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New Product Development and Product Supply Within a Network Setting

The Case of the Chilled Ready-Meal Industry in the UK

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Abstract

This paper analyses inter-organizational networks that link together firms operating in the food processing and distribution industry in the UK. In doing so, the paper draws on insights recently developed by Mark Casson that treat inter-firm networks as an institutional response to the changing costs and opportunities of information management. Detailed analysis of product innovation and supply chain management issues within the industry, exemplified by the growth of chilled ready-meals, leads to the identification of two distinct but complementary inter-firm networks: a network of control and a network of innovation. In each case, the study finds that the critical information is derived from the retailers' interface with consumers and thus that these information-based networks are effectively controlled by the leading supermarket chains. The study's conclusions are considered in relation to the recent findings of the Competition Commission following its investigation into grocery retailing in the UK.

NEW PRODUCT DEVELOPMENT AND PRODUCT SUPPLY WITHIN A NETWORK SETTING: THE CHILLED READY-MEAL INDUSTRY IN THE UK

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INTRODUCTION

It is now widely acknowledged that the 1990s witnessed a sharp rise in the incidence of network forms of business organisation. From an economic perspective, the ability of firms to exploit inter-organisational networks has clearly led to new forms of business-to-business transacting, but it has also had significant implications both for industrial structure and the nature of competition and innovation more generally. The purpose of the present paper, therefore, is to review new evidence regarding the function played by inter-firm networks, and in particular to present a detailed analysis of the operation of vertical network arrangements within the chilled ready meals sector of the food processing industry. The paper identifies and analyses the operation of two distinct inter-organisational network types that operate in this sector: a control network and a network for innovation.

Interest in the study of business networks has evolved along various fronts, across different disciplines. Within economic study, the regional level analysis stemming from Marshall's concept of externalities has been the basis for the study of industrial districts and cluster analysis. At the firm level the transactions cost paradigm (Coase, 1937; later developed by Williamson, 1975; 1985) has been important as a basis for the analysis of

'hybrid' forms of organisation between markets and hierarchies (Powell, 1990). The influence of sociological based studies of business networks, focussing on the process of intermediation and relationships between specific actors has allowed for a more sophisticated understanding of network processes within and between firms (for a review see Ebers, 1997, Grandori and Soda, 1995 and Grabher, 1993). Towards the end of the last decade, elements of all these approaches have been present in studies of network organisations (see Ebers, 1997, for a review also of this literature). In these approaches the boundaries of a firm are blurred by co-operative agreements (Sachwald, 1998), and by the flow of tacit information between firms (Casson and Wadeson, 1998), and the emphasis has moved away from considering the boundaries of the firm to examining information flows within networks (Casson, 1997). This literature focuses on the mechanisms that ensure the quality of information in networks, with an emphasis on the development and economic function of trust (Casson and Cox, 1997; also see Lane and Bachmann, 1998, for a review of trust in network organisations).

Recent studies have attempted to move beyond the identification and taxonomy of network forms to an understanding of their role in the innovation process, principally in high technology industries. This approach is especially prevalent in the study of research and development (R&D) and cluster studies (Swann, Prevezer and Stout, 1998). These industries, characterised by telecommunications, pharmaceuticals and biotechnology, are often unrepresentative of many sectors, and especially to those characterised as low-tech. Focus has turned therefore to networks and innovation within traditional industries. In the literature there has been an acknowledgement that relationships within the automotive sector between suppliers and manufacturers have been transformed by network relationships (such as Dicken's dynamic network, 1998), particularly those driven by new information communications technologies (ICTs) such as electronic data exchange (EDI). Jarillo (1993)

and (particularly) Abernathy *et al* (1999) have extended the understanding of these processes into other sectors such as the textiles industry. Competition and innovation is increasingly being undertaken simultaneously between firms involved in vertical and horizontal network relationships. The role of vertical chains is most evidently expounded in studies of international systems of disintegrated manufacture, commodity chains (Gereffi, 1994; and the concept of the differentiated network, Nohria and Ghoshal 1997), and in studies of co-operative innovation between firms in the supply-chain (Tether, 2000). Several studies have examined the innovation process within these types of vertically non-integrated production systems. In these analyses, the role of customers driving innovation often implicitly assumes the customer to be another firm within the vertical chain, typically a downstream manufacturer (as in Harabi, 1998 and Clark *et al*, 1987) rather than the final consumer.

Our paper extends the analysis of network forms and the innovation processes between firms in vertical relationships. The paper seeks to understand how organisation structures and innovation might be altered within a traditional sector that has introduced new ICT-based technologies. We have sought to do this by means of detailed research into the UK food processing and retailing industry, where during the past decade the competitive dynamics have been transformed as a result of the introduction of networks and electronic data interchange (EDI) systems by the large scale multiple retailers (supermarkets). Studies in the 1980s by Senker (1986; 1988) identified that the impetus for innovation in processed food was beginning to move from branded manufacturers to retailers. This shift has continued, and the introduction of generic-ICTs has further strengthened the position of the multiple retailers relative to manufacturers (Cox, Mowatt and Prevezer, 2002). The present paper finds that there are two complementary networks engendered by the use of new ICTs, one based on innovation and the other on control. An interesting aspect of the network systems depicted in

this paper is that they encompass and are partly driven by the final consumer, as well as by producers themselves.

