exchange. The objectives are to establish whether supply chain integration is an identified goal for the firms involved and to evaluate the extent of integration achieved through these projects.

**Design/methodology/approach** – A case study approach is used, with four separate cases being examined, leading to cross-case analysis and conclusions. The primary form of data collection was interviews with managers participating in the implementations. In order to measure the degree of supply chain integration pertaining in the examples, two frameworks from the literature are used.

**Findings** – In three of the cases it is established that there is very little, or nil integration at supply chain level and only in one case is there evidence of a supply chain perspective contributing to the project. Three of the firms did not consider the supply chain implications of implementing their eBusiness applications.

**Research limitations/implications** – The article builds on previous studies and illustrates the problems of achieving integration in the supply chain. Further research is needed to establish common attributes relating to supply chain integration.

**Practical implications** – Three of the projects examined here were based predominantly on a business case for the implementing firm only. Firms need to be aware that IT projects by their trading partners may have supply chain cost implications for their own business.

**Originality/value** – Whilst much of the literature propounds the need for integration, leading to extension of the supply chain concept, firms are pursuing IT implementations which are premised solely on internal benefits. The research illustrates that, if the new eBusiness mechanisms are to support wider supply chain goals, then the focal firms involved must take a more holistic view of how and why such solutions are implemented.

**Keywords** Supply chain management, Electronic commerce, Integration, Communication technologies

**Paper type** Research paper

## 1. Introduction

Interest in supply chain management has grown significantly since its inception in the 1980s. During this time it has been transformed from a primarily operational activity focusing in the early years on distribution or on supporting the firm's manufacturing objectives and is now recognised as a strategic concept which spans functions and crosses inter-organisational boundaries. Professionals involved in managing supply chains today make interventions in an increasingly extended range of activities in the value chain both upstream, facing towards suppliers and downstream, facing towards customers. Over time, the supply chain has become a key factor in achieving both cost and service improvements and has assumed a more central role in the business planning of successful organisations. In the personal computer industry for example, Dell Corporation engineered its supply chain using make-to-order, outsourced logistics,





low inventories and direct distribution in order to achieve significant competitive advantage over its rivals (Christopher, 2005).

Companies seeking to leverage the supply chain as a means to improved performance have increased the emphasis on developing closer relationships with suppliers, distributors or customers and there has been a consequent movement towards longer-term relational policies and a growth in partnering. This approach is based on the premise that a co-operative philosophy leading to more integration of processes and systems with firms in the supply chain creates greater network-wide efficiencies (Lambert and Cooper, 2000). In an increasingly complex world of globalised trade with extended lead times and greater risk, this integration in the supply chain will require supporting information systems and technology. The growth of the internet and technologies which enable real-time information sharing such as inter-connected ERP systems, web-based EDI, electronic portals and online order processing systems, can potentially support the building of closer links with customers, suppliers and third-party vendors such as logistics service providers. In practice however, the progress towards such supply chain integration between firms has often been stalled by factors such as rival cultures, information technology deficiencies, lack of process alignment and other organisational legacies (Barratt and Oliveira, 2001; Akkermans *et al.*, 1999). Hence whilst this new technology offers much promise, examples of its success in transforming supply chain practice are still relatively few in number. A growth in case evidence on supply chain-related eBusiness projects will help our understanding of success or failure in achieving such "integration".

In this article we examine four organisations who have implemented eBusiness solutions at different points in the supply chain. The four examples illustrate how these recently-emerged mechanisms are being adopted in varying organisational situations. The case firms are compared and contrasted to determine how such technologies are being used in different functional areas which make up the supply chain. The article has two research aims:

- (1) to identify the business drivers for the eBusiness implementation undertaken by these firms; and
- (2) to define the level of supply chain integration achieved in each of the cases examined, using integration frameworks from the literature as a point of reference.

## **2. Supply chain management and integration**

The concept of supply chain management (SCM) developed out of the growth in importance of logistics planning across a range of industries. Initial improvements were at the level of the individual firm, with a focus on breaking down internal functional and management silos. The model proposed by Stevens (1989) outlined an approach to achieving supply chain integration, based on a progression from this silo-based activity to interdependent functions between suppliers, OEMs and customers within the supply chain. As firms sought to further improve their operational performance it became necessary to seek inter-organisational answers to logistics problems. Solutions with an external focus began to appear, characterised by the sharing of resources, utilising third parties and deeper reliance on bought-in expertise. This led to specific developments such as outsourcing, growth in

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common-user assets and vendor managed inventory (Venkatesan, 1992; Dong and Xu, 2002; Knemeyer and Murphy, 2005).

Moving further, firms began to experiment with the potential benefits of wider co-operation with both suppliers and customers at different stages in the supply chain. On the supply side, the lean school advanced the concept of closer supplier collaboration as leading to cost reduction and greater efficiency (Womack and Jones, 1996); alongside this, a raft of literature has emerged outlining the benefits to be achieved in closer alignment of supply with the core activities of the firm and the move away from traditional arms-length or adversarial relationships (Spekman *et al.*, 1994; Goffin *et al.*, 1997; Hines, 1996; Ellram and Hendrick, 1995). On the demand side, within retail in particular, customer-facing initiatives such as Quick Response logistics (Christopher and Juettnner, 1999) and Collaborative Planning, Forecasting and Replenishment (Steerman, 2003) have been advanced to decrease lead-times, reduce inventory levels and improve responsiveness to variations in demand. The theme of much of this development has been on the notion of integration of activities and processes between members of the supply chain, where a major facilitator is the reciprocity of information (Croxtton *et al.*, 2001; McAdam and McCormack, 2001). For example, the exchange of electronic point of sale data between food retailers and their suppliers to manage order scheduling has enabled improved fulfilment accuracy and on-shelf availability (Christopher, 2005).

When positing support for stronger external integration, it has been suggested that the benefits increase as the level of supply chain integration grows, both upstream (Tan *et al.*, 1998; Krause, 1999; Narasimhan and Das, 1999) and downstream (Reeder and Rowell, 2001; Gilbert and Ballou, 1999; Croxtton *et al.*, 2001). Indeed, talk of integration is now commonplace in the literature and it is frequently taken as a standard requirement of successful management of the supply chain, that integration will take place (Stank *et al.*, 1999; Frohlich and Westbrook, 2001). Evidence has further been proffered that the use of eBusiness tools leads to a greater degree of integration within the supply chain (Cagliano *et al.*, 2003). This debate takes place against a background notion that greater co-operation between trading partners is necessary for successful management of the supply chain, with all parties to the transaction potentially benefiting from the efficiencies achieved (Bowersox *et al.*, 2003).

Despite the theories advancing closer working and some documented cases of success, in most industries it has proved extremely difficult to achieve genuine integration between firms operating in the chain. Fawcett and Magnan (2002) have illustrated that even in the USA market where supply chain techniques are more widely understood, the extent of integration between firms is limited. Equally, Akkermans *et al.* (1999) demonstrated that functional thinking is predominantly the norm and that the arrival of new technology will not alter the situation, without significant organisational and cultural change. This position is supported by evidence from a survey by Bagchi and Skjoett-Larsen (2002) who reveal the problems of achieving IT and SCM integration between organisations. One of the concerns faced by functional managers within different firms in the supply chain is “yielding sovereignty” (Fawcett and Magnan, 2002) and the fear of loss of control. Other barriers to integration include technology itself, organisational focus, trust, people and internal structure (Barratt and Oliveira, 2001; Frohlich, 2002; Jharkharia and Shankar,

2005). Hence whilst commentators have advanced the need for and potential benefits of integration, evidence of its success and how to achieve it has been less common.

The discussion of integration and how to measure it is hindered by the lack of a standard or widely-adopted definition of its meaning. This conundrum could prove a valuable area for further research, which might assist both academics and practitioners in their assessment of integration success. However, three articles in particular offer useful descriptions and frameworks for evaluation purposes. Firstly, Fawcett and Magnan (2002, p. 344) propose four “primary types of integration”. These are:

- (1) internal, cross-functional process integration;
- (2) backward integration with valued first-tier suppliers, leading to integration with second-tier;
- (3) forward integration with valued first-tier customers; and
- (4) complete forward and backward integration.

Secondly, in a detailed review of the meaning of supply chain integration, Bagchi and Skjoett-Larsen (2002) suggest two modes for categorisation in this domain, namely Information Integration and Organizational Integration. They outline the processes and characteristics which define these two modes and propose three “stages of integration” within each mode, which are low, medium or high. In a third example, Frohlich and Westbrook (2001) offer a definition based on the concept of “arcs of integration”. They define five “mutually exclusive groups” representing the integration strategies of the firms analysed in the study, using quartiles to allocate respondent firms into appropriate groups. These five arcs are:

- (1) inward-facing;
- (2) periphery-facing;
- (3) supplier-facing;
- (4) customer-facing; and
- (5) outward-facing.

Further comment on the applicability of these frameworks to our case studies is offered in the following section.

### 3. Research methods

Whilst the body of literature on supply chain management continues to grow, there is little empirical evidence demonstrating how, where and why supply chain integration has been achieved through eBusiness implementations. Moreover, much of the material referenced in early papers on eBusiness came from consultancy or software firms, whose purpose was often to promote these mechanisms, rather than offer empirical support of their success or failure.

This was an exploratory study of newly-emerged phenomena and reflecting the two research aims of the article listed above, the purpose of the project was to define the degree of integration in a variety of supply chains where e-Business solutions had been implemented. In order to address the practical issues at stake, we selected a case study research design. Case studies can be a valuable method when investigating contemporary phenomena in their real, industrial and commercial context, as “the case

study allows an investigation to retain the holistic and meaningful characteristics or real-life events” (Yin, 1994, p. 3). We adopted the theoretical sampling approach outlined by Eisenhardt (1989) in developing our case study examples. Four companies were selected as examples of implementation of one of the eBusiness mechanisms (see Table I). A single case would not have captured the variety of the eBusiness mechanisms being used within organisations, hence a firm was selected to provide a basis for analysis of each of the four mechanisms. Three of the firms listed in Table I preferred not to be identified by name.

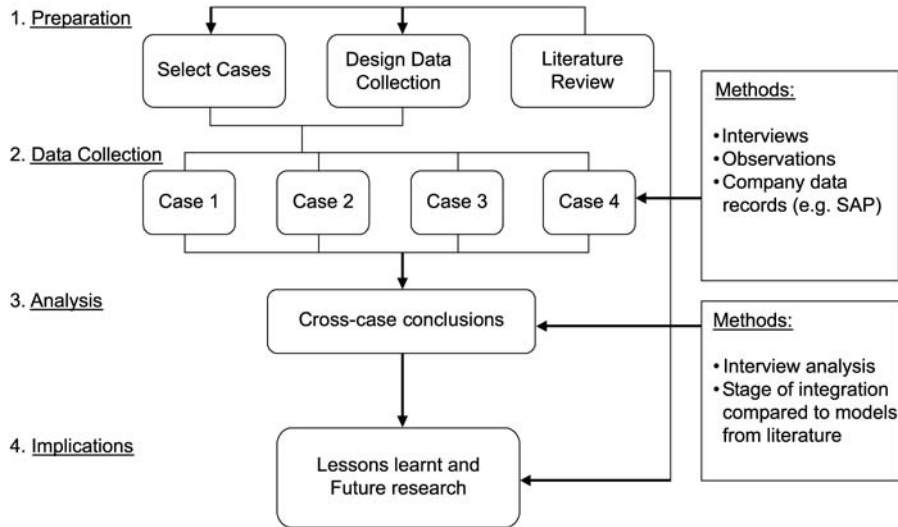
The principal method of data collection was through interviews with senior managers in the selected organisations. Those managers were located in Supply Chain/Logistics, Purchasing, Marketing and IT functions. In all cases, more than one interview took place in each company in order to avoid bias in responses based on the respondents’ functional responsibility. The framework for the interviews was based on a number of key subject areas such as: drivers behind eBusiness adoption; successes and failures in the projects; how a business case was created; the levels of integration targeted and achieved (the framework for interviews is shown in the list below). Respondents did in some situations reply only on questions where they were able to contribute, according to their roles or responsibilities. The subject areas were chosen to support the research aims established for the project and were informed by issues explored in notable earlier studies such as Bagchi and Skjoett-Larsen (2002), Frohlich and Westbrook (2001) and Akkermans *et al.* (1999). The interviews were structured on themes to ensure coherence and continuity between interviews conducted at different times and locations. To allow further verification of information provided at interviews, data were obtained from the firms on some key metrics such as customers or suppliers using the technology, numbers of orders processed, estimated or measured savings achieved. Additionally, access was granted in some cases to allow direct observation of activities within the business, or with suppliers/customers as appropriate to the case. Figure 1 shows the process followed in this research project.

#### *Structure for case study interviews*

- (1) Describe the eBusiness project we identified for discussion in this interview.
- (2) What were the drivers for this project both internal and/or external?
- (3) What specific issues were you trying to address with this technology/mechanism?
- (4) Who was involved in the scoping and implementation?
- (5) Was a business case established for the project and who was involved in drafting it?
- (6) To what extent were your trading partners i.e. customers or suppliers involved in the specification of the solution?

Organisation	eBusiness solution
Firm A	Sales order processing through online catalogue – sell-side
Firm B	eProcurement system for automated purchasing – buy-side
Firm C	Online reverse auctions – buy-side
Cisco Corporation	Supply chain co-ordination through virtual network “ecosytem” – private exchange

**Table I.**  
Case study organisations  
and focus of research



**Figure 1.**  
Flowchart of research  
method

- (7) Did you define what level of internal IT/systems integration you would achieve?
- (8) Did you define what type of external integration you would achieve?
- (9) What benefits have come from the implementation of this solution?
- (10) How are those benefits measured?

In each case there is a focal firm, leading the eBusiness initiative, targeting either its suppliers, customers or both. The research takes this focal firm as the initial unit of analysis and examines the integration impact on trading partners affected by the eBusiness initiative. The results from the data collection process are written up as individual cases, following which the paper offers a discussion of the issues raised during the study, though cross-case analysis and comparison, in order to draw further conclusions on the type of supply chain integration. To develop this discussion a framework was required and we adopted two examples from the literature as a basis for comparison in the case studies. Firstly the “Arcs of integration” model developed by Frohlich and Westbrook (2001), shown in Figure 1 and secondly the “Stages of integration” framework (Bagchi and Skjoett-Larsen, 2002), shown in Figure 2. These models allow a typological description of the integration achieved in each company case, although they do not automatically assist the discussion of specific operational linkages, which naturally vary according to the practices in place between individual firms. This point is addressed further in the concluding section of the paper (see Figure 3).

#### 4. Case studies

##### 4.1. Company A: sales order processing (SOP)

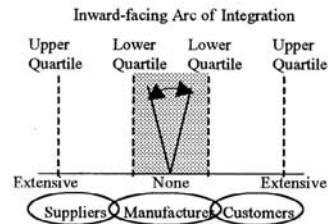
Company A is a business-to-business (B2B) distributor of spares, accessories, electronics and industrial/commercial equipment serving both the business and private user, primarily in European markets. The company stocks 130,000 supplier products and fulfils a new order every ten seconds. Its model is one of high service levels and high prices – orders are taken on day one for domestic delivery on day two through its

To what extent do you organizationally integrate activities with your customers and suppliers?

