

Consumer-Driven Innovation Networks and E-business Management Systems

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Abstract

This paper examines the use of consumer-driven innovation networks within the UK food-retailing industry using qualitative interview-based research analysed within an economic framework. This perspective revealed that by exploiting information gathered directly from their customers at point-of-sale and data mining, supermarkets are able to identify consumer preferences and co-ordinate new product development via innovation networks. This has been made possible through their information control of the supply-chain established through the use of transparent inventory management systems. As a result, supermarkets' e-business systems have established new competitive processes in the UK food-processing and retailing industry and are an example of consumer-driven innovation networks. The informant-based qualitative approach also revealed that trust-based transacting relationships operated differently from those previously described in the literature.

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Introduction

This paper considers the impact of information and communication technologies (ICTs) on innovation within the UK food-processing and retailing industry.

In recent years, the UK's leading supermarket chains have successfully employed various elements of the e-business revolution to improve their services to customers. To date, however, the vaunted benefits expected to accrue from e-commerce (Hughes, 2002), in the shape of online shopping, have proved to be elusive. The leading exponent of this approach in the UK, Tesco plc, now holds 60 per cent of the UK Internet grocery provision market, with annual sales currently valued at £365 million (Tesco, 2002). While this amount is larger than the entire European market for online grocery sales (Key Note Report, 2002), it nevertheless represents only 1.7 per cent of Tesco's UK sales turnover. Rather, it has been through application of ICTs to other parts of their operations that the UK's supermarkets have been able to gain financial benefits and provide

enhanced services to their customers. Specifically, by exploiting information gathered directly from their customers via scanning technology, and through the use of inventory management software systems, the UK supermarkets have been able to benefit directly from a strategy of new product development. In pioneering these innovations, the UK's leading grocery retailers have created a web of inter-firm alliances and networks that have served to transform relationships within the industry's value system.

Knowledge about the requirements of customers can be a strategic asset (Stata, 1989) and the rhetoric of e-business places a strong emphasis on the competitive advantages that firms can gain in the digital economy from integrating this information into their business systems (Moorman *et al.*, 1992). Rowley (2002) reviews customer knowledge management that places the emphasis not on the information *per se*, but on the use of that information within organisations.

By focusing on the UK food industry this paper offers an example of a particularly consumer-driven sector in order to highlight how e-business systems have allowed supermarkets both to gather information, which is used to control the organisation of business, and to turn this information into knowledge which can be exploited in various contexts. This process has made its greatest impact on the vertical relationships within the industry, where retailers have used inventory management systems to gain an intimate knowledge of suppliers' routines and costs. Supermarkets have also refined their ability to exploit data-gathering systems both to reveal and to satisfy customer demand through their control of consumer information. The food industry is an archetypal multi-domestic industry with consumers having widely varying tastes both between and within nations (Wright *et al.*, 2001) and consumer-driven systems of innovation are especially effective in markets where consumer requirements are constantly changing, or highly segmented. Studies in the 1980s by Senker (1986, 1988) showed that the impetus for innovation in processed food was beginning to move from branded manufacturers to retailers and this shift has been quickened by the introduction of generic-ICTs (Cox *et al.*, 2002) and led to the creation of sub-industries such as the chilled-ready meals segment, which are outcomes of the changes made possible by e-business systems. This paper, therefore, focuses on this segment as a specific example of the impact of consumer-driven e-business systems in the UK grocery sector.

Methodological approach

This paper utilised an in-depth interview-based approach in order to understand the contemporary network relationships and the innovation process in the chilled ready-meals segments of the food-retailing sector. Building on a thorough grounding of secondary sources of information, we selected one of the value-chains in the industry centring on retailer A[I], a leading player in the chilled ready-meals market. The aim of this process was to derive in-depth information as to how relationships within the sector functioned, once we were familiar with the organisation of the sector from secondary sources. The empirical programme comprised carefully chosen key actors to act as high-level informants (rather than respondents answering only preformed questions (Osteraker, 2001)) who would be able to expand the frame of research beyond the structured component. The informants were willing to give frank tape-recorded interviews, as we had previously undertaken not to name companies or informants directly. The structured component was composed of several main questions (Rubin and Rubin, 1995, Ch. 7) and was included to ensure a degree of conformity between informants.