APPROACH AND METHODOLOGY

During the mid-1980s Senker (1986; 1988) examined the newly identified role of UK food retailers in new product development in order to test whether contemporary economic theories could account for this pattern of innovative activity, and found that they lacked explanatory power. The recent developments in the study of business-networks outlined in the introduction has widened the theoretical approaches to examine both networks and innovation, and this paper draws on network theory's contribution to economic analysis to enable an examination of retailer-centred vertical chains in the chilled ready-meals sector. The principal theoretical framework used in this paper follows the economic network-theory approach developed by Mark Casson (Casson, 1997; Casson and Cox 1997), emphasising the centrality of information within an economic framework. In moving beyond the conventional axioms of transaction cost theory (Williamson, 1975; 1985), network theory allows for more complex relations between ownership boundaries and the effective locus of control that is facilitated through its systems of information management. As such, the focus on networks anticipates greater flexibility in the ownership boundaries of firms within industries, with the optimal configuration emerging as the dynamic outcome of the interplay between technological change and the exigencies of the competitive process. Furthermore, this information-based approach incorporates an understanding of the role of social mechanisms in creating, guaranteeing and perpetuating trust from an economic perspective. This is particularly useful in examining networks that involve informal organisations such as those identified in this paper, and can help develop an analysis of detailed case-study examples. From an historical perspective, Chandler's approach (1977; 1990; 2000) to examining

business structure also provides our study with a useful framework to understand organisational and industrial change.

The theoretical approach used to identify the changes within the food processing industry and the relationships between firms has been supplemented by more detailed study of specific sets of vertical relationships. In order to test the validity of our characterisation of the contemporary network relationships and innovation process in the sector we also undertook a series of semi-structured interviews designed to substantiate and augment our findings and to build up a detailed knowledge the functioning of networks. Thus to examine the processes of control and innovation we selected one of the vertical chains in the industry which we deemed to be representative. This vertical chain related to a retailer,¹ Retailer A, which accounted for a significant share of the final market for chilled ready-meals. For the examination of the control network in this vertical chain we interviewed the General Manager Development Consumer Europe and the Development Director, Europe, from logistics contractors which we termed M and N, and the Project Manager for Chilled and Perishable Goods in Retailer A. For the innovation network we followed a similar methodology to the interview-based approach used by Senker (1988). Senker made detailed case studies of the main UK grocery retailers in order to examine how they were able to develop products during the mid-1980s when these retailers were beginning to establish novel own-brand products. Through interviews with retailers in the sector she found that some retailers were innovating products and processes, whilst others were merely contracting suppliers to create own-label versions of branded products. The true innovators directly promoted the manufacture of novel products by adopting closer relations with their suppliers, and setting up (or extending) their own internal product development departments.²

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 Senker divided retailers into two main categories: acceptors (who commissioned suppliers to replicate products, accepting supplier standards) and intervenors (who were intimately involved in the product

This paper builds a similarly detailed picture of the innovation network in the sector through interviews with Retailer A's³ new product development section (principally the Senior Trading Manager for Fresh Foods) and representatives of supplier firms and contractors. 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 companies in the sector.⁴ 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. In addition to this programme, supporting interviews were held with those holding a global and long-term view of the industry, namely industry trade journal editors (e.g. *Frozen and Chilled Foods, Food Manufacture*) and trade association officials.⁵

development process with suppliers). The mechanism by which firms dealt with suppliers or managed product development in food was through the establishment of their hygiene departments and food technicians. M&S and J Sainsbury's food hygiene departments underwent a radical change in the 1970s, increasing the number of staff, shifting their emphasis to quality control, product development, packaging technology and machinery. From the table below it can clearly be seen that in the early 1980s Tesco moved from being an acceptor to following M&S and J Sainsbury's strategy of intervention. In this process a hygiene department is vital to gain technical capacity and to learn about rival products and supplier operations. By 2000 all the major UK grocery multiples have become intervenors.

Retailers and their New Product Development Strategies in the mid-1980s. Source: Senker, 1988: 111, table 4.4

Retailer	Hygiene Dept. Established	Internal Food Technicians		Strategy
		1970	1985	
M&S	1948	30	69	Intervenor
J Sainsbury	1920	100	130	Intervenor
Tesco	1973	-	112	Intervenor
Safeway	1964	8	27	Acceptor
Asda	1970	8	27	Acceptor

³ Which included staff with direct knowledge of working with supplier development research, as well as at national and foreign subsidiaries.

⁴ 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.

⁵ The trade association officials involved wished to stay anonymous due to the nature of relationships within the industry.