1. Inward-facing

Classified as inward-facing if response was:

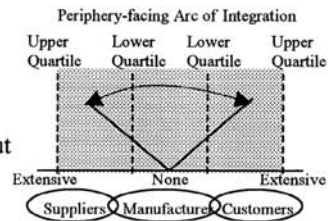
- In lower quartile for suppliers, and
- In lower quartile for customer



2. Periphery-facing

Classified as periphery-facing if response was:

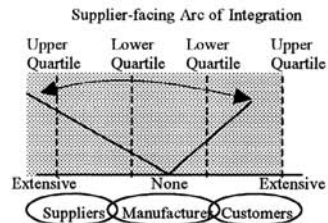
- Above lower quartile for suppliers *or* customers, but
- Below upper quartile for suppliers *and* customers



3. Supplier-facing

Classified as supplier-facing if response was:

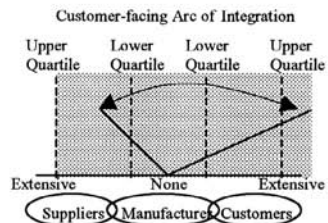
- In upper quartile for suppliers, and
- Below upper quartile for customers



4. Customer-facing

Classified as customer-facing if response was:

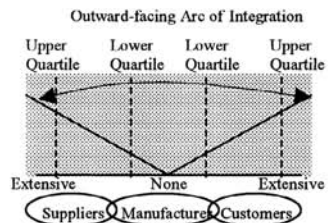
- In upper quartile for customers, and
- Below upper quartile for suppliers



5. Outward-facing

Classified as outward-facing if response was:

- In upper quartile for suppliers, and
- In upper quartile for customers



Source: Frohlich and Westbrook (2001)

Figure 2.  
Arcs of integration



Stages of Information Integration			
Supply Chain Integration Using	LOW Integration	MEDIUM Integration	HIGH Integration
Transaction Systems	MRP II Systems Legacy Systems	ERP Systems • Intra-company • Rigid interfaces Value: Mechanization of existing processes	ERP and Supply Chain Planning (SCP) systems • Inter-company integration • Flexible interfaces Value: Process Improvement
Communication Systems, Internet/Extranet	E-mail/Fax/phone Internet/Extranet only used for limited purposes	Few EDI/Internet links to customers/suppliers Extranet	Extensive use of EDI/Internet/XML links within supply chain
Bar-coding and Track-and-trace Systems, Electronic POS (point-of-sale) Data Capture, Inventory Visibility	Only bar-coding of finished products Track-and-trace and Electronic POS not used	More extensive bar-coding, automated e-mail updates and confirmations	Bar-coding from entry to dispatch Track-and-trace throughout the SC Key suppliers and customers connected
Vendor Managed Inventory (VMI) Collaborate Planning, Forecasting and Replenishment (CPFR), Customer Relationship Management (CRM)	Not used	Experimental stage with one or a few suppliers/customers	Strategic suppliers have access to production plans, materials requirements, sales forecasts and orders CPFR/VMI with key suppliers/customers CRM with key customers

Stages of Organizational Integration			
Organization Characteristics	LOW Integration	MEDIUM Integration	HIGH Integration
Status of Logistics/SCM in the Organization	Logistics sub-function Not part of senior management team	Unified logistics function under one organizational entity	Logistics/SCM member of corporate management group
Degree of Integration	Fragmented logistics activities	Internal integration across functions	Integrated across supply chain/process oriented
Importance of Logistics	Logistics not considered a core competence	Logistics considered a critical activity	Logistics/SCM considered a core competence
Communication Across the Supply Chain	Few contact points between companies in the supply chain	Regular contact at top/senior levels-rare operational level contact	Multiple contact points at all management levels
Governance Structure	Arm's length relationship-market-based	Partnership only at selected areas and levels-hybrid organization (semi-strong form)	Virtual integration-hybrid organization (strong form)
Formal Lateral Organizations	No cross-functional teams	Cross-functional teams in some areas Key account managers	Teams across the supply chain-regular interaction
Performance Measurement	Measurement of delivery service and inventory levels in some parts of the supply chain	Measurement of order lead time, logistics costs and service levels Joint measurement in some interfaces	Measurement of performance of supply chain processes Performance data shared across the supply chain Focus on end-customer value

Figure 3.  
Stages of information and organizational integration

Source: Bagchi and Skjoett-Larsen (2002)

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internally owned and managed distribution network. A traditional catalogue sales approach was used up to the 1990s when the company began experimenting with new electronic channels and was the first in the UK to offer a business to business catalogue on CD ROM. The company regarded the internet as an obvious extension to its marketing channels and in 1998 launched an interactive web site.

Their web-based business is an illustration of the B2B sell-side model, with its focus on moving customers online. Sell-side mechanisms are managed by the supplier firm, using the web as a sales and order processing tool. The interactive sales order processing software allows the firm to capture order data which is connected into its internal IT structure such as an ERP system, to enable order processing, invoicing and settlement. The sell-side model has a further strategic dimension however as it is seen as an alternative to and defence against, the implementation of buy-side (eProcurement) systems, used by an increasing number of buying firms. As seen in the Company B case below, internally deployed buying systems can be a powerful method for taking control of purchases to achieve buying leverage. Company A recognised early in the eBusiness cycle that this trend was a threat to its business model, which was based on higher prices through a service commitment. Buy-side mechanisms including online auctions have the potential to commoditise products, allowing the buyer greater power over suppliers and to exercise purchasing leverage.

The company has targeted a specific market segment with its sell-side offer, being SMEs or larger companies who wish to better manage the “tail” of their purchases. For a buyer, a purchase order can cost up to \$150 to process, hence a reduced cost for low value items is attractive for small buyers. Using Pareto analysis, it established that many firms have a large percentage of C class purchases where the cost of ordering is significant in relation to order value. Customer profiling reveals that a typical customer purchasing only one product buys it 20 times per year, whereas a customer purchasing 3,500 products usually buys each only once or twice. Hence it aims to serve the segment where process savings are more significant than purchase savings. To facilitate customer adoption further, the firm offers its own hosted buy-side application called Purchasing Manager (PM), which it offers free of charge for regular customers on the basis that they will increase their purchasing volumes. PM offers similar functionality to buy-side tools offered by software vendors such as Ariba, with facilities for purchase order approval, workflow management, spend analysis/reporting and job costing. This tool helps circumvent the need for individually tailored integrations of competing buy-side software with customers.

So where are the supply chain benefits in this model? Customers achieve some savings in process costs through automated online buying and can offer a standard, streamlined solution to users within their organisations. Company A achieves some sell-side process integration by taking customer order data direct into its financial and operating systems. However the customer cannot integrate to operations at its end as the system does not facilitate capture of data from the ordering system back into the customers’ ERP or legacy systems. Equally, PM cannot be used on web sites offered by its competitors. This case illustrates the advantage of a sell-side model for suppliers where a firm with a powerful supply chain positioning or service proposition can gain control of the sales channel to substantially reduce its cost of sales. Supply chain benefits in this model are limited and effectively accrue to the supplier, which is able to automate its information flow. However, wider processes are not co-ordinated with



customers and supply chain integration effectively ceases at the customer’s purchasing department. Here, the key resource is operated by Company A, which has deployed the sell-side mechanism to achieve greater channel dominance. Our conclusion in this case example is that supply chain integration was neither a driver for adoption of this technology, nor an outcome of its implementation.

4.2. Company B: procurement process reengineering

As the telecoms sector grew rapidly though the 1990s, emphasis was primarily on market share, product introduction and developing global capabilities. Company B was typical of this growth but by 2000 it saw profits declining and the threat of increased competition. Costs became an important issue and the firm decided to exploit the new eProcurement technologies available. After an initial pilot to prove the business case, a project was designed to implement a business-wide automated procurement system. The focus of this case is the firm’s buy-side application which automates the “requisition-to-payment” cycle and utilises electronic catalogues and purchase orders, with transactional activities being devolved away from the Procurement function towards users in the business.

The changes achieved in procurement practice are summarised in Table II. In order to audit the benefits achieved, the firm engaged external parties such as research firm Gartner to confirm the savings delivered, which helped in their business case to the organisation (see Table III).

**Table II.**  
Interviewees from the  
case study organisations

Case company	Interviewees
Firm A	Logistics Manager eBusiness Manager
Firm B	Marketing Director Purchasing Director Regional Logistics Manager
Firm C	IS Manager Procurement Manager Category Manager
Cisco Corporation	Supply Chain Manager Regional Supply Chain Manager Purchasing Manager IT Integration Manager

**Table III.**  
Company B  
eProcurement project –  
before and after

Before	After
Disconnected and duplicate systems	One global purchasing system
No requisition to pay process	One global requisition to pay process
Maverick buying the norm	Spend directed to chosen vendors
No visibility of spend and supplier data	Total spend and supplier data visibility
Approval system open to abuse	Compliance and control
Waste and inefficiency	Efficient system with “hard” savings

The benefits for the company however were not limited to those illustrated. More robust spend analysis tools led to improved buying leverage, contract compliance and price reductions, but most importantly the role of the central procurement personnel changed from tactical to strategic activities, with the headcount reducing from over one hundred to around fifty.

Buy-side procurement applications provide well-documented benefits for the implementing firm (Croom, 2000; Puschmann and Alt, 2005) but an issue of concern has been whether suppliers see any benefits in such projects or are merely required to increase their transactional cost to pay for such systems in their customers. The company recognised this problem and to speed and facilitate adoption, paid for their suppliers' catalogue and data transfer costs for the first year of the project. Several routes were used to enable inter-connectivity of ordering systems with suppliers: hosted electronic catalogues, third party marketplaces, connections to sell-side sites and in one case, direct connectivity between compatible SAP systems. This degree of systems connectivity goes beyond what most firms have managed to achieve. However, despite Company B's focus on supplier enablement, the emphasis here is not on the supply chain, but a narrowly prescribed procurement cycle. Moreover, all the measures and benefit calculations are based on standard purchasing KPIs, with effectively no analysis of benefits the project might provide at supply chain level. The project was clearly defined to provide benefits to Company B – the Board of Directors was unlikely to approve any IT implementation which did not rigorously support that. Any benefits accruing to suppliers and third parties in the project were incidental to that case.

Commentators have included buy-side applications in taxonomies of integration tools and it is evident from this case that some data and process integration took place, with automation becoming the norm in purchasing transactions. It is misleading however to suggest that buy-side tools are producing greater levels of supply chain integration. The integration which does take place is solely within the requisition to payment cycle and involves the supplier's sales order, buyer's purchase order and buyer's accounts payable. This is a very meagre step towards supply chain functional integration. More importantly perhaps, the key benefit of buy-side eProcurement for the firm comes not from the process improvement, but from the increased buying leverage created through spend visibility and contract compliance. The primary focus of such projects is creating value for the buying firm through purchasing leverage. Functions beyond procurement may never become involved in any greater extent of data sharing than before and integration benefits at the supply chain level may be limited or non-existent in such cases.

#### *4.3. Company C: online reverse auctions (ORAs)*

Owing to recessionary conditions in the airline industry Company C, like many of its competitors, embarked on a business-wide cost reduction programme, with specific targets being established for operating units. The procurement function was central to this programme and adopted the newly emerging eProcurement technologies as a means to pursue cost savings. Online reverse auctions (Smart and Harrison, 2003) were one of the solutions adopted, alongside buy-side software. Initially the firm experimented with reverse auctions in a number of product and service categories and following successful outcomes, extended the mechanism into additional areas of

direct spend. The key benefits achieved with ORAs were price visibility and process cost improvement. Process cost improvement came from the ability to tender more frequently; contraction of purchase cycle time; faster award of contracts; reduced paper and manual effort; lower transaction costs and improved Procurement functional productivity. These process benefits all attribute to the buying firm, although some suppliers involved identified potential benefits for themselves under similar headings. However, the objective of the ORAs for the buyer was specifically purchase cost reduction, which formed the basis of targeting and measurement for the Procurement functional managers.

In this case study, the suppliers involved in the auctions who were interviewed gave their responses to the implementation of ORAs and their views were mixed. Whilst many recognised potential benefits for themselves and the opening up of a lower cost sales channel, several expressed doubts about the longer term effect, through more regular changes in supply, ongoing pressure on price and a shorter-term focus to the relationship. The critical observation is that many suppliers saw this mechanism as working against broader supply chain principles such as collaboration and process or system integration. Some suggested they would be unwilling to invest in IT resources and information sharing with suppliers where there was a constant threat of substitutes offering marginal price advantages. The response of the buyer here is crucial – where the relationship issues are handled sensitively it will be possible to continue to engage suppliers in debates about integration, information sharing and process improvement, for joint gain. In the case of Company C the agenda was more fundamental, with cost management taking precedence over supply chain criteria.

This situation raises the concern that auctions are not a genuinely supply chain supportive mechanism as they reduce the focus on integration and adoption of operational improvement tools, instead driving cost improvement at the expense of a firm's supply chain partners (Emiliani, 2000). Faced with this question, procurement managers at the focal firm were ambivalent. Those with responsibility for MRO category products were usually unconcerned with the broader supply chain, quoting the need for survival in the tight market conditions as a basis for ORA adoption. Category managers in direct products had more concern for the impact on relationships with the supply base, but were still inevitably driven by the cost-reduction agenda. Hence in this case, reverse auctions were perceived by buyers primarily as a mechanism for market price disclosure, with process improvement being a secondary issue. Indeed the process aspect was not seen by any of the managers interviewed as an issue at supply chain level: process improvement was an internal benefit, measurable, if at all, to the buyer's specifications. Improvements for the suppliers were seen by Company C managers as incidental, and for those individual firms to calculate and measure.

Without a framework for implementation and evaluation of outcomes, ORAs can become a blunt instrument. Even with a framework for use, it has been suggested that ORAs should have a specific contextual role in MRO or "leverage" items (Smart and Harrison, 2002) which may not necessarily relate to wider supply chain goals. This case suggests that auctions are not being deployed as a genuinely integrative mechanism. Instead they are typically used by buyers as a means to extract value from the purchasing transaction.

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#### 4.4. Company D – Cisco: Supply chain integration through a private exchange

A supplier of hardware and software for the world wide web through products such as routers, switching technology, networks and supporting software, Cisco has been proffered as the leading firm in the world in achieving integration of data and processes across multiple levels in the supply chain (Kraemer and Dedrick, 2002). Cisco has created a virtual organisation through the linking of its supply chain partners utilising a complex network of platforms which enable almost all of its business transactions to take place over the web. At the time of this study Cisco's "ecosystem" used two principal outward-facing platforms, integrated with its internal ERP system[1].

The customer network (Cisco Connection Online: CCO) allows customers and resellers to place, configure and manage orders using automated ordering software. Users also have access to online technical assistance, a forum of technical experts and intelligent agents which support customer service. The supply side extranet (Manufacturing Connection Online: MCO) is the resource for contract manufacturers, suppliers and logistics service providers, giving access to real-time order and fulfilment data. The community of vendors has direct access to order information allowing a swift and agile response to customer requirements. Wherever possible, a process, activity or function has been web-enabled ensuring a consistency of culture and performance within the business and to a large extent across the virtual organisation it supports. It was not feasible in the context of this study to gather data by which we could evaluate, for example in scales or quartiles, the advantages achieved by suppliers and customers using the Cisco online SCM mechanisms. However, all of those interviewed experienced significant operational benefits such as visibility on orders, fewer logistics failures, less dependence on variable forecasts, lower inventories and more reliability in processes.

The network created by Cisco illustrates how a private exchange (Whitaker *et al.*, 2001) can be created to support the supply chain across multiple organisations. However it is important to note that there is a focal firm or "prime mover" (Bagchi and Skjoett-Larsen, 2002) in this virtual enterprise which defines and manages the supply chain processes. Cisco works with members of the supply chain and assists them in adopting the web based systems in order to achieve operational parity. This case offers a rare example of a company which has created an integrated global supply chain through the deployment of web-based solutions across multiple tiers. Other firms have attempted to achieve this through public or consortia marketplaces (Laseter *et al.*, 2001) but in most cases these failed to deliver due to a combination of technological or organizational issues (the much-heralded Covisint consortium in the automotive industry which closed in 2004 is an example). We suggest that the private exchange mechanism operated by Cisco is the most logical marketplace solution as it reflects the operational reality of a supply chain in today's global business environment. Equally it can be observed that the ecosystem only came into being as a result of the vision and execution capability of the driver of this supply chain. Cisco's business model as well as the products and the corporation itself are relatively new creations, unhindered by the baggage carried by most industrial firms. Most businesses operate in networks and contractual situations developed over decades or longer, as well as carrying assets and legacy IT systems which take time to substitute. For these firms, the barriers to integration are structural and cultural due to the difficulty of re-engineering the operational processes, both internally and externally.

The leading-edge supply chain solutions Cisco has implemented have been a key element in its success, allowing more focus on core growth activities. Equally, the ecosystem is not a democratic association of equals and it can be argued that Cisco has effectively leveraged its assets to achieve a position of power. Here, Cisco possesses the organisational flexibility, IT and employee competences and the dominant market status (*vis-a-vis* both customers and suppliers) to drive through a programme of innovation such as the ecosystem. In this case however, that power has been used to deliver value and benefits amongst the supply chain participants through the visibility created by integration of processes across the network.

5. Findings and discussion

In the first three case studies we can observe commonalities in the impact of the eBusiness mechanisms deployed by companies A, B and C. Following the definitions in the Frohlich and Westbrook (2001) model we define their activities as lying within the lowest integration level, or as “inward-facing” arcs of integration. Similarly, if we use the Bagchi and Skjoett-Larsen (2002) three-layer framework, in companies A, B and C, the stages of both information and organisational integration would be classified as “low”. Indeed we suggest that the real level of integration, as defined by the constructs in these two frameworks, is practically non-existent. The companies are involved in the exchange of data electronically which leads to the automation of some processes, mainly within the narrow sales or purchase order cycle. However, as we have seen, this leads to no further definable benefits, measurable across the supply chain. There is a marked contrast in the Cisco case, where following Frohlich and Westbrook (2001) there is a strong “outward-acing” arc of integration. Similarly, according to the Bagchi and Skjoett-Larsen (2002) definitions, Cisco provides a good example of “high” levels of information and organizational integration (see Table IV).