For the examination of the control of the supply-chain we interviewed the general manager, development consumer Europe and the development director Europe from logistics contractors

that we termed M and N, and the project manager for chilled and perishable goods in retailer A. We built a similarly detailed picture of the innovation network in the sector through interviews with retailer A's new product development section (principally the senior trading manager for fresh foods) and representatives of supplier firms and contractors. Wright (1996) has commented that, where statistical inference is not the intended outcome of a qualitative interview process, then a smaller sample can be more effective. This is especially relevant for obtaining information that is otherwise unpublished, concerns strategy in industrial markets or is complex as in innovation and new product development (Palmer, 2002). This approach is especially relevant in markets characterised by strong competitive forces, whereby information is closely guarded by firms (Crimp and Wright, 1995), a key feature of the sensitive grocery retailing industry especially with reference to own-brand and own-label goods. Interlocking testimony was used to verify information given across interview subjects, which was particularly successful in this case because of the nature of the career path within the industry (there was some overlap at times between actors simultaneously involved in both networks). The interviews had a built-in variety, as it was common for actors to have experience at different stages of the value chain, and for retailers, contractors and suppliers to have worked for other firms in the value-chain[2], whereby they had a view across companies in the sector (Lawrence, 1988). In this way, and by a brief examination of the retailer innovation network of another food retailer, designated as company E, the representative nature of the selected vertical chain was corroborated.

The analysis adopted a networks-based approach in order to conceptualise and analyse the operation of consumer-driven innovation within the supermarket sector, principally the economic network-theory approach developed by Casson (Casson, 1997; Casson and Cox, 1997), emphasising the centrality of information within an economic framework. This framework re-orientates the transactions cost paradigm developed most effectively by Williamson (1975, 1985), which has been important for the economic analysis of firms, but also is able to incorporate sociologically-based studies focusing on the relationships between specific actors, allowing for a more sophisticated understanding of network processes within and between firms (for a review see Ebers, 1997; Grandori and Soda, 1995; Grabher, 1993). The role of trust within these relationships is also considered in this interdisciplinary approach (Casson and Cox, 1997; see also Lane and Bachmann (1998) for a review of trust in network organisations). This approach allowed an understanding of how the nature of control and organisation had changed within the relationships examined, and has been employed in studies of long-term shifts in competitive advantage in the food-processing industry (Cox *et al.*, 2002).