THE INNOVATION NETWORK

The Characteristics and Structure of the Chilled Ready Meals Market

The emergence of network structures in the food processing and retailing sector can be best understood in the context of two primary factors: first, the food retailers' adoption of new ICTs, and second, the example of the system of relational contracting established by the clothing and foodstuffs retailer Marks and Spencer (M&S), which described itself as "a manufacturer without factories". M&S's practice of relational contracting was transferred from its clothing and textiles activities to its food business, and then to the supermarket grocery sector in general as retailers sought to emulate M&S's differentiation strategy and suppliers adopted their quality standards and systems in order to supply the supermarket sector.

The chilled ready-meals market sector was pioneered by M&S, and the major UK⁶ multiples have developed their own lines in the 1990s in response to this. Chilled ready-meals are high value-added premium convenience products, which have displayed rapid growth during the 1990s (see Table 1). They are ready-prepared complete meals or meal centres that need only heating by oven or microwave⁷ 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.

TABLE 1: UK RETAIL SALES OF CHILLED READY MEALS, 1993-1999. SOURCE: KEYNOTE, 2001

⁶ The UK accounted for 49per cent by value of the European chilled ready-meals market in 1998. Germany and France accounted for 21 and 20per cent respectively. The bulk of the products for France and Germany are accounted for by chilled Pizzas, which are qualitatively quite different from ready-meals in general. Source: Vickers, 1999.

⁷ This 'dual-ovenable' product characteristic is one that demands leading-edge materials technology in terms of hygiene and packaging. This also requires that the manufacturers, packagers, and retailers develop the product packaging closely together, as the packaging also forms part of the retailer's generic own-branding strategies.

The appeal of the sector is not only convenience, but also its ability to provide quality substitutes to the restaurant meals. Variety is therefore a key aspect of the sector, and retailers need to be able to respond not only to the market demand in terms of allocation, but with a corresponding array of new products. The sector is controlled largely by six retailers which account for some 95 per cent of the market by sales (see Table 2.)

TABLE 2: UK RETAIL SHARE OF CHILLED READY-MEALS, 1995-2000. SOURCE: KEYNOTE, 2001 (note: figures in columns may not sum due to rounding)

Retailers use chilled ready-meals as part of their own-brand⁸ differentiation strategy that is the key to competitive success within the sector. Retailers therefore attempt to follow customer eating trends closely and the range of products offered by firms within the sector is very large – despite the low volume sales of many individual product lines. Retailer A offered a total of 141 different chilled ready-meals in 2000, having introduced some 44 new products in 1999 alone. Some indication of this variety can be taken from the number of products the top five retailers offer in the ‘ethnic’ market (the majority of the market being comprised of British and Italian recipes) shown in Table 3.

TABLE 3: MAINSTREAM ‘ETHNIC’ MEAL RECIPES, QUARTER 4, 1999. SOURCE: DATA DERIVED FROM MINTEL, KEYNOTE 2001 AND INDUSTRY FIGURES.

In contrast to the dominant position of the leading retailers, the manufacture of chilled ready-meals is widely diffused, with branded manufacturers accounting for less than 5 per cent of total production. In the UK the sector is supplied by over 180 firms ranging from specialist micro-kitchens employing less than five people to a few large companies such as Northern Foods and Hazlewood (Grocer, 1997). The largest firms supplying the sector may

⁸ Own-label products are where retailers source the supply of lower-price alternative products to compete with branded manufacturers products, usually at the bottom end of the market (Burt and Sparks, 1997). Own brand goods are those products developed *by the retailer* to strengthen their brand as retailers, and were developed chiefly in the UK market (Fernie and Pierrel, 1996) where their influence is strongest.

produce other chilled products in addition to ready-meals, but these are the exception.⁹ As product development in the sector is retailer-led, the nature and composition of the suppliers has some distinctive features. 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 recipes, especially in the ‘ethnic’ area, are initially developed by very small specialist companies some of whom, such as Noon Foods, have become major firms through their association with the retail sector. Table 4 indicates the largest suppliers to the sector and gives some indication of their main customers.¹⁰ The range of dishes is also 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). As Table 4 indicates, the specialist suppliers are mostly smaller companies. The largest volume of production however is sourced from a small group of manufacturers; 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. Because the major volume manufacturers have developed in conjunction with retailers, they often have an exclusive relationship with them. In some cases larger producers supply several retailers, but in different product areas with little overlap.¹¹ Where overlap exists, manufacturers may have dedicated plants for each retailer, producing meals to their specification.¹² No manufacturer supplies the *same* product to multiple customers.

⁹ Geest and Hazlewood, for example, are manufacturers of other chilled products, such as pasties and chilled pizzas. Northern Foods supplied M&S exclusively with chilled ready-meals until 1999, but supplied other retailers with chilled products.

¹⁰ Data in this sector is extremely difficult to obtain due to the intense competition within the retail sector, and the sensitive nature of customer-supplier relationships. We are not able to give confidential information released to us by firms used to inform this investigation, but have attempted to give publicly available information wherever possible. The data in this table therefore shows publicly known links and the largest supplier firms and is not comprehensive.