To understand the very limited extent of integration in three of these cases, we need to examine the situational business reasons. Importantly, in the sell-side and buy-side examples, it was apparent from our discussions with managers in all three organisations that the projects were based on an internal business case, designed to create value for the focal firms and to improve their specific processes and costs. A limited benefits case was considered for the partners to the transaction, usually to support the argument for external adoption or deal with objections, but this was not a driver for the change in practice. In other words, the firms did not begin with a supply chain perspective. Indeed, the broader supply chain issues have barely been considered, in so far as the impact on the transactional partner’s business is concerned. In these cases, the focal firms have sought to manage control of a key resource, either the buying or sales channel, in order to more efficiently manage orders with either their customers or suppliers.

**Table IV.**  
Levels of integration in  
the four case studies  
(after Figures 2 and 3)

	According to Frohlich and Westbrook model	According to Bagchi and Skjoett-Larsen model
Firm A	Inward-facing	Low
Firm B	Inward-facing	Low
Firm C	Inward-facing	Low
Cisco	Outward-facing	High

The Cisco case is wholly different and illustrates that broader, external integration is achievable, in this instance in support of a virtual enterprise network. The case presented here supports the assertion by Bagchi and Skjoett-Larsen (2002, p. 104) that “the success of a drive to integrate the supply chain depends on the power, influence, motivation and zeal of the prime mover in the supply chain”. The sophistication of the Cisco solution is unusual and has only been emulated by a handful of firms and as Akkermans *et al.* (1999) have suggested, innovative newcomers may be able to change the rules of SCM in an industry. Moreover, it raises an important question about how value is created and distributed in e-enabled supply chain networks. Cisco’s ecosystem came about through the guiding hand of a powerful focal firm, yet benefits have accrued to the supply chain participants through sharing of demand data and more efficient management of inventories leading to minimisation of obsolescence and risk. Despite discussion of anticipated supply chain optimisation through marketplaces and exchanges (Kaplan and Sawhney, 2000; Laseter *et al.*, 2001) the principal reason that most of them failed was the suppliers’ concern that they would be unable to realise any benefits. This concern has proved a major obstacle to e-marketplace adoption and it is usually only where a mutually beneficial solution has been developed that the electronic marketplace has been a success. The marketplace or exchange model may itself be overtaken by newer technology solutions (de Burca *et al.*, 2005; Themistocleous and Corbitt, 2006) such as Enterprise Application Integration (EAI).

The new wave of eBusiness solutions did not appear in a linear progression, offering incremental improvements with one mechanism following the next. They appeared simultaneously over a short period and many early investors, for example in e-marketplace solutions, were forced to write off major investment capital (Tonner, 2004). Some of the managers interviewed in this study suggested this experience has made firms more cautious with their investments and that a more selfish approach may have developed where they realise they can grasp benefits for themselves through eBusiness implementations. This attitude would suggest that the broader supply chain picture will be ignored. It should be recognised here that connecting functions between companies through IT solutions does not constitute integration. In reality what is achieved is often no more than automation of a transaction, with one side of the exchange benefiting over the other, according to the relative power positions occupied. In some cases, such as with buy-side eProcurement applications, the system may be imposed on suppliers who are threatened with withdrawal of business if they do not co-operate.

Van Hoek (2001, p. 21) has stated that “very often virtual integration is applied in an operational manner and in segments of the supply chain only, as opposed to... strategic and integral supply chain involvement”. A more holistic approach will require an expanded, multi-company perspective amongst trading partners. Where IT projects are proposed and implemented by specific functional departments, we observed that usually those managers did not have access to data which would permit a broader supply chain business case. The starting point for this to be achieved, is for organisations to have integrated internal supply chain structures and Fawcett and Magnan (2002) demonstrate that this starting point is still yet to be reached in most businesses. For greater integration to develop (as defined in the frameworks referenced above), supply chain partners will need to share common mindsets and objectives, recognising the need to deploy mutually agreed processes, technologies and solutions



to common problems. Whilst a number of articles amongst those in our literature review suggest that it is on the increase, our findings support the assertion of Bagchi and Skjoett-Larsen (2002) that external supply chain integration is generally uneven and usually absent.

### Conclusions and lessons learned

The variety in the cases examined here allows us to draw conclusions on some key issues concerning the use of eBusiness or IT mechanisms in supply chain management.

First, web sites or online sales catalogues established by sellers as a channel to market will have as objectives either supporting a market development or penetration strategy, or may be used as a defence mechanism against the imposition of eProcurement tools by large-scale purchasers. In effect they are not designed as supply chain solutions and cannot fulfil such a role unless they are integrated with both the seller's own ERP, or equivalent, systems and more importantly, those of the buying firms.

Second, whilst eProcurement applications have been widely adopted by the purchasing function, their impact on supply chain performance is not well understood. Where their use is solely or primarily driven by purchasing functional requirements the supply chain implications will be not measured. Indeed, our case reveals that the supply chain was never a consideration in the implementation and there was little or no understanding of the potential on-cost downstream. In order for there to be any possibility of an integrated solution being developed, such applications must be part of a supply chain level benefits analysis and not be driven purely by procurement functional targets.

Third, online reverse auctions are premised on creating value for buyers through spend leverage and process improvements. We found no evidence of supply chain considerations in the implementation of reverse auctions technology, a finding supported by other studies on this topic. Whilst suppliers may realise some benefits either in process or cost reduction in response to tenders, there is effectively no supply chain level integration through this technology. This will only occur when firms move beyond pure cost-based metrics as a basis for implementation. As with eProcurement applications, we found that the business case was based on benefits delivered to the buying firm only.

Next, private (as opposed to public or vertical) exchanges are the most likely new eBusiness mechanism to facilitate supply chain integration. The Cisco ecosystem example illustrates how integration both upstream and downstream is achievable and similar outcomes may be delivered in future through the networking of firms' ERP systems. However the fundamental difference in the implementation of this infrastructure is the distribution of benefits to members of the supply chain, through real-time visibility and response, information sharing and reduced risk. This type of solution will often require one firm to initiate the infrastructure on which such inter-dependent systems and processes are established. Such an approach also permits the standardisation of data and processes, further facilitating measurement, reporting and error correction, which build levels of trust between the firms operating in this supply chain.

This paper has contributed to studies in the domain by illustrating that functional or silo-based thinking still drives current eBusiness implementation in supply chain

contexts. Evidence from the case studies advances the literature in this area by demonstrating that the buy and sell-side applications discussed here will not lead to integrated supply chain solutions, unless they are approved within a structure of IT integration which supports supply chain level benefits analysis. This should be an issue of concern, as IT has often been proposed in the literature as the means to advance integration, not inhibit it. Further, it has been identified in these cases that buy and sell-side applications may create obstacles to further integration in the supply chain if they are used to achieve purely functional targets, or if the firm's trading partners are forced to adopt technologies which raise their respective operating costs. Hence frameworks which classify all such mechanisms as "supply chain solutions" are misleading and they should be differentiated from genuine supply chain management mechanisms such as private exchanges, through which deeper levels of external process integration may be achieved. Equally, this step will require the influence of a focal firm, which recognises the potential for supply chain benefits through such integration and it is often the absence of such a prime mover which inhibits success. This paper proposes that firms which seek to integrate externally in order to deliver supply chain cost and service improvements, in which suppliers and/or customers participate, should use lessons from the private exchange or ecosystem model to develop appropriate supply chain-level IT strategies.

### Further research

One can only make limited generalisations from a small number of case studies, as presented here, and to ascertain a more global perspective of the impact of these eBusiness mechanisms will require further in-depth studies and perhaps a survey-based approach. This subject area is in itself problematic in that authors offer alternative or contradictory interpretations of "supply chain integration". The published frameworks referenced in this article use different constructs and activities in defining both supply chain integration and the levels which pertain within it. Research which seeks to formalise our understanding of the components of integration (which in practice may vary between industry sectors) will assist the debate considerably. Further studies in this domain should therefore seek to explore the impact of eBusiness adoption in a wider sample of companies and to establish a typology of attributes which should form the basis for successful supply chain integration.

### Note

1. Since the research was undertaken, there have been developments in the Cisco system architecture.

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# Exploring the business case for e-procurement

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Business case for  
e-procurement

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## Abstract

**Purpose** – Although e-procurement has been adopted in many industries, the business case for this technology has only partially been explored in the literature. This paper aims to investigate, through a case study approach, the extent of the business case developed for e-procurement adoption in three implementations.

**Design/methodology/approach** – The paper employs a case study method and examines three industrial firms through in-depth interviews with managers involved in the projects. The cases were presented and explored individually, followed by identification of relevant drivers and problem factors.

**Findings** – The research identifies 18 drivers which can form the basis of a business case for e-procurement. A further 17 problem factors are presented, which have the potential to militate the original case. It is apparent that the firms involved only developed a limited case for adoption and that there is a significant element of faith that the eventual results will justify the investment.

**Practical implications** – A framework of the business drivers for e-procurement is introduced, in the form of a multi-attribute hierarchy. This framework can assist managers to classify relevant issues in assessing and developing the case for e-procurement adoption.

**Originality/value** – Whilst the literature offers theoretical benefits for e-procurement, the paper provides managers and researchers with empirical evidence of the drivers for this technology and of the problems encountered in implementation.

**Keywords** Procurement, Electronic commerce, Purchasing, Communication technologies

**Paper type** Research paper

## 1. Introduction

From the late 1990s, a raft of new e-commerce technologies emerged which promised to revolutionise working practices, threaten existing businesses and potentially create new business models (Sinha, 2000; Barua *et al.*, 2001). Following this growth in use of e-commerce in business-to-business markets, there has been significant adoption of new supply chain-related technology and applications by organisations globally. The procurement function has been particularly affected by this trend with a predicted growth in e-procurement applications covering both transactional buying and strategic sourcing activities (Corini, 2000; Croom, 2000).

One of the factors behind this development has been the evolution of the procurement function towards a more strategic role in supporting both corporate goals and supply chain objectives. The purchasing expenditure in relation to cost of good sold averages 50 per cent and may be as high as 80 per cent (van Weele, 2005), therefore reduction in cost of bought-in goods and services has been a major focus in much of the merger and acquisition activity though the 1990s and 2000s. Corporations recognise the potential for increasing both profits and stock values by aggregating the buying power



of recently merged organisations and reducing spend with external suppliers to the business. This goal and other drivers within the function have led to greater recognition of the need for tools and technologies which can support procurement managers in increasing their productivity and contribution to value creation.

The applications which form the e-procurement landscape are designed to automate the buying cycle, optimise spend, improve process and workflow, support bidding and tendering and facilitate more effective search for products and services via the internet. It has also been suggested that such technologies will lead to closer collaboration and integration within the supply chain (Garcia-Dastugue and Lambert, 2003; Johnson and Whang, 2002), although this is not necessarily an objective where applied to indirect or non-production spend. Whilst there are definable benefits from e-procurement, in the early days of the internet boom there was without doubt considerable hype about the dramatic changes these technologies would produce, and there is emerging evidence on the realities of e-procurement and some of the difficulties which adoption entails (Davila *et al.*, 2003; Angeles and Nath, 2007).

A further complication is that e-procurement encompasses a number of different technologies and solutions with varying levels of functionality and complexity. A number of authors have defined the mechanisms within e-procurement (Rajkumar, 2001; de Boer *et al.*, 2002; Wang *et al.*, 2004; Quayle, 2005; Nagle *et al.*, 2006; Percy and Guinipero, 2008; Bakker *et al.*, 2008). These authors take a different stance on what is, or should be, included within the definition, so there is no clear consensus. Some definitions admit applications which engage with specific transactional elements such as automated buying tools, catalogue systems and online auctions; others include functions such as planning, scheduling and collaboration between trading partners. Within this paper, the focus will only be on the specific transactional applications which were used by the firms investigated. A definition of these mechanisms is provided in Table I.

The aim of this paper is to explore the business case for e-procurement. All business investments need to be the subject of suitable assessment and evaluation and whilst the literature suggests potential benefits of these technologies, little has been written on the nature of the business case for e-procurement and how it has been developed by buying firms. The term “business case” has been defined in a number of ways. The UK’s Office of Government Commerce suggests it is used “to obtain management commitment and approval for investment in business change including projects and programmes, through rationale for the investment” (OGC, 2009). The Interoperability Clearinghouse defines it as “a structured proposal for business improvement that functions as a decision package for organisational decision-makers” (www.ichnet.org, ICH, 2009).

For this research, three large organisations were selected for examination who had implemented e-procurement, to establish the nature of their individual business case. The research further examines the outcome of their projects to assess factors which militate the original case. The structure employed is to present a review of the relevant literature, followed by discussion of the methods used in the research. The case histories are then presented individually, with a synthesis of the findings from the three cases. Subsequently, a framework is introduced which summarises the key variables identified and allows us to draw conclusions on the findings and provide indications for further research.

Tool	Characteristics
Buying/RTP application	An application hosted by the buying firm to allow users to search for products, place and track orders, receive and pay for purchases. Uses catalogues provided by suppliers or draws product data from supplier sites through punch-out. Automates the "RTP" cycle
Supplier catalogue sites	Web sites hosted by an individual firm which displays its product range in an electronic catalogue. Allows customers to order online, usually using point and click system, linked to shopping basket, check out, etc. Designed by suppliers as a channel to market
Electronic marketplaces	Web portals which offer an online store for buyers and suppliers to conduct transactions. Suppliers offer content, allowing buyers to browse in multiple catalogues on one site. Marketplaces may be "horizontal" in offering a wide range of products such as office supplies, or "vertical", related to a specific industry or sector
Reverse auctions	Online, real time bidding events where buyers offer a contract to specified suppliers, who make reducing bids in order to gain the business. The winner in principle is the lowest bidder, although a range of criteria may be used to award the contract. Terms and conditions for the event are specified by the buying firm
e-RFX	A suite of applications which support buyer analysis of supply markets and suppliers. Includes search tools, supplier rating and scoring systems, bid analysis tools, evaluation techniques. Designed to improving decision-making by buyers

**Table I.**  
Definition of  
e-procurement  
applications used  
in the case firms

## 2. Literature review

The literature on e-procurement has been steadily growing since the late 1990s when papers began to appear on the impact of the internet and e-commerce on supply chain management (SCM). Prior to this, the focus of discussion within SCM had been on electronic data interchange (EDI) which has been replaced almost entirely by web technology and is therefore largely ignored in this review.

There has been a broad analysis of benefits and disadvantages of e-procurement, within the literature. The advantages cited include lower purchasing costs, achieving compliance to contract, improved communication, enhanced planning, reduction in transaction costs, faster cycle times and improvement in procurement personnel efficiency (Tatsis *et al.*, 2006; Ash and Burn, 2003; Puschmann and Alt, 2005; Lancioni *et al.*, 2003; Pressutti, 2003). Similarly, there has been discussion of the barriers or disadvantages in implementing e-procurement, which include technology immaturity, problems in implementing change, potential conflicts with suppliers, inability of small and medium-sized enterprises to materialise savings, and cost of implementation (Angeles and Nath, 2007; Tanner *et al.*, 2008; Hawking *et al.*, 2004; Shakir *et al.*, 2007; Quayle, 2005; Min and Galle, 2002). Angeles and Nath (2007) in particular explore the challenges to e-procurement and identify three important issues, namely lack of system integration and standardisation, immaturity of e-procurement market services and maverick buying/difficulty of integrating e-commerce with other systems. Other relevant issues to be explored include adoption of the new technologies (Batenburg, 2007; Percy *et al.*, 2008; Gunasekeran and Ngai, 2008; Tanner *et al.*, 2008), success factors (Versendaal and Brinkkemper, 2003; Puschmann and Alt, 2005; Gunasekeran and Ngai, 2008), and the impact on organisation and costs (de Boer *et al.*, 2002; Brun *et al.*, 2004).



Whilst this literature grows, there has been little evaluation specifically of the business case for e-procurement. It may be argued that the benefits identified from existing studies can help to create a basis for a business case, but this has to be balanced with the evidence of barriers, risks and adoption or implementation problems. The evidence of such problem areas is now emerging from more recent studies. Croom (2005) states that there has been poor validation for many e-business projects, with survey results indicating that the justification from adopters is based mainly on squeezing out costs. In another survey-based study, Tanner *et al.* (2008) showed that the potential and benefits of new IT investments such as e-procurement are difficult to appraise. Similarly, Rajkumar (2001) suggests that benefits may prove difficult to measure as there are less visible costs in such implementations including consultants, integration, catalogue development and staff training programmes. Abery and Glindemann (2004) noted that alleged process cost reductions are a myth and a case based upon process improvement alone will not justify the investment in e-procurement. In an examination of smaller firms, Min and Galle (2001) observed that smaller businesses may lack e-commerce capability and so reap fewer rewards from such technologies; hence cost of entry may be too high and benefits would be less extensive.