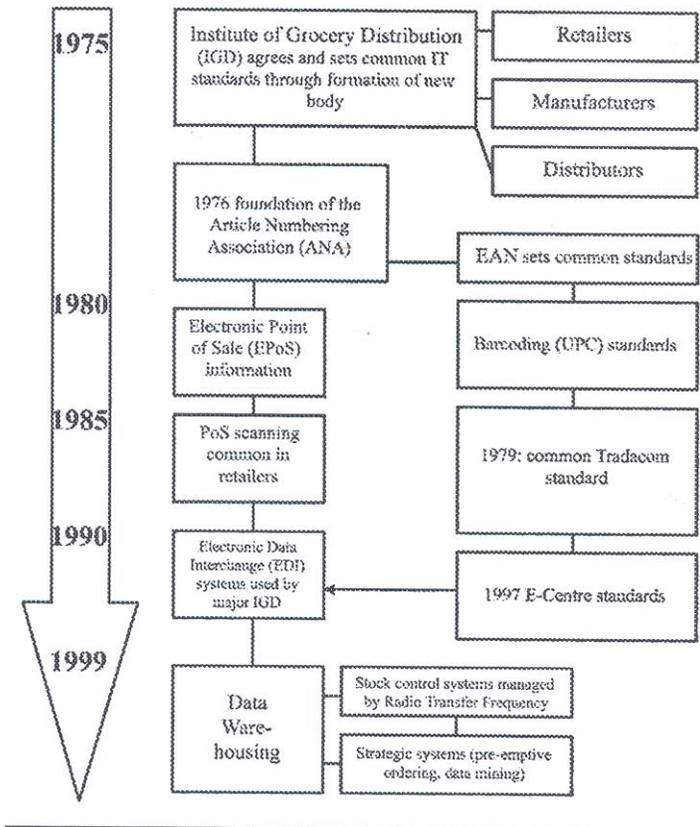
Consumer-driven innovation

The chilled ready-meals segment

The principal technologies discussed in this paper are related to those developed in conjunction with the universal product code (UPC), including scanning and the capture of consumer information at electronic point-of-sale (EPoS). Figure 1 gives an overview of the key developments in this area and shows the relative importance of the grocery sector in instigating and directing the technological path and standards. In conjunction with initiatives introduced in the 1990s, such as loyalty cards, supermarkets in particular have been increasingly able to assimilate information on purchasing patterns. Qualitative information through in-store activities and through marketing organisations has also helped develop knowledge of consumer trends and the increasing power and decreasing cost of computers since the mid-1990s have allowed supermarkets to invest heavily in data warehousing and mining facilities (see Dobbs *et al.* (2002), for a review of the increasing penetration of data warehousing in the UK). Information is

becoming ever more available to supermarket retailers, but success has come when they are able to leverage this into new products or services.

Figure 1 Development of IT systems in the food retail sector



The gradual adoption of EPOS replenishment systems in the early 1980s and scanning technology in the mid-1980s also allowed the supply chain to be managed in a more efficient way. Grocery retailers, constrained by the perishable nature of certain products, were at the forefront of the move from inventory-based systems to customer-driven systems (Macdonald, 1994). The ability to use EDI between organisations in real time is a key feature of being able to manage inter-firm systems of co-ordination (Hughes and Merton, 1996; Mason-Jones and Towill, 1998). This ability to manage the supply-chain allowed retailers to switch to customer demand-driven systems of replenishment (Smart, 1995; Winters, 1996; Fernie and Pierrel, 1996; Ody and Newman, 1991 (Figure 1).

The emergence of the chilled ready-meals segment within food retailing can be best understood in the context of two primary factors:

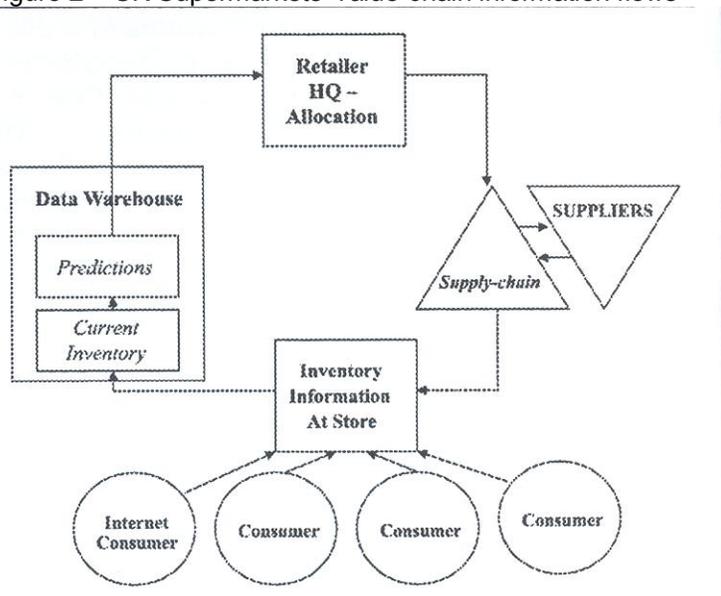
1. the adoption by food retailers of new ICTs;
- and
2. the system of relational contracting established by the clothing and foodstuffs retailer Marks & Spencer (M&S).