¹¹ Geest, for example, supplies Tesco with Indian, Sainsbury’s with Italian, and Waitrose with British recipes

¹² Northern Foods has two production plants dedicated to M&S at Sheffield and Grantham; Geest has separate plants for Tesco (Button Bridge and Spalding), Sainsbury’s (Sun Valley) and Waitrose (Tilbrook), and Noon has

TABLE 4: MAJOR OUTSIDE OWN-BRAND SUPPLIERS IN 2000.

Profits in the chilled ready-meals market are not derived primarily from the economies of standardisation. Rather, variety, novelty, and quality are the key elements. The chilled ready-meal new product development (NPD) process therefore needs to be rapid and responsive to changing customer tastes. The organisational solution to this problem in the sector is an inter-organisational trust-based network rather than a strategy of internalisation. The large retailers are in a position to gain marketing information directly from their intimate relationship with the customer through POS monitoring, customer loyalty schemes (exploited by sophisticated data mining centres maintained by the retailers) and their own market research. The aim is to identify new market niches, and fill them with new differentiated products as quickly as possible, and respond effectively to new eating trends. Thus the critical information required to develop new products is obtained by retailers, who use this knowledge to leverage control over the innovative process as a whole. Retailers in the UK are able to co-ordinate the development of new products as they have internal hygiene and product development departments, even though they do not have any production capacity of their own (Fernie, 1997; Hughes and Merton, 1996; Senker, 1986, 1988).

Co-ordinated New Product Development through Strategic Alliances: Retailer A's Innovation Network

Retailer A is an example of a firm that has been able to exploit its proximity to the consumer to develop new products more effectively than firms higher up the value-chain. Retailer A derives knowledge about consumer trends through the innovation network, especially from expert sources of information and small specialist companies, in addition to its own

dedicated centres for its customers.

consumer-based information. 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 1 depicts the new product development network.

FIGURE 1 ABOUT HERE. THE INNOVATION NETWORK

Retailer A claims to have a “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. Details of products, specifications and recipes developed for specific retailers and retailer’s sensitive information remains confidential, as suppliers rely on retailers’ loyalty and support in an oligopolistic final market comprised of few firms. 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 than 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 (whose existence is crucial to the retailer in developing new products quickly) where the retailer is their sole client.¹³ In certain examples, retailers can help lower the asset specificity risks and information costs of suppliers by lending specialist staff, information, equipment, and money in return for dedicated investments. This series of very close relations binds the network firms into mutual dependencies whereby it becomes more profitable for firms to act without opportunism, having redefined the pay-off structures to reward co-operative approaches. 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, many of which could be termed ‘micro-kitchens’ employing less than ten staff, 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.

¹³ The difference in relationships between the largest and smallest suppliers is something that the literature has not focused on, and which this study did not directly address. However, this, and the issue of firm growth through relational contracting in dependent network relations, is an area worthy of future attention. This study found little differences in the transaction costs issues for smaller suppliers.

Managing Production in the Innovation Network

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 Foods¹⁴ and has a permanent team of 26 people that includes a product development team, working on recipe development with suppliers, and 6 buyers who are responsible for the day-to-day administrative, commercial side of the business. The unit works with the fresh foods division staff that liaises with the food technicians in the hygiene department (who have a total staff of 198), 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 central meeting grounds. “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.¹⁵ 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”.

THE CONTROL NETWORK

Retailers’ control networks differ from the open-ended relational networks that they have

¹⁴ The senior trading manager was our main interview respondent for the innovation network within retailer A.

¹⁵ 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

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, 1994; Burt and Sparks, 1997; Fernie and Pierrel, 1996). By focussing on the economic relationships and drawing on our detailed interview-based research with Retailer A's internal logistics department and external contractors, we offer new insights to the processes at work. Retailers' control of the supply chain represents a sophisticated form of network organisation that is essentially one of subcontracted co-ordination. Although at first glance this system appears similar to conventional subcontracting, a closer examination of the linkages reveals a system that more closely resembles a form of upstream franchising, with novel solutions to organisation problems. Under traditional subcontracting arrangements, the retailer devolves process and operations to a logistics subcontractor. The true costs and risks are obscured by the problems of information impactedness and asset specificity, as when the contractor buys or builds dedicated facilities such as warehouses. Much of the economics-based literature on the management of the supply chain focuses on these issues 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 transactions cost problems centring around uncertainty and opportunism have been addressed in novel and sophisticated ways. In the control network, 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 Retailer A's control network.