In a rare example of analysis of financial benefits from electronic commerce in procurement, Mukhopadyay *et al.* (1995) in their study of EDI implementation by Chrysler with its suppliers, established that the firm had gained cost savings equivalent to \$62 per vehicle, although they noted that in such projects it may be necessary to reduce the number of suppliers as some may be reluctant to incur additional expenses or make the necessary IT investment. Research by Brun *et al.* (2004) developed a modular methodology for evaluating e-procurement projects using financial and operational criteria.

In a study of web-based applications, Ellram and Zsidisin (2002) used transaction cost analysis to justify using technology to support purchasing management. Pressutti (2003) argues that a business case requires the firm to show a link between e-procurement strategy and financial performance. He further proposes the use of economic value added as a financial measure in establishing this case.

Citing a report from Deloitte Consulting, Corini (2000) claims the business case for e-procurement is clear as companies can expect to achieve a return on investment (ROI) of 30 per cent in the first two or three years. However, the actual savings achieved can be difficult to capture as they relate to "soft" areas such as transaction cost reduction. Similarly, he cites supplier resistance as an issue which must be addressed in the business case along with rationalising supplier numbers. This point is supported by Deeter-Schmelz *et al.* (2001) who state that suppliers play a critical role in successful adoption of e-procurement. Min and Galle (2002) also stress the importance of ROI, citing examples of reductions in purchasing price, inventory and cycle time. Taking the ROI debate further, Quayle (2005) suggests that often the cost of change is undertaken without full benefits being clear, therefore firms should set a target ROI, covering cost of capital expenditure as well as items such as internal resources used and time allocated. In the UK, the Office of Government Commerce has developed a business case formula as part of its national e-procurement project initiative. This provides a checklist to the public or governmental sector on how to create benefits and value from such investments (NEPP, 2009).

Offering perhaps the broadest evaluation of the business case in e-procurement, Subramanian and Shaw (2002) stress that the evidence of benefits from web technology is anecdotal and that there are few studies which explore the issue of value. However, they state usefully that different web-based models or technologies have a different way of creating value. Few models for e-procurement evaluation have been proposed in the literature. Smeltzer and Carter (2001) suggest a benefit/implementation cost framework which uses cost/benefit analysis. Similarly to Subramanian and Shaw (2002) they propose that a different case can be made for different e-procurement “activities” with each potentially having its own value propositions.

Looking more broadly, since the significant growth of IT usage in the 1980s, there has been discussion of the case for information technology through analysis of value delivered by IT investments in general. Evidence suggests that it has been problematic to establish the value actually contributed by IT. Weill and Olson (1989) provided a review of research on IT projects and demonstrated that there was a problem in showing the impact of IT investment on firm performance. In a subsequent review of the literature on IT, Brynjolfsson (1993) identified the “productivity paradox” and cited four factors explaining why, over the course of a range of investments, IT had not measurably improved productivity. These were:

- (1) measurement error;
- (2) lags (i.e. in achieving pay-off from investment);
- (3) redistribution (IT could be privately beneficial but not adding to total output); and
- (4) mismanagement.

Barua *et al.* (1995) identified that commitment to IT investment required an even larger commitment in faith and suggested that gains from IT projects in previous decades had been shown to be inconclusive, with some showing little or even negative impact, whilst others showed a positive impact. In effect, they suggest that benefits from IT investments are often elusive or problematic to quantify and measure. It was found by Farbey *et al.* (1993) that in only 50 per cent of cases were IT projects subject to a formal pre-investment appraisal process, and in only 30 per cent of cases was the investment outcome evaluated. It has also been identified that over 80 per cent of IT directors consider cost-benefit analyses for IT to be a fiction, and one chief executive officer suggested there was a spontaneous conspiracy to exaggerate the benefits (Grindley, 1993).

In a more recent study, Ashurst *et al.* (2008) have demonstrated that one of the major problems in IT projects is effectively managing change and cite evidence that in the 1990s up to 90 per cent of projects failed to deliver benefits. Moreover, Sircar *et al.* (2000) have proposed that some researchers have given up on trying to correlate results with IT projects and advocate focusing instead on the processes IT is supposed to enhance and how this should be executed.

From this review we can draw two important conclusions:

- (1) there has been a long-term problem with identifying value from IT investments and in creating a case for IT introduction in general; and
- (2) to date there has been only a partial and fragmented business case established for the deployment of e-procurement specifically.



### 3. Methods and objectives

It is apparent from the literature reviewed in this paper, that there has been a generic problem in measuring the value of IT and in building a case for making such investments. In relation to e-procurement, the business case has been marginally explored, and in most of the studies to date there has been an assumption that the benefits identified (although often from theoretical, rather than empirical research) justify the deployment of such technology. Consequently, the objective of this research was to explore the realities of the business case for e-procurement in a selection of firms, and to understand the factors in the decision to invest in this technology.

It was also identified in the literature that much of the research undertaken hitherto on e-procurement has been survey based. These studies will by their nature focus on generalisations such as statements that firms are more likely to adopt e-procurement if they are large in size or have higher levels of IT capability (Soares-Aguiar and Palma-dos-Reis, 2008). Such statements, whilst valid, are of limited use to individual firms, even if they reflect the identified criteria for adoption. The approach in this study was to explore, through company examples, the specifics of some e-procurement project experiences, and a case-based approach was selected. Case histories can illustrate the real impact of technologies such as e-procurement and define in depth and in context the nature of the decisions made and the achievements experienced by the firms examined.

Case research is particularly suitable for new or developing areas of practice where knowledge of the phenomenon is limited or not well documented (Yin, 1994). Stuart *et al.* (2002, p. 422) describe the research strategies possible within case research and following their classification, this project seeks to explore “what are the key issues” and to identify critical factors “what are the key variables”. Similarly, it has been noted that whilst research on organisations is usually characterised by large, multi-industry samples, research within organisations requires thick description and data derived by direct or participant observation (Dubois and Araujo, 2007). Such case study research allows a level of intimacy with the subjects under study, which compensates for the low number of examples explored and the resulting issue of generalisation of results.

The purpose here then was, through an inductive approach, to develop insights and propositions, rather than to measure results or outputs quantitatively. A method was developed following the example from a study in the Greek food industry (Tatsis *et al.*, 2006), although in the project described here, the firms selected are all multinationals involved in buying and trading in international markets. The firms are situated in varying business sectors (consumer products, telecommunications and chemicals), however, they possess some common characteristics such as operations of similar size and scope, being at similar stages of usage of e-procurement and deploying a range of e-procurement applications. These cases were selected as they possessed the potential to be particularly revelatory and offered deep levels of research access (Eisenhardt and Graebner, 2007).

The aim of this research was to demonstrate the extent of the business case developed for the e-procurement implementations, and to uncover what factors were encountered subsequently which affected the original case. These militating factors resulted from the adoption programme in each company, however, here the details of e-procurement implementation are not specifically discussed as they are explored in a separate paper. For this investigation, three key research questions were articulated:

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*RQ1.* What were the drivers for e-procurement adoption? What kind of business case, if any, was proposed for the project? What issues during or post-implementation affected this business case?

These questions were considered to be important as there is virtually no research evidence on how managers reach decisions on e-procurement; similarly the case examples published are generally lacking in providing evidence of the problems encountered in adoption (Tatsis *et al.*, 2006; Cagliano *et al.*, 2005). The research therefore seeks to contribute to knowledge in this domain by providing empirical examples of origins for the business case for e-procurement, and of implementation issues which militate that case.

Once the firms had agreed to participate, time was spent identifying the appropriate respondents. Those selected were managers who owned the projects or were close enough to the e-procurement initiatives to give valid responses, i.e. those involved in the initial project set up and/or ongoing management, as well as senior executives. The senior purchasing executives were interviewed initially in order to establish much of the background to the projects and corporate level drivers. Middle or lower ranking managers were then interviewed with the same question set. Perhaps, unsurprisingly, the lower ranking managers were usually able to provide more insight into the reality of the project as they had usually struggled with day to day issues of implementation and change.

A minimum of three respondents was used in each organisation and these interviews took place over a number of weeks during 2008. The interviews were recorded and the resulting transcripts were coded for further analysis. A coding system was developed from prior work conducted by the researchers in a related area and informed by concepts derived from the literature. Techniques used in coding and interpreting interview data were based on suggestions from Miles and Huberman (1994). The approach taken was to conduct within-case analysis, tabulating responses in key areas, then to undertake cross-case analysis to compare and contrast results, leading to synthesis of key themes. The initial findings are described below as individual cases, focusing on the research questions covering drivers, the business case and issues arising from implementation.

The interview responses were supplemented with documents and records from within the three firms. This included: internal presentations and training information, data on spend and purchasing performance, specific examples of use of e-procurement tools such as e-auctions and catalogues. These various sources allowed validation of responses against a range of supporting data, and provided a rich picture of these firms' experiences. Limited claims for generalisation can be made from three case studies, however, the objective here was to provide, through empirical evidence, valid insights into an area where little research evidence existed.

In the following sections, the discussion of drivers identified in the research is followed by presentation of a theoretical framework, based on a hierarchical model. The factors leading to the hierarchy and the proposed model itself were reviewed in a second set of discussions with a representative from each company who was involved in the original round of interviews. These interviewees were invited to critique the findings and through iteration, the factors were classified into appropriate headings to create the final model. This is designed to enhance understanding of the components of the business case for e-procurement and to aid decision-making by firms planning to adopt such technology.

4. Case studies

The literature identifies a range of applications and mechanisms which can be classified under e-procurement (as shown in Table I). In these cases, the focus is primarily on the use of buying applications which aim to automate the “requisition to pay” (RTP) cycle as shown in Figure 1. Such applications can be an existing function within systems such as SAP, or stand alone versions which can be integrated into enterprise resource planning (ERP) applications.

Case A

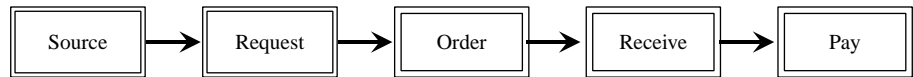
Company A is a consumer products firm which manufactures in several locations across the world, supplying product to the global markets under various brand names. The central procurement team which determines overall strategy is located in the UK head office (HO), supported by regional and local procurement groups.

At the time of this case study research being undertaken, the firm had been involved in its e-procurement project for two years, and had implemented a range of solutions at different points. The approach to segmentation of the different applications available was based on the Kraljic (1983) risk/value matrix which is used in the firm as one of the principal tools for strategic decisions. Reverse auctions have been used on a limited basis for leverage, and some routine products. RFX tools such as vendor search, tendering, supplier qualification and evaluation, are deployed across a range of segments, to assist in the contract award process. Similarly, the firm has deployed an online buying tool based in SAP which automates the RTP cycle. This buying tool was being used successfully for a range of categories, where there are no obstacles to the buying transaction being automated.

The initial push behind these projects was a global programme devised to manage the indirect spend which hitherto had been under local control. The firm set a target of savings of approximately 9 per cent of its global indirect spend of £2 billion. However, this figure was an estimation as its existing systems and reporting were unable to produce a reliable spend figure. It also identified that some e-procurement tools had been adopted locally without any real co-ordination. The central procurement team recognised the need to establish a common global process and database against which to manage this savings programme and saw e-procurement as the means to drive achievement of the targets.

Some additional drivers which the firm recognised relate to varying stages of the procurement process. The first of these was standardisation. The firm was establishing a SAP platform for the business and the use of common applications would enable a standard approach to spend processes. Knowledge sharing was seen as important and common e-procurement tools would act as an enabler. A point stressed by managers in the firm was the need to move resources from transactional to strategic activity, also defined as changing focus to higher value-added activities. This in turn was seen as improving productivity from people. Gaining control over spend was cited and relates both to spend compliance and to approval levels. Supporting this point, the firm

Figure 1.  
The “RTP” cycle of  
e-procurement buying  
applications



identified better visibility of spend as essential, in order to manage cost reduction targets. Finally, the result of better visibility would be improved supplier management, as the firm would be able to identify areas for process improvement and cost reduction through improved supplier information.

Looking back at the roots of the project, these drivers were clear for managers interviewed, although they were honest in admitting that the business case put forward for e-procurement was less well articulated. The drivers discussed are all based on certain assumptions of what e-procurement would produce, i.e. improved data, visibility, common standards, improved process, etc. In response to the question of what level of business case was put forward prior to starting any e-procurement project, one manager stated:

[...] that's a very good question; a document was put together but I think it would be very kind to call it a business case because I don't think it had many numbers in it [...]

This respondent offered a further revealing quotation on the reasons for this:

[...] it was quite informal compared to what you might do for a standard IT implementation; if you are going out to buy an SAP system, for example, you're normally going to do a detailed business case, but it's interesting how a lot of companies fudge that issue [with e-procurement]; it's a bit of a "wait and see" situation and there's faith that the outcomes will justify the investment.

This respondent mentioned that he had experienced a similar approach in his previous position in another multinational corporation.

Two further managers interviewed in this case example agreed that although there were legitimate drivers for the projects, the business case had been vague and the principal reason for this was the lack of understanding of what benefits could actually be realised. It was also interesting in this instance that little or no consideration was given to benefits for, or impact upon, the firm's suppliers.

Turning to the firm's experience of implementation and problems in relation to the business case, the main driver was the lack of information on indirect spend which had been a major problem before implementation. The e-procurement system did not solve this problem as the firm had expected, with full spend visibility not yet being available. The respondents admitted that they had not really understood what the technology would deliver in this regard. The issue had been further complicated by the differing accounting and reporting regulations in various parts of the world, which had tended to drive data availability in financial systems. The respondent responsible for this particular element revealed that the firm had engaged an additional software company to do a more detailed analysis of its global spend data to provide the granularity it required. She disclosed that:

I think we went into e-procurement with a slightly false business case; we thought we could put 100 per cent of our spend through it and it would just sort out any visibility issues. I think initially there was disappointment that it wasn't delivering what it should; the fact is there's more than one procurement channel and now that's been recognised we are in a far better place.

A further problem area had been the change in people's job functions, which the firm had underestimated. The managers in Firm A were realistic in stating that they had been poor at dealing with the change to roles and tasks which the e-procurement systems introduced:

[...] we underestimated the amount of change management that would be needed; in terms of training we were poor because we were training only from a technical perspective rather than from a business process perspective.

Similarly, the changes in roles at both central and regional locations were not clearly delineated, leading to confusion over where responsibilities lay once the new systems were being introduced. A learning point for the firm was that the move from transactional to strategic activities will be slowed if the change elements and resulting roles are poorly executed, which in turn can forestall the achievement of important savings targets.

#### *Case B*

Firm B is a European-based telecoms business which, like many firms in this industry, experienced increased competition in its markets, causing increased focus on cost management. Procurement was managed from a central HO location with over 100 personnel originally involved in the function, supported by local employees in regional markets.

The firm had undertaken its e-procurement project over a period of two to three years and had adopted a number of solutions to address specific issues. Initially, the focus was on the automation of the buying process and a web-based system (SAP/BBP) was implemented to manage the RTP cycle. Reverse auctions were adopted in only a limited way and other tools to support sourcing and market intelligence were introduced once the basic buying application was functional. The buying system was the focus of most of the project as the firm embarked on a sophisticated integration programme, whereby the buying tool would be integrated via web technology with external internet platforms such as third party marketplaces and some vendor-managed portals. To ensure reliable implementation practice, a pilot project was undertaken to establish proof of concept before the system was rolled out to business units.

A key issue in the business was that due to poor management information the firm had unreliable data on its expenditure to such an extent that the total global spend figure ranged in estimate from €3 to 5 billion. The drivers for the e-procurement programme related to this spend target analysis and additional issues as shown here. First, compliance to contract and preferred suppliers was a major concern – although the HO team established central contracts and in theory regional businesses would order against these agreements, record keeping was poor. Allied to compliance is the issue of management information which an e-procurement system was expected to deliver: suppliers often had to be asked how the firm was performing against contract. Next, vendor price reductions were established as a key driver, however, until proper reporting was established it would be difficult to monitor the level of savings being achieved. The firm was equally concerned with transaction efficiency, namely reducing cost of purchase order transactions. Finally, the firm identified the need to improve prompt payment to suppliers where the performance was unacceptable. This in turn had led to poor relations with some suppliers and affected contract negotiations.