M&S was able to pioneer the chilled-ready meal product using organisational competencies in co-ordinating small suppliers, and these products have remained largely outside the control of the large, branded food manufacturers. Subsequently, the introduction and exploitation of e-business systems by mainstream grocery retailers also allowed them to enter this high-value niche market, through their provision of own-label and own-brand goods [3]. Chilled ready-meals are the prime example of retailers' ability to differentiate quality own-brands, and are high value-added premium convenience products, which have displayed consistently rapid growth from the 1990s to date. They are ready-prepared complete meals and are chilled, not frozen, for freshness. As the meals are highly perishable, and have a very limited shelf life, they require a sophisticated chill-chain which can deliver meals from manufacturer to point of retail in a few days in small batches.

The appeal of the sector lies not only in its convenience, but also as a substitute for takeaway and restaurant meals, and retailers therefore need to be able to offer their customers an expanding range of high quality products. Retailer A, for example, offered a total of 141 different chilled ready-meals in 2000, having introduced some 44 new products in 1999 alone. Retailers tend to source from a great number of suppliers in order to respond quickly to new restaurant trends with new recipes, exploiting the flexibility of small suppliers. Many of these small suppliers can only function through the co-ordination of the supermarkets' supply-chain system, as they are too small to have marketing or sales functions of their own. Maintaining a wide range of dishes is dependent on access to many specialist suppliers, as the production of ready-meals spans different product-bases (poultry, fish, meats, vegetables), market segments (healthy eating, luxury, etc.) and ethnic recipes (traditional British, Oriental, French, Italian, Thai, Tex-Mex). Each retailer sources from a core group of larger manufacturers and has many small suppliers: Northern Foods, for example, supplies about 30 per cent of M&S convenience foods and Hazlewood Foods produces 20 per cent of all chilled ready-meals but the total number of ready-meal suppliers is more than 180 firms.

Supermarkets' access to information allows them to exploit these data within different contexts. Figure 2 shows the supermarkets' control of information flows, linking the supply chain to the information about consumer demand derived ultimately from purchasing behaviour.

Figure 2 – UK Supermarkets' value-chain information flows

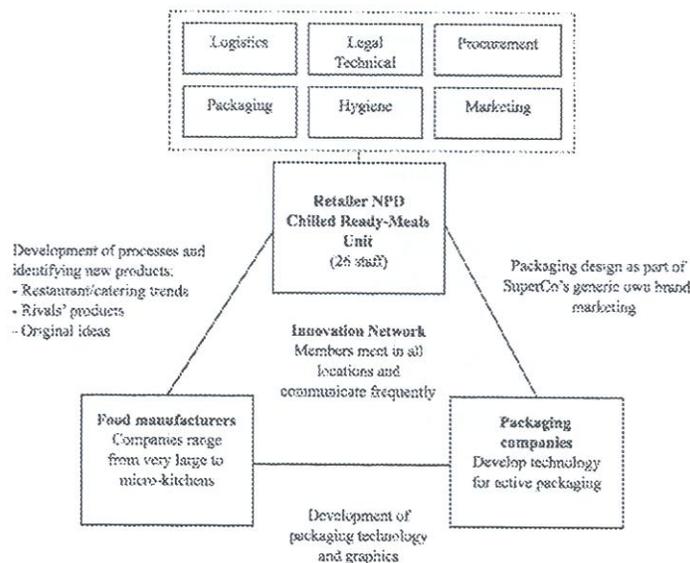


Supermarkets are able to exploit this control to co-ordinate the supply of short shelf life products such as chilled ready-meals and this is examined in later sections in more detail. This information control also puts retailers in the optimal position to gain marketing information directly from their intimate relationship with the customer through PoS monitoring, customer loyalty schemes exploited by data mining and their own market research. Retailers can also exploit this control by identifying new market niches, and fill them with new differentiated products as quickly as possible, and respond effectively to new eating trends. Retailers in the UK are able to coordinate the development of new products through internal hygiene and product development departments (Fernie, 1997; Hughes and Merton, 1996; Senker, 1986, 1988). From control of the information systems retailers are able to co-ordinate the innovation process.