From a Warehouse-Based to a Replenishment-Based Supply Chain

Grocery retailers in the UK have achieved control over IT-based systems of supply-chain coordination. This has changed the nature of the supply chain from a warehouse-based system to one whereby retailers manage their inventory on a replenishment-based just-in-time system with little stock holding. This not only enables retailers to economise on warehousing costs, but also allows them to correlate demand and supply with unprecedented accuracy. Managing the logistics of product distribution had emerged in the early 1980s as a major objective of the food retailers in the UK (Quarmby, 1988), with the objective of centralising their logistics and distribution operations to use “logistical competency to gain competitive advantage” (Bowersox, 1998). 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 whereby contractors were guaranteed fixed-term management fees. 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 British 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. The efficiency therefore does not come from

standardised delivery and economies of scale. Indeed, as the logistics manager of Retailer A notes, the drawback of the system is that “you are moving more air” but the compensating advantage is derived from the degree to which it is possible to accurately match supply and demand. 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) system 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 logistic 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 mechanism by which co-ordination has been achieved is via ICT-based communication and information exchange systems. The gradual adoption of electronic point of sale (EPOS) replenishment systems in the early 1980s, and scanning technology in the mid-1980s allowed the supply chain to be managed in a more efficient way.¹⁶ 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-driven¹⁷ systems of replenishment (Smart, 1995; Winters, 1996; Fernie and Pierrel,

¹⁶ The development of these generic IT systems was co-ordinated in the UK by the Institute of Grocery Distributors (IGD), a trade body founded in 1975 comprised of retailers, manufacturers and distributors (de Angeli, 1995; Bamfield, 1994). Indeed, the logistics literature has detailed how retailers have turned around the management of the supply chain. The IGD, for example, set-up the Article Numbering Association (ANA) in 1976, which set common standards for bar-coding, leading eventually to the adoption of an e-standard in 1997.

¹⁷ Information as to customer buying patterns and trends has been gathered from store data and loyalty card information. Data warehousing was becoming common in the late 1990s, as retailers continued to gather information on the buying patterns of consumers. Data mining technologies allowed them to develop bundles of products and promotions to exploit consumer demand. The retailers have used this knowledge for product

1996; Ody and Newman, 1991), and encouraged the expansion of their control backwards down the supply-chain. These factors led to a boom in the 1980s of third-party contractors to handle distribution (Ferne 1997), and the domination of the supply chain by retailers at the expense of manufacturing firms, who saw their distribution services decimated (Whiteoak, 1993; Cooper, Browne and Peters, 1994). By moving their direct management backwards into the chain of logistics (Ferne and Sparks, 1998), retailers were able to gather information regarding the role of wholesaling much more effectively and to introduce their own computer-controlled stock management systems into this aspect of the value chain. As a result, retailers have been able to unbundle many of the costs of services that were supplied by wholesaling subcontractors and gain much more precise information over a variety of costs that had previously been beyond their purview.

This unbundling process is especially significant. Traditional subcontracting relationships are complicated by the provision of a bundle of value-added services, asset specificity, and the problem of contractor-based risk. In such cases, bilateral negotiation is undertaken. In contrast, the removal of these questions simplifies the process of negotiation, lowering the costs of individual transactions. The management of RDCs have in many cases been subcontracted to third parties in a system that effectively involves reverse-franchising. The retailer retains direct ownership of the asset (such as a warehouse or fleet) and the computer-controlled stock management system, but subcontracts out the operation and various other support services that the physical management of the asset requires. Thus the integrated information system underpins and provides control over an organisational structure that actually constitutes a network of independent firms revolving around the hub played by the retailer's head office. This arrangement represents the inverse of the concept of "hollowing-out", since it allows the company to maintain control over the critical system-

development. They have been in the sole position to gather this information, and it must be noted that in a system of transparent information, this critical information is guarded closely within the organisation.

wide information whilst enabling them to relinquish direct responsibility for its management. And whilst this arrangement requires the management of many times the number of discrete transactions than would be involved in conventional subcontracting, the costs of managing these transactions has been sharply reduced by the development of computerised information management systems.

In relation to distribution, sub-contractors and the management of RDCs, the traditional problems of opportunism and bounded rationality are circumvented by three means. First, sub-contractors' management fees do not include risks associated with building idiosyncratic assets (such as RDCs), because the retailers have either internalised these costs, or given guarantees to agents by means of extended and relational contracts. Second, manufacturers are not able to conflate distribution costs into the cost of manufacture because they no longer undertake these functions. Third, because of retailers' involvement in controlling the flow of supply-chain information through the system, they are very aware of the real costs involved. This also applies, as was observed in the innovation network, to the costs of development and the manufacture when retailers are directly involved in the process. 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: Unbundling Costs and Managing Multiple Relationships.

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, of which one is the manager for ambient and frozen goods and one for chilled and perishable goods, responsible for the day-to-day running of the supply-chain working with a total staff of 250 employees. Retailer A's distribution

network comprises of 24 RDCs and 13 PCCs as shown in Table 5. The supply-chain is coordinated 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 can'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.

TABLE 5: RETAILER A'S RDC AND PCC STRUCTURE. SOURCE: INTERVIEWS WITH RETAILER A

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 information about costs: Contractor M relating that Retailer A's "knowledge about costs is as great as ours is. There is nothing hidden there for us to extract margins from." 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. Coupled with increased information transparency, Retailer A's decision to build its own (or buy back) RDCs led to a 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 relationship between retailer and contractor, and this can be observed in longer contract lengths - Retailers 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 contractors 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 – indicated by the fact that only two contractors are responsible for managing six out of their eight externally-managed RDCs.