In effect, the approach was that e-procurement should support a wider transformation programme within the procurement function. The HO central team would be reduced by over 50 per cent, with transactional buying being de-centralised and the central team focusing on strategic activities. This approach led to the presentation of a financial business case, which had to be drafted in accordance with normal capital expenditure

rules. Costs of the project and benefits based on key drivers were established. Full details of the case cannot be revealed here, however, total costs in the implementation were established at circa €70 meter, including, for example: system/software purchases, back-office re-engineering, consultancy and training support, staff re-deployment and redundancy. Initial vendor price reductions and benefits were established at circa €100 meter, representing an estimated 2 per cent of global spend in all categories. However, this figure, produced by the e-procurement project team, was recognised as fairly speculative, given the poor legacy data. Interestingly, the senior procurement manager interviewed in this project added that this was not just about the savings – the firm wanted to demonstrate to the marketplace that it could show leadership in this technology and use it further as a public relations exercise.

Although subsequent outlays and financial benefits obtained remain confidential, it is clear the firm was able to rationalise a clear business case. However, there have been some problem areas which have affected the delivery of that original case. Echoing Firm A, one respondent in the firm admitted that they had underestimated the impact on people:

[...] there were a lot of people and structural changes, but as a change management project, this has probably failed; we have had to employ a communications person to put across the message effectively about what we want to achieve. Change never finishes in fact, it goes on forever with developing people.

This had made the transformation of staff roles and subsequent headcount savings more difficult than anticipated, leaving significant organisational cost savings unrealised. The firm was also involved in a head hunting exercise to try and identify the right people to work in the new highly computerised environment.

The impact on suppliers was still being assimilated and respondents advised the firm would probably have to scale back its intentions of automating all transactions globally. In some smaller markets, the cost of implementation of the buying system would outweigh the spend, let alone potential supplier price reductions. A further problem area was integration. The ambitious target to integrate across a range of external platforms had been problematic and although much was achieved, plans here were also retrenched. Lastly, the senior executive interviewed in this project admitted that they had set the wrong targets for savings, as legacy spend data had been poor.

### *Case C*

Company C is a manufacturer of chemicals used in industrial and agricultural markets, serving primarily the European and North American markets. The data from this case focuses on the European activities of the firm. Procurement exists as an HO function with some centralised personnel, although many of the procurement specialists are attached to individual business units located within markets.

The firm, at the time of the case research, had been undertaking its e-procurement programme for approximately four years and had advanced from trials with buying applications through to full-scale use of a range of mechanisms including auctions, RFX and sourcing tools. The main focus had been on the RTP cycle, using the buying tool in its ERP system. The firm had experimented with catalogues and supplier systems but today has its own buying application integrated with an independent industry marketplace which offers full transactional capability through access to supplier



catalogues hosted on its site. The buying tool was initially used to acquire indirect purchases but the firm later on to buy production materials through the system.

The over-arching rationale for the e-procurement project was lack of data on spend. The firm admitted that previously it had weak procurement information, providing very little data on which to act in improving spend management. This lack of information also led to poor visibility of supplier performance, institutionalised lack of compliance and unsatisfactory analysis and interpretation of the supply base and supply markets. The firm recognised it would be unable to leverage its buying power without supporting management reporting and simplified process. Based on pareto analysis, it had already established that there was a long “tail” of suppliers and there was a need to reduce supplier numbers through consolidation of purchasing in many categories. It was considered that e-procurement would improve visibility of spend and compliance to preferred suppliers, leading to a reduction in the supply base. All of these issues were therefore drivers for the project.

Further, there was a mandate to transform the role of procurement from what was seen internally as a support function advising on purchasing practice, to a strategic activity which could drive higher standards and improved productivity. Hence, the programme was seen as necessary to change the function’s role from transactional to policy making. To do this the procurement managers needed to be relieved of routine ordering tasks and empowered to direct current and future strategy.

The discussions with managers in the firm only focussed in this example on indirect materials rather than the full spend profile. A business case had been established for the areas of spend under their control. The basis of the case was a budgeted circa 10 per cent saving on the average annual indirect spend of US \$1.2 billion. As in Case B, this figure was highly speculative and was partly based on suggestions from e-procurement vendors. However, no budget had been fixed for the costs of implementing e-procurement. As in other examples, the company provided what it considered a fair estimate of savings from vendors through improved data, process and supplier management. This estimate was, however, frustrated by poor legacy management systems. As one of the managers interviewed stated:

There is a problem in measuring the difference between then and now. Because we did not have very good information before on how we were doing, we can’t see exactly how much we have improved.

Some of the observations made in Case A are relevant here, as there was an element of faith that the benefits and savings would be delivered through e-procurement. However, it can also be observed that the need for a change in process, structure and roles was driving the move to automation and that measurable savings were almost secondary to the transformation in procurement practice itself.

The problems encountered in this case show similarities to those in Cases A and B: re-training was more complex than anticipated; new staff had to be hired; a lengthy process was required to sell the changes to internal managers; poor information on past performance hindered progress. Additionally, the company identified the following concerns: buying systems not as user-friendly as commonly used sites, e.g. [www. amazon.com](http://www.amazon.com); need to replace software over time as functionality developed; reduction in supplier numbers not easy to achieve. Nevertheless, this firm had progressed to the

point where the transformations in roles had begun and there was now much more focus in the business on effective management of the supply base.

The table below summarises the stage of implementation for the different applications in each case firm (Table II).

## 5. Discussion

In this section, we present some thematic findings from the individual cases, which progress towards the development of a hierarchical model for the business case. It should be clarified here that this paper reports selectively on some of the findings in this project through specific research questions. The e-procurement implementation process is reported elsewhere although the paper does concern itself with the outcomes of implementation, through problem factors which arose from the project roll-out. The information obtained in the interviews was supported by various company information sources, which allow us to draw useful conclusions on the issues the firms faced during the phases of developing a case and ongoing use of the applications.

From the interviews with respondents the drivers were identified which applied across the three cases and these are presented in Table III. It was evident that the projects were primarily driven by legacy issues such as poor data and visibility of spend, targets to improve process, a need to improve compliance and the aim of raising levels of productivity within procurement operations. In reality, data were not available in the firms against which to calculate accurate savings targets and then to measure the benefits once projects were underway. Each of the cases reveals that the firms had difficulties in achieving expected levels of process improvement, adoption and/or integration. This demonstrates, as one respondent stated, a misunderstanding of what the technology could actually deliver. One can also derive from this that the early publicity and some of the literature on e-procurement have over-simplified the functionality and deliverables. It emerged that managers are tempted to see e-procurement as a panacea for their problems and to set unsubstantiated targets.

The change management issues have been explored in the case histories and it is apparent that despite the considerable evidence that change is a key success factor in any IT-related project, firms have still to understand the complexity of this requirement. Respondents in all three firms were concerned that their failure to implement change effectively put the project at risk as savings and benefits are postponed or fail to materialise. The cases reveal that delivering the benefits of

E-procurement tool	Case A	Case B	Case C
Buying/RTP application	Widely used Integrated to SAP	Main focus of e-procurement project Integrated to SAP	Widely used Integrated to ERP
Supplier catalogue sites	Used only where incentivised	Used for supplier controlled category	Minimal use Some punch-out
Electronic marketplaces	Not used	Used to access some larger suppliers	Used to aggregate spend with other buyers
Reverse auctions	Limited use for tactical spend	Limited use for "leverage" spend	Increasing use across segments
e-RFX	Widely used	Being introduced	Widely used

**Table II.**  
Stage of implementation of e-procurement in case firms



**Table III.**  
Drivers for e-procurement  
in the three cases

	Firm A	Firm B	Firm C
Optimise strategic sourcing policy	X		
Support spend savings targets	X		X
Establish common processes	X	X	X
Standard platform for managing procurement spend	X		
Knowledge sharing between business units	X		
Move procurement managers from transactional to strategic activities	X	X	X
Improving productivity of purchasing personnel	X		
Spend compliance	X	X	X
Visibility of global spend	X	X	X
Improved supplier management and selection	X		X
Integration with suppliers	X		X
Auditable spend management data		X	X
Achieve buying leverage		X	X
P.O. cost reduction	X	X	
Efficient payment and invoice settlement		X	X
Centralise control		X	
Reduce supplier numbers		X	X
Raise standards within procurement function			X

e-procurement is more problematic than any had expected. This may be due to the fact that we are dealing with a new phenomenon or that the technology is still fairly immature and subject to further refinement. However, it is evident that the business case put forward can be speculative and based on false assumptions of what will be achieved through such mechanisms.

Some further important observations relate to the scope of the business case and drivers identified here. First, there was little consideration of the impact on suppliers and their business. Indeed, suppliers were virtually treated as willing accomplices to these implementations. There is much evidence in the literature that suppliers need to be able to benefit from e-procurement adoption and failure to offer benefits will entail resistance to the mechanism (Yen and Ng, 2002; Bartels, 2004; Quayle, 2005). In two instances, the firms stated that they needed to use their major suppliers' e-procurement or ordering systems if they wanted to obtain the best terms. Second, there was no discussion in any of the firms of the wider supply chain implications of e-procurement adoption. It has been postulated that supply chain-related systems need to be evaluated in a wider, holistic sense and the business case which neglects the supply chain of trading partners (be it customers or suppliers), is inadequate as it ignores important process and productivity issues (Van Hoek, 2001; Smart, 2008). Third, there was no evidence of a total cost of ownership approach in the project. If suppliers incur costs through new technology adoption, total cost may be affected, unless there are corresponding improvements in process, operation cost or cycle time for that supplier. This issue was only considered in part by Firm B who at the early stages of adoption, paid for some of the suppliers' costs in developing catalogues and integrating to their platform. There is evidence, particularly in relation to reverse auctions, that unhappy suppliers will indulge in retaliatory pricing against buyers (Emiliani and Stec, 2005).

The full range of issues and problems encountered by each firm in the implementation and usage phases is summarised in Table IV. These were extrapolated

	Firm A	Firm B	Firm C	Business case for e-procurement
Unclear original business case	X		X	
Poor legacy systems and data	X	X	X	
Visibility on spend not solved	X			
Need to use suppliers' systems to get best deals	X		X	
Change management	X	X		
Training requirements	X	X		
Different accounting/reporting rules globally	X			
Misunderstanding of what the technology could deliver	X	X		
Finding new people with right skills		X	X	
Integration to external platforms		X		
Wrong targets set initially		X	X	
Re-defining task and roles	X	X		
Role of internal communications		X	X	
Not possible to add all suppliers		X		
Buying systems not user-friendly	X		X	
Software needs updating over time			X	
Reducing supplier numbers proved difficult			X	

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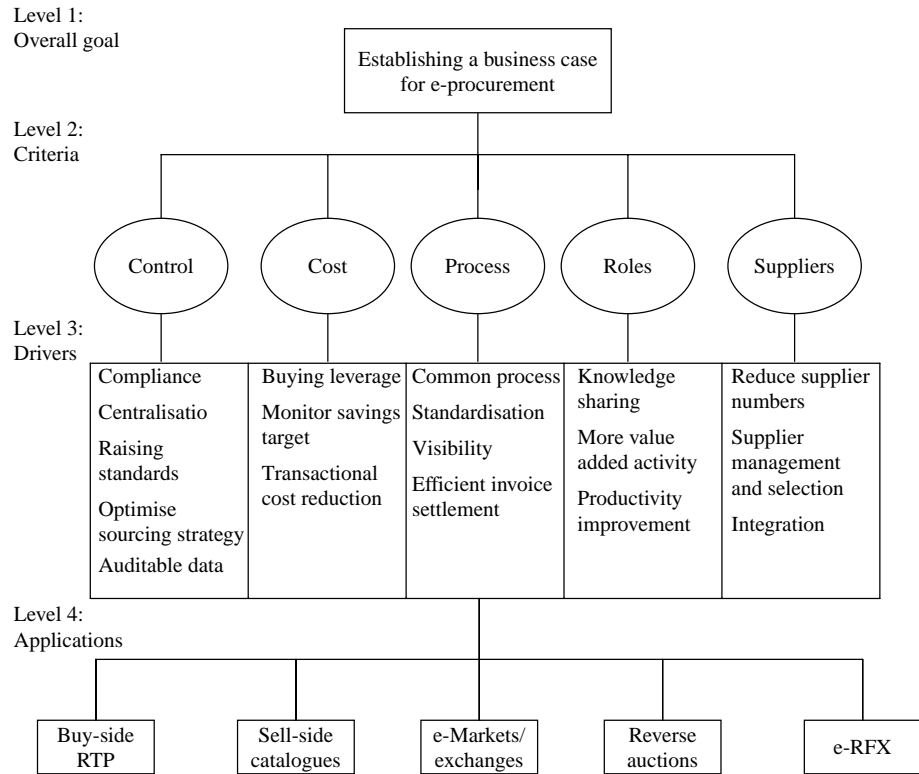
**Table IV.**  
Problem factors affecting the project implementation and development

from the interview transcripts and verified with the respondents in the final round of interviews and discussions, as undertaken for the variables in Table III.

It became clear from the interviews with respondents that the various e-procurement applications are used for very different purposes and logically have their own drivers. For example, firms making extensive use of reverse auctions are normally pursuing price reductions or exploiting excess capacity or competition in the supply market – this was evident in Case C. Use of suppliers' web sites was driven by the relative power in the relationships between buyer and seller. Firms A and C found themselves obliged to accommodate powerful suppliers in this way. In all three cases, the firms developed a high level case for investment in e-procurement, based on overall savings exceeding cost outlays. No evaluation was conducted on how much each application individually could contribute to those savings. From these examples, it derives that firms are justifying e-procurement in a generic sense and need a clearer understanding of what the individual components of e-procurement software can contribute, within an overall business case. This would allow for more accurate measuring of benefits subsequently, and to compare the contribution or value of alternative applications. The mechanisms address different business problems and it is necessary to understand which issues in purchasing management each is designed to improve. Hence, the hierarchical model introduced here offers a starting point for a case relating to the different e-procurement mechanisms, depending on the nature of the drivers in the individual firm.

## 6. Hierarchical framework

As illustrated in Table III, there were 18 different drivers identified across these three cases. The business context and internal managerial issues are likely to differ between firms, even in the same industry, yet the issues raised relate to a number of common criteria in e-procurement projects. Through discussions with the respondents, we were able to explore and categorise these drivers within the framework shown (Figure 2).



**Figure 2.**  
Hierarchical framework of  
drivers for e-procurement  
adoption

The concept of the multi-attribute hierarchy (MAH) was introduced by Min (1994) as a method of categorising variables and illustrating the relationships between them in a clear, structured format. The MAH is in turn based on multiple attribute utility theory (Green and Wind, 1973). Min (1994, p. 25) states “MAUT enables the decision maker to structure a complex problem in the form of a simple hierarchy and to subjectively evaluate a number of quantitative and qualitative factors”. The MAH model has been adapted more recently in a case on purchasing synergy within a multi-national organisation, to structure the decision-making process (Smart and Dudas, 2008).

The hierarchy introduced here contains a number of levels, as originally formulated by Min (1994). Level one of the hierarchy shows the primary goal, described as establishing a business case for e-procurement. The second level indicates the criteria into which the drivers, shown on level three, have been allocated. This was achieved by the following process. Initially, the list of drivers was created from the interview transcriptions and these were analysed in a mind map in order to create a set of logical categories. This initial draft was developed further through discussing the factors with respondents, which allowed through an iterative process for them to be classified under the relevant headings. Some of the drivers feasibly could be classified under more than one heading, however, we chose the most logical based on evidence from the cases and comments from respondents. This process also allowed verification of the drivers identified and elimination of any duplicates. The fourth level in the hierarchy shows

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the applications available within the e-procurement domain, which can deliver solutions to the drivers in the level above.

The principle of the hierarchy is that it provides a relevant framework for interpretation of the issues faced by firms when considering e-procurement adoption. It will help to identify components of a business case, based on empirically derived drivers, shown under key categories. This framework will assist firms in understanding these drivers for change in the procurement function and the respective criteria they address.

## 7. Conclusions

Most of the evidence on e-procurement, with the exception of e-auctions, has dealt with hypotheses or concepts derived from survey results. This paper has examined, through case examples, the issues faced in developing a business case and the factors during implementation and usage which support or refute that case. It is clear that even large multinational firms with significant resources are struggling to achieve the full extent of the benefits which e-procurement offers. We can conclude from the evidence reported here that the global and diversified nature of such firms is part of the problem – the lack of audited spend data, large numbers of personnel involved and range of legacy systems in use, all complicate the fulfilment of the original drivers for the project.