Innovation through strategic alliances: retailer A's innovation network

The consumer information which retailer A collects is considered in conjunction with strategic alliance partners, whose activity is co-ordinated through the retailer's control of the supply-chain, which we consider in the next section. Retailer A is an example of a firm that has been able to exploit its proximity to the consumer to develop and supply new products, deriving knowledge about consumer trends through the innovation network, especially from expert sources of information and small specialist companies. Retailer A accepts that "many new product ideas come from our suppliers and we work very closely with some of the top chefs. . . so we follow those consumer trends which are very fashionable." The relationships engaged in this sector are best understood as inter-organisational networks, whereby manufacturers and packaging firms develop new products in conjunction with retailers. Figure 3 depicts the new product development network.

Figure 3 The innovation network



Retailer A claims to have "very long-term relationships with [its] suppliers". Trust within long-term relationships is critical (Lane and Bachmann, 1998), as retailer A has no capital stake in suppliers and there are few formal contracts between retailers and food suppliers in the chilled ready-meal sector but instead many strategic alliances based on mutual advantage. Relations essentially

take the form of a "gentleman's agreement" and this is made possible by the structure of the industry created by the innovation network itself. Retailer A uses many small suppliers to ensure it has access to a large variety of recipes, but relies on supplier Z for 50 per cent of its ready-meals by sales volume. As is typical with the larger suppliers in the sector, supplier Z has a dedicated factory for retailer A, guaranteeing confidentiality and exclusivity. This trust has enabled retailer A to move from business plans of typically three years to longer terms of five years, and implement joint investment plans. These plans range from non-contractually based agreements, in which retailer A agrees to "deliver a volume of business to a manufacturer for five years and the manufacturer invests in a dedicated factory", to arrangements to supply small firms with technical assistance in return for access to new recipes. For this process to be effective the retailer must ensure that its quality standards and processes are adopted and integrated with its packaging and, crucially, own-brand marketing strategy. Information needs to be passed between the partners in this network. The "relationships in this sector are different from when you are working with the big branded suppliers, as we work very closely with ready-meal suppliers and the confidences that we tell them we wouldn't do on the branded side". This is especially significant for small-scale suppliers where the retailer is their sole client. This series of very close relations binds the network firms into mutual dependencies. In the case of large manufacturers the relationship centres on negotiation over exclusivity agreements, the use and development of dedicated manufacturing centres, and the co-ordination of new hygiene technologies and processes, such as the development of specific packaging systems. Relations with smaller firms were characterised more by an exchange of hygiene technician staff to co-ordinate basic standards and to transfer technological information, especially information about production systems from manufacturers, from the retailer to small producers.

Managing consumer knowledge

Knowledge is developed and disseminated throughout the innovation network. The process of working in a network is itself important knowledge. Relations in the innovation network are "fluid and dynamic" within and between firms. Retailer A's chilled ready-meal NPD unit is part of the fresh foods division and incorporates buyers responsible for recipe development. The chilled ready-meals unit is headed by the senior trading manager for fresh foods and has a permanent team of 26 people that includes a product development team, working on recipe development with suppliers, and six buyers who are responsible for the day-to-day administrative, commercial side of the business. Staff based in the chilled ready meals unit, liaise with the food technicians in the hygiene department, logistics, marketing, procurement, legal/technical department and packaging technologists. This organisation is mirrored in suppliers. The chilled ready-meals NPD unit and their supplier counterparts spend around 50 per cent of their time in each other's firms or in other joint locations. "Some of the factories now are like large hotel kitchens, because it has become more and more specialised and the runs have become smaller" and in these cases the ongoing exchange of staff and knowledge for development and monitoring is especially important. This is of special importance in this segment, as the technical requirements of the packaging are so demanding. The NPD unit therefore co-ordinates between internal departments, external manufacturers and third-party packaging firms[4]. In the case of a micro-kitchen, retailer A supplies access to its packaging and food hygiene and production experts through the chilled ready-meals unit and "really do work very closely together".