Casson (1997:122) has used the term “communal networks” to describe forms of co-ordination in which existing high levels of trust act to facilitate price negotiation through the removal of opportunistic threats and uncertainties that usually result from one party bearing irreversible costs. Co-operative price negotiation therefore helps to foster longer-term relationships in contrast to competitive tendering, a situation demonstrated by retailers adopting longer-term contracts, facilitating trust. In this case, however, the mutual trust that develops within such a “communal network” is an outcome of the information transparency engendered by the retailer’s computer systems rather than being a precursor.

In their management of the RDC-to-store supply-chain, retailer A negotiates contracts with third-party logistics firms to manage specific RDC management contracts. These suppliers are third-party logistics firms.¹⁸ The PCC network is significantly different from the RDC network, and less under the direct control of the retailer. The PCC exists to allow larger manufacturers to make smaller, more regular demand-driven deliveries to RDCs, and to bring smaller suppliers within the supermarkets supply-chain, allowing infrequent deliveries of products or regular deliveries of small loads. This capability is critical for chilled foods because the production volumes on some lines are already relatively small, in the case of Retailer A 90 per cent of products selling less than 6 units a week per store. Large and medium food manufacturers with their own distribution systems (such as Northern Foods and

¹⁸ The main suppliers are: Exel Logistics, Christian Salversson, NFT, BOC Transshiled, Tibbet & Britten, and Wincanton. Tibbet & Brittan was formerly Unilver’s internal logistics division, and BOC Transhiled was

Geest) and small regional logistics companies are in the ideal position to collect small crate loads from suppliers and make consolidated deliveries into PCCs. This is only efficient if these small loads are consolidated for multiple retailers, so Retailer A's logistic 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 O] is not just going to a supplier and picking up for us but for Retailer C and Retailer D as well". The composition of the PCC network means that it is regionally constrained and local in nature. In operational terms this means that Manufacturer X's Midlands PCC is run by Contractor O, which collects all the goods from the suppliers in the Midlands and delivers to the 8 regional RDCs, but whose range is confined to 1 – 1½ hours road time from its base RDC. For Retailer A this means that managing and extending the PCC network entails recreating and managing many relationships with local firms. As in the innovation network, Retailer A manages multiple relationships with suppliers and adds value by central co-ordination.

Information Exchange and Innovation

The supply-chain described in the previous section can be represented by the flow of physical goods shown in Figure 2. Through POS information, retailers respond to demand by ordering from their suppliers the stock needed to fulfil or, increasingly, anticipate demand. Orders are passed directly to suppliers' computer systems through the EDI network, where they are tracked by the retailer's control of the IT information system through primary and secondary consolidation points before delivery to individual outlets. This control over the supply chain is fundamental to the existence of the chilled ready-meal market, as it allows retailers to correlate supply with demand (vital for extremely short-life products where wastage tends to vary between 20 to 40 per cent of output) through the delivery of small

established as a joint-venture between BOC and M&S to develop the chilled supply-chain.

batches and allows small specialist suppliers to be incorporated into the supply chain. The transparent information system co-ordinating the supply chain has changed the nature of relationships, and the potential structure of linkages, between manufacturers and retailers. Integration of the information network allows retailers to work more closely with suppliers and contractors than typical contractual models suggest. The POS data is the critical information that drives the supply-chain, and is tightly controlled by the retailer. This is because the POS information can be exploited not only to match supply and demand, but in the case of chilled ready-meals, to develop and innovate new products for markets revealed by this data. The potential for close relationships in the supply chain allows retailers to form supply-chain based networks with firms that own complementary assets and the capabilities to exploit these revealed consumer demand.

FIGURE 2 ABOUT HERE: THE CHILLED READY-MEAL SUPPLY-CHAIN: PHYSICAL FLOWS

CONCLUSION

This paper has used insights drawn from Casson's reformulation of the economic theory of the firm based on information requirements to explore the changing structure of inter-firm relations in the UK's food processing and retailing industry. In Casson's view, the structure of institutions at any given time can be interpreted as a rational response to the social need to economize on information costs (Casson, 1997: 3). The importance of such an approach is that it provides a starting point for embedding a variety of organisational forms of economic co-ordination – firms, markets, networks – into an integrated theoretical framework. In this framework, relationships between firms that are not mediated purely by the price mechanism (i.e. inter-organizational networks) can be treated as a response to the changing imperatives of information management within an economic system. The present paper, however, attempts to move beyond the idea of treating networks purely as an efficiency response and

considers how the possession of certain critical information may confer enduring forms of competitive advantage on specific actors within a given industry, particularly within the vertical value-adding chain.

In the food processing and retailing industry, the emergence of sophisticated computerised information management systems has placed the leading retailers in a potentially dominant position. In the case of the vertical supply chain, ownership of inventory management software extends 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. We have termed this a network of control. In addition, data generated and recorded at the point of sale on customer preferences and purchasing patterns has given British supermarkets access to information that can be utilised, in conjunction with food processors and packaging firms, to directly initiate aspects of new product development. These firm alliances we have termed a network of innovation.