Only one of the three firms here developed a quantified business case for the project, including financial measures such as ROI and headcount reduction and this example was subsequently recognised as incomplete. The cases suggest that due to lack of empirical evidence of the success factors in achieving e-procurement, firms have taken a fairly speculative approach to the use of this technology. In effect, the temptations of visibility, compliance, integration and spend optimisation have outweighed the lack of hard evidence for the outlays involved. However, that is not to suggest that these projects have been a failure: all of the firms have gone some considerable way towards achieving the targets they established. What is clear is that there are numerous obstacles in such projects to achieving in full the potential benefits which e-procurement offers.

The theoretical model elaborated in this paper and expressed as a hierarchy offers a template whereby the drivers for e-procurement can be allocated into key categories: control, cost, process, roles and suppliers. Each of these categories impact upon the firm in different ways, are critical to success and each could be the basis for a different part of a business case. For example, the project could be divided into five segments represented by the categories, each with its own timetable, actions, allocation of personnel and supporting metrics. By identifying the relevant drivers as shown here in the hierarchy, firms can develop a business case which addresses their legacies and objectives, and which will guide them towards a more successful project outcome. It is apparent from these cases that insufficient time has been devoted to the issue of roles in particular; therefore training, communication and re-deployment of people within the resulting procurement structure, must be managed more effectively.

The problem factors identified in Table IV will assist firms to act upon potential show-stoppers, by comprehending the issues they will potentially face, from planning, through implementation, to adoption by users. We can conclude from the case evidence that e-procurement systems will not guarantee to solve the issue of poor legacy

management information. Firms need to undertake robust analysis of the tools and data capability of the applications they are adopting and a case based on a simplistic expectation of wiping clean the problems of the past is inadequate.

Establishing a case for IT investments of all kinds is problematic. Ward and Peppard (2005, p. 423) have stated that "it is often difficult to associate [IT] infrastructure investments with the subsequent benefits of using applications, even where sophisticated capital cost recovery accounting techniques are used". The firms investigated here had taken different approaches to justification and found that there were significant factors during or after the implementation which militated their case. This suggests firms still have much to learn about the realities of e-procurement adoption, hence case histories of the kind presented here are necessary in advancing understanding of the state of play in this emerging but important phenomenon within purchasing practice. The drivers and problem factors identified in this research, and the hierarchical framework for analysis are a step towards improving this understanding and can form the basis for further research with a wider sample of organisations.

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## **E-procurement and its impact on supply management – evidence from industrial case studies**

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Many buying firms have adopted e-procurement systems, yet the impact of these applications is still being assessed by both academics and practitioners alike. This paper examines the use of e-procurement within four multinational firms, to establish the impact of these mechanisms on their approach to the supply market, using thematic parameters derived from the literature. The results indicate that these firms established a clear supply market strategy based on a segmentation model: e-procurement tools were used as tactical means to implement and extend that strategy towards the supply base. In addition, it was observed that tactics within defined segments are developing, as buying firms use e-procurement tools both to reduce supplier numbers and to leverage their volumes in price-competitive markets. Various propositions are offered on the key themes, summarising the findings in the paper and providing further indications for research.

**Keywords:** e-procurement; purchasing; supply management; supply strategy; supplier segmentation

### **Introduction**

The e-commerce tools available to purchasing managers have developed at a rapid pace and through the universality of the world-wide web, new technology is becoming widely available at low cost, replacing earlier systems such as electronic data interchange (EDI). A range of applications, under the title of e-procurement, has been adopted by buying firms and the landscape for this technology has become increasingly complex, through the use of automated buying systems, electronic catalogues, e-marketplaces, market aggregators, online reverse auctions and supporting tools for supplier search and analysis.

This move towards more automation within the purchasing function has led to suggestions that relationships with suppliers and the supply market are destined to change, as technology provides the opportunity for different types of buyer–supplier interaction. Proposals from some of the early electronic marketplace operators such as Covisint and Transora suggested that not only transactional buying but also complex supply chain collaboration would be quickly moved to the web. However, some of these predictions have proven unfounded as, after 10 years of

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e-procurement applications, the impact of such technologies is still being evaluated, by both academics and practitioners alike.

The aim of this paper is to examine how users of e-procurement in buying firms have deployed these applications and how this deployment has impacted on their use of the supply market. Here 'supply markets' refers to separate segments of the external spend of buying firms, as identified through a segmentation model. The research approach is based on case studies of organisations who have implemented e-procurement and have experience of deployment of these applications for a minimum of two years. In investigating these buyers' projects, some key themes were used as parameters which were extrapolated from the literature. The paper describes the methods used in this research, discusses the findings from the cases and concludes with a number of propositions derived from the case results, which correspond to key themes from the literature on e-procurement.

## E-procurement, suppliers and supply markets

### Overview

Supplier relationship types have been one of the main themes in the purchasing literature. In recent years, the trend has been away from the traditional arms-length or transactional relationship which is focused on price, towards closer, co-operative interactions with fewer suppliers (Ellram 1991, Krause 1997, Cousins 1999, Burt *et al.* 2003). Suppliers are increasingly seen as vehicles to add value to the buying organisation and in some cases should be more closely integrated into the supply chain. Hence there has been a move towards collaborative supply chain solutions which use information sharing and joint planning to create joint benefits for buyer and supplier (Matthyssens and Van den Bulte 1994, Ellram and Edis 1996, Goffin *et al.* 1997). However, distinction is made between direct and indirect spend, where direct spend becomes the more strategic area of concern. Consequently, buyers operate a mix of relationships, according to defined criteria. The differentiated approach to spend categories through a segmentation matrix was originally proposed by Kraljic (1983) and developed by others (Bensaou 1999, Gelderman and van Weele 2002) and remains a core part of purchasing strategy. Table 1 summarises the differences in the two relationship modes, which have been extrapolated from the literature cited here.

In relation to e-procurement, Carr and Smeltzer (2002, p. 294) emphasise that 'the changing nature of buyer-supplier relationships, as the use of information technology becomes more important, has not been investigated'. Indeed, as a newly emerging phenomenon, e-procurement is only now being explored in depth and a growing body of literature is emerging, covering issues such as benefits and disadvantages, adoption, implementation, governance and costs (Croom 2000, Tatsis *et al.* 2006, Angeles and Nath 2007). The emphasis in this paper is on the impact of e-procurement

Table 1. Transactional and collaborative relationship types.

Features	Transactional	Collaborative
Timescale	Short term	Long term
Type of interaction	Transaction based	Relationship building
Relationship driver	Power	Added value
Focus	Price	Joint profit
Style	Contractual	Trust based
Planning	Separate	Shared
Attitude to gains	Win-lose	Win-win
Integration	Minimal	Extensive
Management commitment	Low	High

usage on supply management, which will be the focus of the literature review presented here. An analysis of relevant papers identified the following key themes.

### **Communication**

McIvor *et al.* (2003) state that the developing e-commerce technologies have a considerable impact on patterns of communication between supply chain members. Web technology can improve the communication flow in the supply chain as it facilitates information exchange between trading partners (McIvor and Humphreys 2004). Carr and Smeltzer (2002) found that interaction frequency increased as IT improved ease of communication. In a study of e-procurement in public sector organisations in the UK, Croom and Brandon-Jones (2007) found that increases in communication between customers and suppliers assisted knowledge sharing. Information provision in areas such as forecasts and inventory management can enable collaboration between buyers and suppliers (Puschmann and Alt 2005). Similarly, data exchanged on demand or raw materials flow can assist with coordination of production for both trading partners (Lancioni *et al.* 2003).

### **Integration**

In principle, increased levels of information exchange can lead to greater integration with suppliers (Garcia-Dastugue and Lambert 2003). McIvor and Humphreys (2004) report that web-based buying systems reduce the cost of integrating suppliers. A survey by Percy and Guinipero (2008) found that alternative e-procurement applications lead to quite differing levels of integration. On the other hand, in a survey of companies adopting e-procurement, Davila *et al.* (2003) found that there was actually little real integration with suppliers. Angeles and Nath (2007) found that system integration was one of the major challenges to successful e-procurement implementation. Incompatibility of systems may also be a barrier to close integration with suppliers (McIvor and Humphreys 2004). Smart (2008) found that the degree of integration between buyers and suppliers in three case study examples of e-procurement adoption was very limited. Finally, Cagliano *et al.* (2005) suggest that the tools used in e-procurement are not aimed at integrating inter-firm processes, but are designed for increasing purchasing efficiency.

### **Compliance**

One of the drivers for e-procurement adoption for buyers has been the need to improve compliance, such as compliance with the use of approved suppliers. Puschmann and Alt (2005) report that some companies will undertake bundling of spend in order to achieve improved terms and maintain adherence to contracts. The problem of non-compliance is also referred to as the need to eliminate 'maverick' spending – Corini (2000) refers to a report by Deloitte Consulting in which controlling maverick spending was cited as a principal benefit of e-procurement. Angeles and Nath (2007) found that implementing an e-procurement system did not necessarily eliminate the problem of maverick buying. However this maverick spend, if not addressed, will reduce the bargaining power of buyers (de Boer *et al.* 2002). In a case study on e-procurement use in GlaxoSmithKline, Kulp *et al.* (2006) disclose that the company had been losing 20–30 cents on every dollar which was not compliant with contracts.

### **Price**

Compliance is closely linked to price as it enforces negotiated pricing levels, and price reductions from suppliers are one of the principal targets in adoption of e-procurement systems. In a study of

Australian organisations, Williams and Hardy (2007) identified that the most important factor for buyers in e-procurement adoption was reduction of prices. The study by Tanner *et al.* (2008) found that in e-procurement adoption, reduction in purchasing price was the highest priority among 12 cited goals for e-procurement. de Boer *et al.* (2002) built a model to illustrate how different e-procurement mechanisms impact on prices. Ellram and Zsidisin (2002) suggest that firms can use IT applications in purchasing to understand total cost of ownership and to support target costing initiatives. Several studies of reverse auctions in particular have indicated that price reductions can be expected from suppliers, subject to factors such as commodity, competition and supplier numbers (Emiliani 2000, Smart and Harrison 2003, Carter *et al.* 2004).

### ***Supplier numbers***

There has been a long-term trend in buying organisations towards reducing supplier numbers, often through centralisation programmes or bundling of spend, where for example, Narasimhan and Das (2001) suggest that consolidation of purchases leads to greater leverage or buying power. The study by Davila *et al.* (2003) revealed a reduction in the number of suppliers used by e-procurement adopters, and the authors noted that this could eventually push some suppliers out of the market. Similarly, reduced search costs through web technology may lead to higher competition in supply markets, creating more leverage for buyers (Croom and Brandon-Jones 2007). It is suggested by Corini (2000) that buyers should reduce supplier numbers first, before embarking on an e-procurement project, as this reduces implementation cost and effort. One of the key drivers reported in a number of studies of e-procurement implementation has been the opportunity to reduce supplier numbers and create spend leverage (Min and Galle 2001, Angeles and Nath 2007, Smart 2008). Quayle (2005) points out that if the supply base reduces with e-procurement use, then SME suppliers will be faced with meeting international standards which may lead to deficiencies in, and risks for, the supply chain.

### ***Supplier resistance***

A study by Yen and Ng (2002) reported that there is some resistance to e-procurement from suppliers who may not achieve benefits from the cost of development and process change involved in adoption of buyers' systems. Bartels (2004) suggests that getting suppliers to fully participate in and adopt e-procurement technologies is a major issue in implementation. Similarly, Quayle (2005) reports that suppliers can be a barrier to implementation, if they are either unwilling to take part or are unclear of what is required of them. He suggests that supplier buy-in can be obtained through running pilot projects and seeking their input to the process, making them feel part of the decision-making. A study by Deeter-Schmelz *et al.* (2001) equally found that suppliers can play a critical role in the adoption success of web-based purchasing systems. Supplier cooperation can be key to the success of e-procurement projects as they must also be willing to supply catalogue information (Davila *et al.* 2003). This is supported by Corini (2000) who suggests that lack of supplier catalogues or electronic content is a major hurdle to success. However, suppliers with a dominant market position may be able to force buyers to adopt their sell-side systems, as opposed to using buyer-controlled applications (Smart 2008).

### ***Relationships***

In this section, we focus on the buying firm perspective of supplier relationships. The evidence on supplier relationships within e-procurement usage is, so far, rather mixed. Carr and Smeltzer (2002) suggest that where it is mediated by technology, the buyer-supplier interface is likely

to change. In particular, where technology is used for routine purchases, although information exchange increases, personal contact and interaction reduces. Croom (2001) suggests that increased use of e-procurement creates more effective buyer–supplier relationships. Similarly, it is proposed that e-procurement is likely to enhance rather than damage supplier relationships and one study revealed that it reinforces hierarchical relations rather than market-based ones (Croom and Brandon-Jones 2007). This finding was repeated by White *et al.* (2004) who found that use of electronic marketplaces led to closer relationships with fewer suppliers. At the same time however, e-procurement systems lead to greater transparency in pricing and process and while this is a benefit to buyers, it may disadvantage suppliers as more perfect market information becomes available (Barratt and Rosdahl 2002). Interestingly, Carr and Smeltzer (2002) found that technologies had limited utility when deployed in more complex relationships. This can be explained by the fact that strategic relationships depend more on close liaison and interaction between the contracting parties, where there will be high levels of mutual dependency (Cox 2001).

In the study by Carr and Smeltzer (2002), the use of information technology in supply chains did not necessarily increase trust, however Croom and Brandon-Jones (2007) found that e-procurement transactions were more likely with suppliers who were well known and trusted by the buying firm. Conversely, Tucker and Jones (2000) suggest that relationships facilitated by web technology are more likely to be adversarial and characterised by lack of trust. According to McIvor *et al.* (2003), the use of technology in purchasing allows buyers to spend less time on transactions and thus to focus more on value-related activities, including building relationships. They also suggest that successful IT implementations require collaboration between buyers and their suppliers. Nagle *et al.* (2006) differentiate between adversarial and collaborative relationships and propose that these two behavioural modes have different impacts on the use of e-procurement systems. These furthermore have an impact on the levels of integration which are possible between buyer and supplier.

The literature on reverse auctions addresses the buyer–supplier interface more specifically and this is where much of the discussion of the impact on relationships takes place. One viewpoint suggests that reverse auctions are damaging in a number of ways as they drive down prices to unsustainable levels, coerce suppliers into contracts, defeat benefits obtained through longer term collaborative efforts and can destroy relationships with suppliers which have sometimes been built up over many years (Emiliani and Stec 2002, Giampietro and Emiliani 2007). There is also evidence of retaliatory pricing by suppliers and refusal to do business with some buyers, after auctions have taken place (Emiliani and Stec 2005). Conversely, it has been suggested that auctions create a more level playing field, allow visibility of pricing for suppliers, reduce sales costs and improve the overall transaction process and time, providing benefits for suppliers as well as buyers (Smart and Harrison 2003, Carter *et al.* 2004, Wagner and Schwab 2004).

The key observations from this literature review are summarised in Table 2. The review has identified that the understanding of how e-procurement impacts on supply management and on interaction with suppliers is still at an emerging stage. This nascent level of development in the domain offers gaps in knowledge and has structured the formulation of a research agenda, as described in the following section.

The research project described in this paper had several objectives. The first of these was to understand how large firms are making use of the different e-procurement applications once they have undertaken a successful implementation. Evidence from the literature is thin on this issue as there is little case evidence of actual implementations, excepting reverse auctions. Hence more knowledge is required of where firms are going with this range of technologies. This led to the first research question:

*RQ1:* How are e-procurement applications being deployed by buyers?

Table 2. Key observations on themes identified from the literature.