Information control and knowledge in the supply-chain

Control over the supply-chain has enabled retailers to move to strategic ordering systems, as shown in Figure 1. This has enabled them to engage in the supply of short shelf-life products such as chilled ready-meals but also to change the nature of relationships with firms in the supply-chain. Retailers' control of the supply chain differs from the open-ended relational networks that they have established for innovation, and are characterised more by formal contractual arrangements. The radical changes that have occurred in the UK grocery supply-chain have been well documented, especially from the fields of logistics and supply chain management (Burt and Sparks, 1997; Fernie and Pierrel, 1996). By focusing on the economic relationships and drawing on our detailed interview-based research with retailer A's internal logistics department and external contractors, we were able to identify new processes at work. Under traditional subcontracting arrangements, the retailer devolves process and operations to a logistics subcontractor. Much of the economics-based literature on the management of the supply chain focuses on ownership of assets such as warehouses and the mix between internalisation and externalisation (Buck, 1990; Ross, 1997; Bourlakis, 1998). However, this approach underplays the changing nature of the modes of externalisation employed, as in this example the retailer seeks to resolve these problems by retaining ownership of the key assets and by controlling supplier processes and the co-ordination of information directly throughout the network via their control of the computer information system. In the following sections we will first examine the development of the supply-chain in the UK food retail industry, and following this we concentrate on examining how retailer A has used its control of the ICT systems to generate knowledge not only about the operation of the supply-chain but also about transforming business relationships to more open-ended long-term relationships.

From a warehouse-based to a replenishment-based supply chain

Grocery retailers' strategic ordering systems not only enable them to economise on warehousing costs, but also allow them to correlate demand and supply with unprecedented accuracy. The retailer J. Sainsbury pioneered the development of dedicated regional distribution centres (RDCs) in the 1970s as an intermediate stage in the distribution process. These RDCs operated on Sainsbury's behalf but were owned by one of the growing number of specialist distributors through a process of subcontracting. Transportation of products from the RDCs to the stores was then largely undertaken directly by Sainsbury's own fleet of vehicles (McKinnon, 1989).

By the 1990s, the RDC pattern had become established with UK food retailers, although they increasingly owned the RDCs, which they had either built themselves, or bought from contractors at the end of contract periods. In addition, retailers began to encourage the development of primary consolidation centres (PCCs) to which manufacturers were able to deliver increasingly small batch-driven loads, prior to their transfer to the RDCs. These allowed very small crate (rather than pallet) based deliveries to be made. Crates can accommodate partial boxes, ideal for the delivery of very short shelf-life low-volume, high value-added products such as ready-meals. Larger manufacturers can co-ordinate the collection of stock from small suppliers for delivery into the PCC. Therefore, as long as the retailers use their transparent electronic data interchange (EDI) and Internet-based supply chain systems to co-ordinate and control this process, they can manage the supply chain from beginning to end. Under this system of organisation, the RDCs no longer carry out a warehousing function, but consolidate goods for demand-driven direct delivery to retail outlets. The distribution and logistics structure, using both RDCs and PCCs, allows small manufacturers to join the supply chain efficiently, and for large manufacturers to supply products on demand, rather than by bulk-delivery.

The ability of retailers to monitor many transactions made possible by the development of computerised information management systems significantly lowers the information costs of monitoring. Retailers are able to cement the tacit components of this by direct involvement in the process (such as running their own vehicles and RDCs as benchmarking operations) and transform information on costs into knowledge. This also applies, as was observed in the innovation network, when retailers are directly involved in the process. Retailer A remarked therefore that, when knowledge of real costs and processes is shared between parties, co-operation is a more likely outcome, although this does change the nature of power between partners. The outcome of these changes in logistics and RDC management subcontracting is a move towards open book negotiation with retailers based on low management fees in conjunction with reward structures for efficiency improvements.

Retailer A: leveraging knowledge through supply-chain control

A close examination of retailer A's supply-chain illustrates the operation of the linkages within the control network. Retailer A's logistics department is formed by a director operating with a team of four senior managers. Retailer A's distribution network (in 2002) comprised 24 RDCs and 13 PCCs. The supply-chain is co-ordinated by retailer A's hardware and software systems. Retailer A's logistics manager commented that "If you go to (contractor O's) RDC, it's our hardware, even if they own the depot", explaining that this integration makes the supply-chain transparent to the retailer. "Unless you knew that RDC 2 was owned by us and RDC 12 was owned by (contractor N), you couldn't see the difference. . . you have the same information and the computer systems dictate the processes and methods of working. Throughout the supply-chain really you have our systems." The same condition applies in the case of physical distribution, where the contractors that operate retailer A's fleet own only 50 per cent of the RDC-to-store vehicles.