The implications of these information-centred networks of control and innovation for the structure of the food processing and retailing industry are particularly well exemplified by the development of the chilled ready-meals sector. These meals represent a type of product in which accurate management of the supply chain and stock replenishment process is a critical determinant of success, and where the high profit margins that are achievable stand to be undermined by high wastage rates. Only with the ability to effectively manage both the production and distribution of these items are the supermarkets able to exploit this potentially lucrative market segment. Moreover, the financial benefits to be gained from the successful management of these products are further enhanced by the reputation advantages that the supermarkets receive through the continued development of these relatively expensive, high-quality items that carry the brand name of the retailer. Indeed, the perception of British supermarkets as innovative businesses has been built to an important degree on the ever-

extending range and quality of these chilled ready-meals, despite the well-known fact that the products are manufactured by independent (but anonymous) suppliers. Thus the reputation of the retailer actually depends upon its quality control system, which represents the fulcrum of the networks of control and innovation. Retailer A's NPD manager made this point clearly by stating that "when you look at our competitors ... the only thing that's different is the own-brand offering because Heinz baked beans are Heinz baked beans ... so the big point of difference we offer our customers in own-brand is really through quality. Chicken Tikka Masala is the perfect example – everybody's got it but who has the best one?"

Thus, both the new product development and supply-chain management systems represent inter-firm networks that are ultimately driven by consumer demands. Access to data on purchasing patterns therefore stands at the centre of each network and is, in each case, under the control of supermarkets. However, the structure of the two networks differs. In terms of new product development, alliances have been formed between supermarkets, packaging companies and manufacturers that are based on an open exchange of information since the effective competitive pressures are horizontal in nature, i.e. between competing alliances of such collaborative networks. No formal ownership links need to be developed between these firms who are bound together via gentlemen's agreements of mutual benefit. Information may be freely shared, although the retailer's access to the end customer remains of crucial importance.

The institutional structure of the control networks is more complex. Effective management of the supply-chain by supermarkets requires the extension of its computer-based information management system along the length of the vertical chain. Thus, some degree of vertical integration has historically been a pre-requisite for the development of this network of control. In this case it has involved direct management by retailers of the final tier of distribution through the provision of Regional Distribution Centres and vehicle fleets.

Over time, however, supermarkets have subcontracted the management of these services to independent contractors, and ultimately to transfer ownership of some of these facilities whilst retaining control over the management of the information system embedded within them. Indeed, the more recent development of Primary Consolidation Centres has been an initiative in which retailers have promoted a new layer of distribution that incorporates supermarkets' supply-chain information systems but in which they hold no ownership or management responsibilities whatsoever. The transparency afforded to the supermarkets through the operation of these management information systems has had the effect of removing information asymmetries between actors along the supply chain and allowed for much higher levels of trust in inter-firm negotiations.

There is no doubt that the changes outlined in this paper have served to enhance the competitive position of retailers in the UK relative to other actors in the industry. The decision by the Director General of Fair Trading to refer the operations of the leading supermarket chains for investigation by the Competition Commission in April 1999 was provoked by a general sense of unease about their competitive strength relative to both suppliers and consumers (Dobson, Waterson and Chu, 1998). In fact, the findings of the Commission suggested that neither the prices charged nor the profits made by the supermarkets were excessive (Competition Commission, 2002:6). Within the supply chain, the buying power and control exerted by the supermarkets created, according to the Commission's summary, "a climate of apprehension among many suppliers in their relationship with the main parties" and also appeared to discourage suppliers from investing in new product development and innovation (Competition Commission, 2002:5). In a more detailed assessment, however, the relationship between the supermarkets and their suppliers was shown to be more complex. In the case of own-brand suppliers, there was evidence of supermarkets encouraging and collaborating in product innovation and of good, long-term

supplier relations. On the other hand, producers of undifferentiated goods and branded manufacturers exhibited less harmonious relations with the large multiple retailers (Competition Commission, 2002:240-1).

A critical finding of the Commission's report was the growing importance in the food processing and retailing industry of ECR (Efficient Consumer Response). 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, 2002:241-3). In similar fashion, a recent analysis of the sector has noted that added value will continue to be the major driver in the food market, citing a spokesman from the large retailers as follows: "consumers change enormously and out of that comes opportunity. What we have to do is become the one that realises that opportunity..." (Key Note Report, 2002:49).

The observations made in this paper have implications both for theory and the study of network organisations. In particular, they highlight the limitations of transaction cost theory's focus on firm boundaries and emphasise the need to place information flows at the heart of institutional analysis. Clearly, the increasing incidence of inter-firm collaboration points up a general need to analyse networks as systems rather than focusing on specific manifestations such as subcontracting, alliances and joint ventures. Our paper shows that the networks underpinning the chilled ready-meals sector are dynamic structures, which evolve in relation to technical change and involve elements of both control and innovation. It is our contention that the example of the ready-meals sector is an indication of the potential role of IT more generally and a signal of the growing importance of consumer information to the competitive process. Such long-term relationships between those firms whose activities are close to customers and their suppliers using ICT-driven networks are poised to become still

more prevalent in industries where competition is fundamentally demand-driven.