Theme		Key observations from the literature		
Communication	Web technology improves communication flow in the supply chain (McIvor and Humphreys 2004)	Interaction frequency increases, as IT improves ease of communication (Carr and Smeltzer 2002)	Increase in communication between customers and suppliers assists knowledge sharing (Croom and Brandon-Jones 2007)	Information provision in areas such as forecasts and inventory management enables more collaboration between buyers and suppliers (Puschmann and Alt 2005)
Integration	Increased levels of information exchange can lead to greater integration with suppliers (Garcia-Dastugue and Lambert 2003).	Alternative e-procurement applications lead to differing levels of integration (Pearcy and Guinipero 2008)	Survey findings showed there was actually little real integration with suppliers (Davila <i>et al.</i> 2003)	Tools used in e-procurement are not aimed at integrating inter-firm processes, but are designed for increasing purchasing efficiency (Cagliano <i>et al.</i> 2005)
Compliance	One of the drivers for e-procurement adoption for buyers has been the need to improve compliance to approved suppliers (Puschmann and Alt 2005)	Controlling maverick spending, cited as a principal benefit of e-procurement (Corini 2000)	Implementing an e-procurement system does not necessarily eliminate the problem of maverick buying (Angeles and Nath 2007)	Lack of compliance if not addressed, reduces the bargaining power of buyers (de Boer <i>et al.</i> 2002)
Price	The most important factor for buyers in e-procurement adoption was reduction of prices (Williams and Hardy 2007)	Reduction in purchasing price was highest priority among 12 cited goals for e-procurement (Tanner <i>et al.</i> 2008)	Model to illustrate how different e-procurement mechanisms impact on prices (de Boer <i>et al.</i> 2002)	In reverse auctions, price reductions can be achieved, subject to factors such as commodity, competition and supplier numbers (Emiliani 2000, Smart and Harrison 2003, Carter <i>et al.</i> 2004)
Supplier numbers	Reduction in the number of suppliers used by e-procurement adopters could eventually push some suppliers out of the market (Davila <i>et al.</i> 2003)	Reduced search costs through web technology may lead to higher competition in supply markets, creating more leverage for buyers over supplier numbers (Croom and Brandon-Jones 2007)	Buyers should reduce supplier numbers first, before embarking on an e-procurement project, as this reduces implementation cost and effort (Corini 2000)	One of the key drivers for e-procurement adoption has been the opportunity to reduce suppliers numbers and create spend leverage (Min and Galle 2001, Angeles and Nath 2007, Smart 2008)
Supplier resistance	Some resistance to e-procurement from suppliers who may not achieve benefits from the cost of development and process change (Yen and Ng 2002)	Getting suppliers to fully participate in and adopt e-procurement technologies is a major issue in implementation (Bartels 2004)	Suppliers can be a barrier to implementation, if they are either unwilling to take part or are unclear of what is required of them (Quayle 2005)	Supplier co-operation can be key to the success of e-procurement projects as they must be willing to supply catalogue information (Davila <i>et al.</i> 2003)
Relationships	Where it is mediated by technology, the buyer-supplier interface is likely to change (Carr and Smeltzer 2002)	Increased use of e-procurement creates more effective buyer-supplier relationships (Croom 2001)	E-procurement is likely to enhance rather than damage supplier relationships as it reinforces hierarchical relations rather than market-based ones (Croom and Brandon-Jones 2007)	Use of electronic marketplaces leads to closer relationships with fewer suppliers (White <i>et al.</i> 2004)
	The use of information technology in supply chains does not necessarily increase trust (Carr and Smeltzer 2002)	E-procurement transactions more likely with suppliers who are well known and trusted by the buying firm (Croom and Brandon-Jones 2007)	Relationships facilitated by web technology are more likely to be adversarial and characterised by lack of trust (Tucker and Jones 2000)	Adversarial and collaborative relationship modes have different impacts on the use of e-procurement systems (Nagle <i>et al.</i> 2006)

The second aim was to understand the way in which use of such technology affects buyers' relationships with suppliers. The literature published to date offers conflicting evidence on this issue (Table 2) but it is apparent that supplier interactions are a key concern in the studies reviewed above. Hence the second research question:

*RQ2: What impact does this deployment have on supplier interaction?*

Thirdly, a clear gap exists concerning the nature of the relationship between e-procurement and procurement strategy. This issue is barely approached in the literature and an understanding is required of the cause and effect relationship between these two factors. Therefore the third research question is:

*RQ3: What is the relationship between e-procurement use and supply market strategy?*

## Research method

The area of investigation in this paper is the impact of buying firms' e-procurement systems on supply management. As seen in the literature review section, suggestions are made that supplier numbers are likely to reduce, that prices will be impacted, and that integration and relationships with buyers will be affected. However the evidence is contradictory and still at an early stage of development. Based on their case study analysis of IT and procurement processes, Carr and Smeltzer (2002) have suggested that much more research is needed to properly understand the relationship between the deployment of information technology and buyer-supplier relationships. E-procurement is still an emerging mechanism and methods such as case studies and in-depth interviewing are appropriate when investigating the early stages of an organisational phenomenon (Eisenhardt 1989). This requires an exploratory approach, which is likely to be inductive in nature while propositions and hypotheses are still being developed around the true impact of e-procurement tools (Yin 2002).

The subject area needs detailed exploration – a standardised scoring approach would risk oversimplifying issues such as the complexity of managing supplier relationships, the use of segmented approaches, the role of individuals in the buyer-supplier interface and the changing face of practice as firms learn from their experiences. While survey methods offer useful generalisations they usually cannot offer detailed, specific insights into firms' strategy or decision-making. The approach in this research was to use a number of industrial case studies to explore the realities of e-procurement usage as there have been a growing number of articles using surveys and questionnaires, but to date, case histories and illustrations of real-life projects are still few in number.

Equally, cases allow us to compare and contrast between examples and to illustrate at a more detailed level, the impact of firms' decisions and strategies. At this point in the evolution of knowledge on e-procurement, case examples can provide a statement of what has been implemented, demonstrate its impact and suggest reference points for firms who are undertaking similar projects. In this sense, the paper seeks to advance academic knowledge in the domain, but also to provide valuable lessons for practitioners. To achieve this, it is important to be able to evaluate the experiences of managers involved in using these technologies.

The cases were identified through access the author developed while conducting research in a related area. These contacts led to knowledge of a wider range of firms who were involved in e-procurement implementation. The selection of firms for this study was based on an approach developed in a similar vein of research by Tatsis *et al.* (2006) who analysed e-procurement within Greek industrial firms. Their study used four cases as a basis for analysis and cross-case comparison. In this study, four large multinationals were selected from the original list of firms identified, as previous studies have suggested that firm size is one of the determinants of adoption

of e-commerce technologies (Joo and Kim 2004, Zheng *et al.* 2004). Another criterion for selection was their level of maturity in e-commerce. All four companies chosen were at least two years into their e-procurement projects, as this would allow an exploration of a range of advanced issues concerning strategy, adoption, successes/failures and relationships. The firms who agreed to participate offered extensive access as they were aware that in sharing their experiences they would also obtain insight into the efforts of other firms. The firms are all large corporations with centralised procurement functions serving a distributed range of users and with similar levels of complexity within their purchasing. However in return for supplying detailed information on their strategy and performance, it was agreed that their identities would be kept confidential, hence company names are not mentioned here.

Initially, access was given to senior executives and subsequent interviews were conducted with managers involved directly in the e-procurement implementations. Interviews were conducted using the funnelling approach, starting with more general questions and moving to specifics on strategy, applications deployed, supplier issues, relationships, problems experienced and so forth. The content for these questions was heavily informed by the literature review and the seven themes identified there formed part of the discussion agenda. Open-style question structure was used to enable respondents to discuss relevant and contextual details, which mirrored their experiences during these projects. A coding system was used based on key findings and themes from the literature, and relevant to the research questions for the project. The interviews were transcribed and individual case histories were created, followed by comparing and contrasting the case details. Further data were supplied from company records, training materials and reporting systems, to help in validating the answers given in interviews. Each case is reported in the next section, followed by extrapolation of findings across the cases.

## Case findings

A number of different e-procurement mechanisms are discussed in relation to the case studies detailed in this paper, and these are described in Table 3 below.

### *Case 1 – consumer product firm*

The first case study firm is a large manufacturing business operating from a UK head office (HO), with global markets for its products. A central procurement team is based in the HO, but much of the spend has been managed within local business units (BUs). The firm aimed to achieve closer control over this global spend through e-procurement adoption. The focus was primarily on an automated buying system, operating in SAP, although e-RFX tools were utilised, with auctions only applying for a limited amount of tactical spend.

The firm at first did not see the introduction of e-procurement primarily as a means to manage suppliers, but rather as a mechanism to control processes within the purchasing function, and to gain better visibility and compliance in relation to its total spend. This was particularly important as re-design of the supply chain would result in some categories being sourced in greater quantities from external suppliers, rather than from internal capabilities.

Issues relating to supply management were identified as follows:

- The balance of power in some supply markets affects what the firm can control or enforce, therefore they cannot coerce all suppliers to receive orders through their SAP buying tool.
- Some large suppliers incentivise them to buy through their own catalogue systems.
- Better information leads to the ability to aggregate spend in a global business so they will use leverage tactics where feasible.



Table 3. E-procurement applications investigated in this research.

Application	Features
Buying/requisition to pay (RTP) applications (buy-side e-procurement)	An application hosted by the buying firm to allow users to search for products, place and track orders, receive and pay for purchases. Uses catalogues provided by suppliers or draws product data from supplier sites through punch-out (retrieving data from supplier web sites). Automates the RTP cycle, covering placement of order, delivery through to payment of supplier
Supplier catalogue sites (sell-side e-procurement)	Web sites hosted by an individual firm which displays its product range in an electronic catalogue. Allows customers to order online, usually using point and click system, linked to shopping basket, check-out, etc. Designed by suppliers as an e-commerce channel to market
Electronic marketplaces (many-to-many e-procurement)	Web portals which offer an online store for buyers and suppliers to conduct transactions. Suppliers offer content, allowing buyers to browse in multiple catalogues on one site. Marketplaces may be 'horizontal' in offering a wide range of products such as office supplies, or 'vertical', related to a specific industry or sector
Reverse auctions (buyer-controlled online tenders)	Online, real-time bidding events where buyers offer a contract to specified suppliers, who make reducing bids in order to gain the business. The winner in principle is the lowest bidder, although a range of criteria may be used to award the contract. Terms and conditions for the event are specified by the buying firm
e-RFX (buyer analysis support)	A suite of applications which support buyer analysis of supply markets and suppliers. Includes search tools, supplier rating and scoring systems, bid analysis tools, and assessment techniques. Designed to improving decision-making and evaluation by buyers

- Due to the need for global or standardised catalogues for MRO (maintenance, repair and operating supplies), some suppliers were dropped.
- The strategy was to work towards reducing supplier numbers and e-procurement assisted this process.
- e-RFX tools were used to analyse supplier offers more systematically, to enable more structured decision-making on sourcing.
- Better audit tools enabled buyers to make more informed decisions about suppliers.
- Reverse auctions are only used for limited tactical purchases as there were mixed views in the firm about the role and suitability of auctions.
- It is not possible to simply impose e-procurement or e-auction mechanisms on the supply base – there is a need to negotiate with and engage suppliers as part of a process of change.

In this case, the firm used e-procurement as a means to support its existing goals within the function. The 'requisition to pay' (RTP) tool (Table 3) and e-RFX assisted in reducing supplier numbers through better information, although this was not a prime goal at the outset. The firm described its overall approach to e-procurement as part of 'optimised supplier management'. Despite its position as a prominent player in its sector and considerable buying power, the firm considers supply market structure very carefully and sees its supplier relationship management (SRM) approach as one of working closely with suppliers. Fundamentally, relations with core suppliers would not alter, but there would be fewer suppliers over time.

### *Case 2 – telecommunications firm*

Case firm 2 is a European telecoms business which managed its procurement from an HO team. The principal aim of the e-procurement project was to gain control over the spend which was distributed across many businesses world-wide. Despite a central unit which negotiated contracts

and ostensibly monitored performance, compliance was a concern as the firm did not have accurate data on its total external spend.

The introduction of e-procurement was designed to support a project of internal transformation of the purchasing function, supporting a move away from transactional tasks and allowing more value-adding activities. The main project focused on a buying system implementation (SAP/BPP), some integration into external web marketplaces and limited use of reverse auctions. Supply issues were identified as follows:

- Less focus on transactions by HO staff would allow more time for analysis leading to a more highly developed SRM programme, with emphasis on developing appropriate relationships with suppliers.
- This in turn would bring more clarity to tactical and strategic purchases, leading to potential change in supply segmentation.
- Purchases in tactical segments would be treated as lower priority and become more price-driven than previously.
- The various e-procurement mechanisms would be used within the standard segmentation model (risk/value matrix); price-driven auctions would be applied in the tactical segments more extensively.
- In future, key relationships in the strategic areas would be more about identifying opportunities and growing value.
- Supplier numbers would be reduced across the board through catalogue compliance.
- Once reliable data became available from the e-procurement system, spend leverage would be deployed to decrease prices from fewer suppliers.
- Use of auctions would increase once spend visibility was available.

The core focus in this example is on improving the productivity of the purchasing function. The firm was determined to move into development of its strategic and core supplier relationships which in the telecoms business are often with competitors. The impact on suppliers in the tactical segments would be more severe as there would be a more price-based approach, using spend leverage with a reduced supplier base. Here, e-procurement was used to support a strategy which altered the relationship with the firm's suppliers in the routine and leverage segments of the spend matrix.

### *Case 3 – energy firm*

The firm in this instance is an energy utility operating in Continental Europe. The business is an integrated power supplier serving clients in Northern Europe. Total external spend was estimated at slightly under 1 billion Euros. The e-procurement project had a similar purpose to that seen in case 2. The firm recruited a new head of procurement who aimed to re-engineer the purchasing function. In doing this the focus was primarily on process and in particular, improving compliance which was identified as a key problem.

The firm split the procurement cycle into strategic and transactional activities. The strategic part of the cycle dealt with sourcing, requests for proposals (RFPs) from suppliers and methods for creating transparency in the strategic sourcing activities. The transactional part dealt with the RTP cycle through the use of a buying tool and supplier catalogues, creating an audit of all spend. RFX tools were also used within the sourcing cycle to automate supplier responses to RFPs and evaluate supplier proposals. The key supply-related issues identified in the business were as follows:

- The benefits of e-RFX accrue to the buyer through reducing risk of errors and improved auditing – suppliers are unlikely to be impacted by this technology.

- Catalogues were used to control spend in the tactical segments, which will lead to more categories being commoditised, based on price-based purchasing.
- The firm was more prepared to replace or substitute in such categories, leading to changes in supply source as market prices move.
- Auctions were used sparingly as there was some concern about harming some supply markets and reducing profit; consequently they would only be used in highly price-competitive categories.
- Supplier numbers were reduced by enforcing compliance to catalogues.
- The strategy of reducing supplier numbers was supported by the e-procurement implementation, which provided accurate spend data.
- Sourcing and 'transactional' procurement were separated so that personnel could focus on areas of expertise; this would lead to buyers becoming more effective in dealing with suppliers.
- E-procurement was used to put into operation the strategy of pushing efficiency and productivity into the procurement function.

The approach in this firm can be summarised as improving supply and supplier management. The segmentation of spend would continue, with the tactical areas being more highly automated, supported by process tools such as e-RFX and SAP's buying system. This would result in more emphasis on the sourcing area where buyers can continue to rationalise supplier numbers, drive higher compliance and use e-procurement to then implement the policy. The impact here is that through freeing up time from transactional work, buyers would be able to spend more time on strategic activity, which would impact upon the profile and number of suppliers in the future.

#### ***Case 4 – chemicals firm***

The firm under investigation here is a UK-based chemicals business which specialises in products for industrial and agricultural markets, with world-wide customers. A central procurement unit establishes policy, with local buying teams responsible for undertaking spend. At the time of this investigation, the business had been involved in e-procurement for four years and had utilised buying applications, reverse auctions, RFX and sourcing tools. The main focus had been on automating the RTP cycle, through the buying application within the SAP suite.

The introduction of e-procurement had been driven by poor data on spend across the business. Without supporting management reporting and standard process, it would be unable to leverage its buying power and improve procurement performance. There was a second rationale in aiming to move procurement managers away from transactional and towards more strategic activities, enabling more emphasis on supplier development. The issues affecting suppliers were as follows:

- Catalogues were introduced for many categories, bringing visibility to pricing and allowing more consolidated buying between BUs.
- A chemicals industry marketplace (<http://www.hubwoo.com>) was used which facilitated aggregation of spend with other buying firms for items such as office supplies.
- E-procurement tools were used aggressively to manage the leverage and routine segments (Kraljic 1983) within the total spend, with more pressure put on price.
- Reverse auctions were used for the first time for commodity-type purchases such as pipe work.
- Auctions were also used to force existing suppliers into price discussions even where there was no firm intent to change source of supply.
- Improved data from e-procurement systems allowed bundling of spend between BUs and better price deals from fewer suppliers.
- Buying tools and e-RFX were used specifically for improved analysis of supplier offers, which supported spend reduction and phasing out of suppliers from the 'tail'.

- Relationships were changing with ‘consumables’ suppliers as these became more transactional or price-based, with old relationships not sustainable in some cases.
- For strategic purchases, e-procurement tools were seen as not relevant, except where purchase orders could be automated through the SAP buying system.