Logistics contractors explained that the transparency afforded to retailers both by the integration of their computer systems and the benchmarking provided by their own operations supplied them with a high-level of knowledge about true costs, contractor M relating that retailer A's "knowledge about costs is as great as ours. There is nothing hidden there from which we could extract margins". Consequently contractor M's management fee declined from 15 per cent to 10 per cent to 5 per cent to 2 per cent on each contract renewal. There was an accompanying change in emphasis in contractor's reward structures, moving from management fees based on fixed-volume freight rates to a system based on low management fees with an incentive structure for productivity gains. "Quite often it is the retailer's capital and the fee therefore becomes two-tier - a fixed fee and then a sum of money that is deliverable in addition, if service or costs are improved." This profoundly alters the nature of the relationship between retailer and contractor, and this can be observed in longer contract lengths – retailer A's contracts with contractor M having increased from two to five years. Within this longer-term relationship retailer A and its suppliers pool information on real incurred costs during negotiation in order to arrive at mutually acceptable distribution of costs and profits, with the retailer sometimes finding that contractor's actual costs were higher than its own predictions and adjusting rewards to account for this. As a result of this framework, the close relations enable retailer A to use fewer contractors in more trusted, mutually advantageous relationships. The detailed information about the negotiation and operation within these relationships revealed that the information transparency afforded by the supply-chain and management information systems allowed contracting parties to negotiate as if they were already in established trust-based relationships, and then to move towards a situation in which trust became engendered. This is in contrast with the literature, whereby trust is taken to be a precursor to open-transacting in networks (Casson, 1997, p. 122).

The PCC network allows very small firms to enter the market for chilled ready-meals, and is significantly different from the RDC network and less under the direct control of the retailer. The PCC network allows larger manufacturers to make smaller, more regular demand-driven deliveries to RDCs and smaller suppliers to make small and infrequent deliveries. The large and medium food manufacturers with their own distribution systems and small regional logistics companies are in the ideal position to collect small crate loads from suppliers and make consolidated deliveries into and from PCCs. This is only efficient if these small loads are consolidated for multiple retailers, so retailer A's logistics manager's "job is to go round and convince the suppliers that it is in their interest to become part of this network, because (contractor 0) is not going to a supplier and picking up just for us but for retailer C and retailer D as well". As in the innovation network, retailer A manages multiple relationships with suppliers and adds value by the central co-ordination made economically viable by e-business management systems.

Conclusion

It is clear that the increasing use of integrated generic ICT systems is having a profound impact on the organisation and activities of firms, in terms of both the scope of control that they have over the value-chain and the way in which they are able to build up detailed consumer information. The systems concerned here are generally generic supply-chain systems and data-processing systems, which were designed in order to manage the process of efficient inventory management and warehousing, eventually becoming more sophisticated and facilitating a move towards just-in-time systems and consumer demand prediction. In the example offered by the UK food-processing and retailing sector, supermarkets have been able to control and co-ordinate activities through their control over the supply-chain and consumer information. The nature of the competitive process in this industry has thus been substantially modified by these systems, not so much by their introduction as by their subsequent application as drivers of both innovation and quality-based differentiation.

Significantly, the shift to ICT systems encompasses computer-mediated retail, where ordering can be made online and the supply chain extended to individual customers' houses. While home-delivery and Internet shopping are likely to play an increasingly important role in the development of shopping behaviour (Dennis *et al.*, 2002) in the grocery retail sector, however, the ultimate impact of this remains uncertain despite the high profile which has been afforded to these systems. In contrast it is apparent that the competitive structure of the industry has been changed due to the implementation of generic ICT systems. Initially, supply-chain management systems enabled supermarkets both to integrate new firms into the supply-chain, and to create competitive advantage through linkages with complementary firms in order to innovate new products. Even more significantly, grocery retailers have been able to integrate consumer demand information from consumers at point of sale into their information systems. Crucially, it is the ability to gather and analyse consumer buying patterns and trends through PoS data collection, loyalty card information, internet order histories and subsequent data mining which has driven both the shift to just-in-time ordering and stock control systems and the ability of retailers to target smaller target markets more accurately. This ability to reveal and satisfy consumer demand has ultimately enabled supermarkets to engage in the development and supply of new products using vertical network arrangements with supplier firms.

The qualitative approach examining these networks in operation reveals that the information management systems information transparency results allow the networks to operate in ways different from expectations from the literature. While the introduction of ICTs into the supply-chain has been examined in the logistics management literature, a qualitative approach was able to shed new light on the operation of the supply-chain in terms of the changing nature of the relationships between firms. Using this data in conjunction with an economic framework emphasising information gave context by which to interpret the relationships identified. Specifically in this example the creation of trust within transactions between logistics contractors and retailers appears to be an outcome of information sharing rather than a precursor. In other examples, however, information transparency has also allowed supermarkets to have much more power relative to suppliers and to focus on price-based relationships. The nature of power within these networks is one area where future research attention could be directed.

One major impact of the control of inventory management systems through the supply-chain has been to extend the reach of supermarket chains through the distribution process and has enabled them to exert a significant degree of control over the strategies of food producers and manufacturers as well. Coupled with the major UK multiples' ever-increasing share of the grocery retail market and proximity to the consumer, supermarkets appear to be increasing their power over the food retail and manufacturing sector including the perceived ability to charge excess prices. This perception resulted in the Office of Fair Trading launching an investigation into the activities of supermarkets by the Competition Commission (2002). A critical finding of the Commission's report, completed in 2002, was the acceptance of the growing importance in the food processing and retailing industry of efficient consumer response (ECR). This involves both supply management, through continuous replenishment and automated store ordering, and demand management in which retailers and suppliers jointly manage product categories. Both of these activities are based on the use of information systems of the kind discussed in this paper (Competition Commission, 2002, pp. 241-3). The shift made possible by the detailed consumer information gathered by supermarkets is therefore enabling them not only to exert greater power over other actors in the value-chain in order to drive their costs down, but also to charge premium prices to targeted consumers through the supply of high margin goods.

In conclusion, the ability of firms to collect and then effectively exploit consumer information about demand and preferences is becoming a key aspect of competitive advantage. For firms in consumer-driven sectors such as retailing the control of this information has also strengthened their position within the industry, and enabled them to extend the number of suppliers within the industry's value-chain through the use of networks in order to meet customer demand for new products. The control of the information systems needed to co-ordinate inventory and the movement of goods through the supply chain has also enabled the firms to initially collect consumer information and to leverage this information by combining consumer information with the ability for highly co-ordinated product supply. The convergence of discrete systems into an overarching system creating an information network controlled by supermarket retailers from final consumers to food manufacturers could be considered an e-business system that has in this instance created a new competitive structure. As Palmer (2002) has recently argued, it is the successful integration of different elements of ICTs into novel systems of operation, qualitatively distinct from previous forms of activity in the sector, which constitutes the essence of the e-business revolution.

Notes

1. Because of the sensitive nature of competition and inter-firm relationships in the industry, we are not able to reveal the names of the companies and individuals who helped with this study.
2. For example, one of two managers interviewed at contractor A had worked in a similar role for both retailer C and supplier B, and retailer A's logistics manager had worked previously for retailer C.
3. While own-label products are lower-price alternatives to those of branded manufacturers (Burt and Sparks, 1997), own-brand goods are innovative products developed by the retailer (Ferne and Pierre!, 1996).
4. In the case of larger manufacturers packaging is managed specifically for each customer, and often through third-party specialist firms as well. Where large manufacturers do produce packaging, this is in close development with the retailer's hygiene, marketing, procurement and packaging departments through the chilled ready-meal NPD unit.

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