In summary, there were significant changes here in the way suppliers were managed and how the procurement function operated. As in case 3, buyers would be spending more time on strategic, rather than transactional functions. However the principal impact on suppliers relates to the more aggressive approach taken towards the low-risk spend, as defined in the procurement segmentation. Suppliers who had in the past enjoyed a stable relationship with the firm would find themselves in more price-based negotiations, including through e-auctions; catalogues hosted on the marketplace would open up price visibility to all BUs; supplier numbers would be reduced through aggregation of spend. In effect, the firm used e-procurement mechanisms to enforce a policy of driving down prices in low-risk segments.

## Discussion

The cases introduced here are limited in number but the case approach has the advantage of allowing the researcher to explore business impacts in detail. The cases indicate that there are some commonalities in the way e-procurement was introduced and deployed in these firms, but there are subtle variations in both the outcomes of e-procurement usage and the impact on the supply market. These issues are explored further in relation to the research questions.

### *RQ1. How are e-procurement applications being deployed by buyers?*

Table 3 summarises the role of the different mechanisms discussed in this paper. The summary in Table 4 indicates how each case firm is deploying e-procurement mechanisms. All four firms used the buying application within the SAP suite. Two of the firms had experimented with independent software but had abandoned this as integration with internal enterprise resource planning (ERP) systems such as SAP proved problematic. As discussed in much of the literature, buying systems which automate the RTP cycle offer clear benefits in reducing transaction cost, improving order cycle time, enabling compliance and providing accurate reporting on spend. These benefits were confirmed by the buying firms investigated here. Use of suppliers’ catalogue sites (sell-side applications) was limited. In this scenario, the buyer uses the suppliers’ website to place orders. This situation reflects the balance of power in the market and suppliers with dominant positions or operating in conditions of limited competition can avoid being coerced into buyers’ RTP applications, and the resulting problem of product commoditisation. In effect, only one of the firms was making significant use of this. However suppliers’ catalogues can also be accessed through ‘punch-out’ and the other three firms were making use of this technology (punch-out is a web technology employed in many RTP buying systems which allows the buyer to retrieve product data from the suppliers’ web site and deposit it into the buyer’s ordering system).

Use of marketplaces was also limited here, with only the chemicals industry firm utilising this for regular transactions. Many of the early marketplaces which grew in a ‘gold rush’ mentality in the early 2000s disappeared as it became clear their business model was not sustainable. Those which now exist offer a specific value proposition such as the opportunity to aggregate spend, or to access a wide range of suppliers, with minimum integration cost. Firm 4 used <http://www.hubwoo.com> for this specific purpose. Firm 2 had also experimented with marketplaces and had integrated its RTP system (through middleware) into one specific industry vertical site in order to gain access to one of its suppliers who was also a competitor – here the balance of power implied that

Table 4. Use of e-procurement applications in case study firms.

Application	Firm 1	Firm 2	Firm 3	Firm 4
Buying/RTP application	<ul style="list-style-type: none"> <li>Widely used</li> <li>SAP integration</li> </ul>	<ul style="list-style-type: none"> <li>Main focus of e-procurement project</li> <li>SAP integration</li> </ul>	<ul style="list-style-type: none"> <li>Main focus of e-procurement project</li> <li>SAP integration</li> </ul>	<ul style="list-style-type: none"> <li>Widely used</li> <li>SAP integration</li> </ul>
Supplier catalogue sites	<ul style="list-style-type: none"> <li>Use where incentivised</li> </ul>	<ul style="list-style-type: none"> <li>Used for supplier-controlled category</li> </ul>	<ul style="list-style-type: none"> <li>Minimal use</li> <li>Some punch-out</li> </ul>	<ul style="list-style-type: none"> <li>Minimal use</li> <li>Some punch-out</li> </ul>
Electronic marketplaces	<ul style="list-style-type: none"> <li>Not used</li> </ul>	<ul style="list-style-type: none"> <li>Used to access some larger suppliers</li> </ul>	<ul style="list-style-type: none"> <li>Not used</li> </ul>	<ul style="list-style-type: none"> <li>Used to aggregate spend with other buyers</li> </ul>
Reverse auctions	<ul style="list-style-type: none"> <li>Limited use for tactical spend</li> </ul>	<ul style="list-style-type: none"> <li>Limited use for leverage spend only</li> </ul>	<ul style="list-style-type: none"> <li>Limited use for tactical spend</li> </ul>	<ul style="list-style-type: none"> <li>Increasing use across segments</li> </ul>
e-RFX	<ul style="list-style-type: none"> <li>Widely used</li> </ul>	<ul style="list-style-type: none"> <li>Being introduced</li> </ul>	<ul style="list-style-type: none"> <li>Widely used</li> </ul>	<ul style="list-style-type: none"> <li>Widely used</li> </ul>

neither trading partner was in a position to exercise dominance in how the transaction should be undertaken and in this respect the online marketplace creates a 'neutral' platform in which firms can undertake transactions.

Reverse auctions were being used by three of the firms in a limited way and it was apparent from discussion with managers at several levels that some of the negative reporting about auctions, and experiences by their suppliers, had created a cautious attitude. However firm 4 had a different approach and was moving more categories into auctions, following some initial experiments with commodity-type products. Their tactic of using auctions to force existing suppliers to the negotiating table demonstrated a more aggressive approach to some lower risk categories. But the mechanism was also being used in other segments which had been dominated in the past by a few powerful suppliers.

All firms were making use of e-RFX applications which were seen to offer benefits such as improved search for suppliers, analysis of tender response, supplier evaluation and ranking and metrics for managing both suppliers and spend categories. These applications are less controversial for suppliers and are primarily focused on improving the decision-making and effectiveness of the procurement function. It was interesting how all the firms saw the extended use of these tools as supporting a policy of raising the productivity and skills of the personnel involved in procurement operations.

### ***RQ2. What impact does this deployment have on supplier interaction?***

In this section, we address the issues raised in the literature review, which were classified under seven themes (Table 2). Firstly, communication and integration with suppliers were not seen as critical issues. The evidence from these cases suggests that buyers will be transacting with a smaller supply base more regularly, where the e-procurement tools focus primarily on the routine and leverage segments of spend. Suppliers, where more strategic relationships are developed, will see more emphasis from buyers on value-based discussions and most managers interviewed suggested this would be the main impact in terms of communication. Integration with suppliers was barely an issue for the buyers in these cases. Suppliers provided catalogues for the RTP applications, or their websites were accessed via punch-out. None of the firms used e-procurement tools as a means to integrate in other areas, through information exchange relating to inventory, demand planning, etc. As demonstrated by Smart (2008), there is often little real attempt at integration of business processes in such situations. In fact there is a fundamental misunderstanding in much of the literature about the role of e-procurement, as its applications are not designed to support

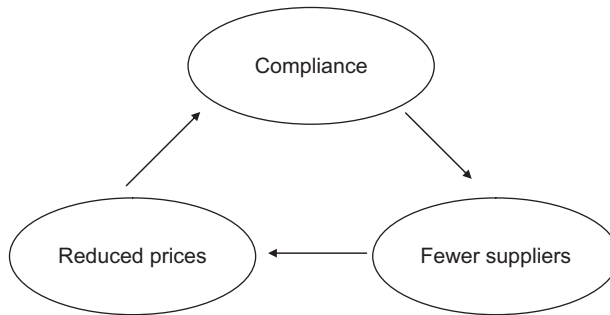


Figure 1. Virtuous circle between compliance, price and supplier numbers in e-procurement.

supply chain integration. This research confirms the statement by Cagliano *et al.* (2005, p. 1331) that ‘e-sourcing and e-procurement tools such as e-auctions, RFX applications, e-catalogues, etc. are aimed at increasing purchasing efficiency, rather than integrating inter-firm processes’.

The identified themes of compliance, price and supplier numbers were all found to be closely linked in these cases and tend to operate in a virtuous circle (Figure 1). For all the firms in the study, compliance with approved suppliers was a major driver for e-procurement adoption and in fact was identified by all the respondents as a key part of the business case. There was a suggestion from two of the firms that in the early days of web purchasing, when buyers were using suppliers’ catalogues sites, compliance actually worsened as it was much simpler for individuals to order using point and click technology, popularised by consumer sites such as [www.amazon.com](http://www.amazon.com). Compliance in turn builds trust, where the supplier can see that forecasts or guarantees given on spend volume are delivered by the customer. Furthermore, it creates leverage where spend categories are bundled and this was being practised by three of the firms, with widely distributed businesses which formerly exercised autonomy on how spend was allocated.

Price was clearly being affected in all four cases. Price improvements came from the higher volumes to approved suppliers and all of the firms had set targets for cost savings from suppliers, which formed part of the business justification for investment in the technology. Firm 1 took the most cautious approach to this as their policy was to ensure good supplier relations, however the firm also intended to reduce supplier numbers where practical. In firm 2, there was a clear intention to move towards harder negotiations on price once better data were available. Firm 3 had the biggest problem with compliance and so used the RTP system to achieve specific compliance goals. It was less concerned with supplier numbers but expected those to reduce as an effect of the compliance programme through cutting off the tail within the Pareto analysis. For firm 4, the approach to price was more aggressive. Compliance was expected from the system, with a specific intention to reduce supplier numbers and re-negotiate price levels with remaining suppliers. Auctions were also being used to support the reduction in existing prices. In effect, certain categories of spend were being pushed into the low-risk segments, increasing the risk of commoditisation for some suppliers.

Supplier resistance did not emerge here as a significant issue in the projects, although there were instances where suppliers had been initially unwilling to provide catalogues or content, but incentives were offered to overcome this (for instance case firm 2). Case firm 1 was quite concerned with maintaining relationships with some large suppliers established over a long duration and so used those suppliers’ systems. Case firm 4 had met supplier resistance to auctions but had decided it could afford to be more aggressive in their use as some supply markets were characterised by sufficient competition. This issue reflects the nature of the power balance between buyer and supplier and it is clear that where buyers do not have the stronger position vis-a-vis certain suppliers, they may choose, or be obliged to, adopt that supplier’s system. Where the supply

market is fragmented, highly competitive and not dominated by key suppliers, then buyers will be able to impose use of their buying applications. There are clear benefits for suppliers who drive adoption of their own systems, such as lower sales cost, automating of the transaction, integration to their own internal ERP systems and domination of the channel to market.

Perhaps the most important issue identified in the literature – relationships – is also the most complex to answer. It is evident that the buying firms examined here did not see their relationships as a function of the e-procurement application tools being used (although the jury is perhaps still to return a verdict on the impact of auctions). Indeed, the approach in all four firms was to establish a clear policy on the supply market through use of a risk/value segmentation, and to implement that policy with e-procurement tools as a supporting mechanism. The approach in all the firms was to differentiate between the transactional relationships, controlled through RTP and auctions, and the critical ones. All four firms aimed to move their key purchasing personnel away from transactions and towards more value-added activities. There was also evidence of some categories being moved into tactical segments to enable price reductions. The value-added focus involves more time spent on strategic spend and developing the relationship with the suppliers in that category. This was where the procurement function could add benefit to the organisation by identifying areas for bringing value into the business through more effective outsourcing and use of supplier expertise, technology or innovation. The firms would be focusing their SRM efforts into these issues. The e-procurement toolbox facilitates this step by automating many of the mundane activities of purchasing process.

### ***RQ3: What is the relationship between e-procurement use and supply market strategy?***

It can be seen from the analysis in the previous section that e-procurement tools are used in these firms to support and develop the strategic decisions taken in relation to supply market structure. The suite of e-procurement applications, which includes some not discussed in this paper, can be deployed in relation to specific activities and have different functions and purpose. It is important for both practitioners and academics to realise the differences in these applications as some commentators in both domains have not differentiated between them accurately. In this respect, we can posit that the e-procurement applications are tactical tools which need to be deployed for specific ends. Those ends are defined by the strategic framework of procurement, constructed through: alignment with corporate goals, spend analysis, segmentation of markets and decisions on additional issues such as balance of overseas to local sourcing. Ellram and Zsidisin (2002) suggest that buyer–supplier relationships strongly influence the use of IT. This article goes further, and postulates that relationship modes, defined within a strategic procurement framework, directly influence how e-procurement tools should be deployed by the buying firm.

Furthermore, it emerged that use of e-procurement or e-sourcing applications is in large part determined by the problem(s) the firm is facing. Deployment of such applications needs to be seen in context and understood in relation to several legacy issues, which have been explored above. All four cases showed similar approaches to procurement strategy development, however, the tactics used for e-procurement deployment varied according to the mixture of problems, nature of organisational and IT legacies, resources available and functional targets.

## **Conclusions and management implications**

Since the influential paper by Kraljic (1983), and subsequent progression of the concepts, procurement has emerged as a more strategic activity within firms and the components of a strategic approach such as supply market analysis and segmentation, among others, have been adopted

by many forward-thinking buying organisations. The firms in the cases discussed here have all developed strategic approaches to the role and contribution of the procurement function, largely based on the segmentation model. They were quite explicit that the approach to e-procurement use followed from their strategic intent. From this perspective it is evident that e-procurement is a tactical tool whose main purpose is to support the strategic goals of the function.

Although there was no clear evidence that e-procurement was influencing or changing strategy, tactics within spend segmentation are developing. For example, we saw firms pushing harder in routine and leverage segments via the use of supplier consolidation and reverse auctions. In this sense, organisations use e-procurement to drive through policies which will impact most effectively on the business – this could be either closer collaboration with fewer suppliers, price reductions in leverage spend, better decision-making through e-RFX or forcing suppliers to the negotiation table with auctions. In this respect, relationships with some suppliers may change, where a more rigid price-based policy is enforced for specific categories.

Consequently, there was no *de facto* impact on supply management and suppliers from applying e-procurement tools. So e-procurement does not influence relationships *per se*, it facilitates the implementation of a coherent supply strategy which determines the expected relationship mode. B2B interactions take place within a narrow social system, with prescribed rules of behaviour, defined roles and contractual/legal obligations. The impact of web technology will not be driven by the functionality of such applications, but by the way they are used. Problems such as poorly defined supply strategy or unclear supplier objectives will not be resolved through e-procurement. Auctions can be an example of where problems may occur – where applied inappropriately or the subject of poor decision-making by buyers, they may damage relationships or even future sources of supply. However, the same may be said of any technology or business solution, when the subject of a poorly specified implementation. Like all information technology, these are tools, and how we use them within the rules prescribed by the firm for their application will determine their usefulness. As Porter (2001) has elucidated, in determining the future of a business, strategy comes before the Internet.

The e-procurement phenomenon is still at an early stage of development and adoption, but this research has demonstrated that different tactical uses of e-procurement will have varying outcomes for both buyer and supplier, and those variations need to be better understood in order to interpret the longer-term impact of these mechanisms. The findings from this research allow

Table 5. Supplier-related issues in e-procurement: propositions from research.

Theme	Propositions from case study findings
Communication	P1: Communication volume between buyers and suppliers increases with e-procurement, but over time results in more contact with fewer suppliers
Integration	P2: Integration with suppliers is superficial and only encompasses the 'RTP' cycle: buyers do not use e-procurement systems to drive supply chain integration
Compliance	P3: Compliance is a major driver for e-procurement projects, as e-procurement tools improve compliance to contract and preferred suppliers, allowing buyers to aggregate spend
Price	P4: Successful e-procurement projects focus on creating spend leverage with a smaller supply base; however, reverse auctions are used as the principal mechanism to specifically drive price reduction
Supplier numbers	P5: Buying firms using e-procurement aim to reduce supplier numbers: e-procurement tools facilitate this objective while reducing transactional cost with those remaining
Supplier resistance	P6: Powerful suppliers can resist attempts by buyers to impose terms of e-procurement interaction and can drive buyers to adopt their catalogue or sell-side systems
Relationships	P7: Relationships are not driven by the technology type – they are determined by buyers' spend and segmentation strategies. Hence e-procurement tools are used as tactical mechanisms to support strategic procurement decision-making



us to offer various propositions as to the impact of e-procurement in relation to suppliers and supply management. These propositions are presented in Table 5, corresponding to the seven core literature themes identified in this paper, and offer an agenda for further research in this domain.

Finally, from a managerial perspective, an important factor is that the use of e-sourcing and e-procurement tools is allowing the procurement function to re-invent itself in some firms. With a move away from the transactional, processing activities of buying and ordering, procurement managers can begin to develop the more critical relationships within the supply base. All the firms in this study saw this development as one of the key outcomes of e-procurement utilisation and as a means to improve their function's productivity, effectiveness and potential for value creation within the business. In addition, managers should recognise that a transparent supply strategy needs to be developed in order to establish the type of interactions buyers will pursue with segments of the supply market, and as demonstrated here, e-procurement tools can be deployed to implement a coherent segmentation policy more effectively.

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