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Tables

TABLE 2: UK RETAIL SALES OF CHILLED READY MEALS, 1993-1999. SOURCE: KEYNOTE, 2000

Year	£m	Index
1993	340	100
1994	380	112
1995	435	130
1996	475	140
1997	497	146
1998	551	162
1999	596	175

TABLE 2: UK RETAIL SHARE OF CHILLED READY-MEALS, 1995-2000. SOURCE: KEYNOTE, 2001 (note: figures in columns may not sum to 100 due to rounding)

	1995	1996	1997	1998	1999	2000
<i>Own Label, of which</i>	95	95	95	95	95	95
M&S	45	42	40	37	35	32
J Sainsbury's	20	23	25	22	23	23
Tesco	14	16	17	22	23	23
Asda	4	5	5	6	8	8
Safeway	5	4	4	4	4	4
Waitrose	5	4	3	3	3	3
Other own-label	2	1	2	1	1	1
<i>Branded</i>	5	5	5	5	5	5

TABLE 3: MAINSTREAM 'ETHNIC' MEAL RECIPES, QUARTER 4, 1999. SOURCE: DATA DERIVED FROM KEYNOTE, 2001 AND INDUSTRY FIGURES.

	M&S	J. Sainsbury	Tesco	Asda	Waitrose
Indian	18	12	15	12	26
Oriental	13	11	18	9	14
Tex-Mex	12	4	12	5	3

TABLE 4: MAJOR OUTSIDE OWN-BRAND SUPPLIERS IN 2000. SOURCE: VARIOUS^a.

Supplier	£m ^b	Specialisation	Major Customer (Firm Specific Specialisation Indicated)
Northern Foods	1,285.9	General	M&S ^c , Sainsbury's, Asda, Tesco
- Recipe Dish Company		General	M&S
- Cavaghan & Grey		Vegetarian / Fish / Poultry	M&S
Hazlewood Foods	788.9	General	Safeway, Tesco, Waitrose, Somerfield
Van de Bergh	763.8	Oriental	Tesco
Geest	522.1	General	Tesco (Indian), Sainbury's (Italian), Waitrose (British, Italian)
Sun Valley	268.0	Poultry	M&S
Bluecrest	169.3	Fish	Tesco
Freebooter ^d			
Headland	164.0	General	Major supermarkets
S&A	60.13	Indian / Oriental	Asda, Waitrose, Safeway, Morrison
Katsouris	60.0	Indian / Vegetarian	Tesco, Waitrose, Somerfield
Marlow Foods	56.6	Quorn	Sainsbury's, Tesco
Noon Foods	52.1	Indian / Oriental	Waitrose, Sainsbury's
Pinney's	51.0	Fish	M&S, Sainsbury's
Oscar Mayer	42.6	General	Sainsbury's
Ferndale	25.0	Tex-mex	Asda
Ethic Cuisine	19.3	Vegetarian	Sainsbury's
Grampian Country Foods	15.4 ^e	Poultry	M&S
Perkins	12.8 ^f	Vegetarian	not.known
RF Brookes	9.0	Italian / Vegetarian	M&S
Daloon	8.3	Indian / Oriental	Major supermarkets
Cherry Valley	6.0	Poultry	Waitrose, Morrison

^a Data derived from company annual reports, Mintel (2000), Keynote (2001), FAME and AMADEUS databases and industry sources.

^b Turnover has been provided wherever possible at the level of the firm, subsidiary or division producing chilled ready-meals.

^c Until 2000 Northern Foods exclusively supplied M&S with chilled ready-meals. After the M&S groups change in policy on long-term relational contracts, Northern Foods began to supply other supermarkets, although the Recipe Dish Company and Cavaghan & Grey remain exclusive subsidiaries for supplying M&S.

^d Bluecrest Freebooter, which until 1998 was a subsidiary of Booker Foods, along with Grampian Country Foods appear to be the only supermarket contract suppliers which also offer a range of chilled ready-meals under their own brand name. Their total branded market share is less than 1%.

^e GCF Group turnover is £851.2m in 2001, however most of this is derived from the group's primary activity of meat processing. This estimate relating to turnover of chilled ready-meals is taken from the *GCF Group Director's Report and Consolidated Financial Statements for the Year Ended 31 May 2001*, the chicken convenience food division having a total turnover of £147.9m and supplying prepared meats and sandwiches.

^f Perkins Groups is a major international with a £303m turnover Frozen Foods groups which acquired the UK chilled ready meal company Lender (now operating as Simply Fresh Foods Ltd, a subsidiary of Perkins Chilled Foods holding company.) Turnover indicated is from this activity. Source: Industry sources and FAME for turnover data.

TABLE 5: RETAILER A'S RDC AND PCC STRUCTURE. SOURCE: INTERVIEWS WITH RETAILER A

	RDCs		PCCs	
		No. of contractors		No. of contractors
Self managed	9	Nil	Nil	
Managed by third party	15	8 ^a	13	10 ^b
Total	24		13	

^a The two major contractors manage 6 RDCs.

^b Most PCC contractors only operate one PCC (being regionally constrained), and none of them manage RDCs.

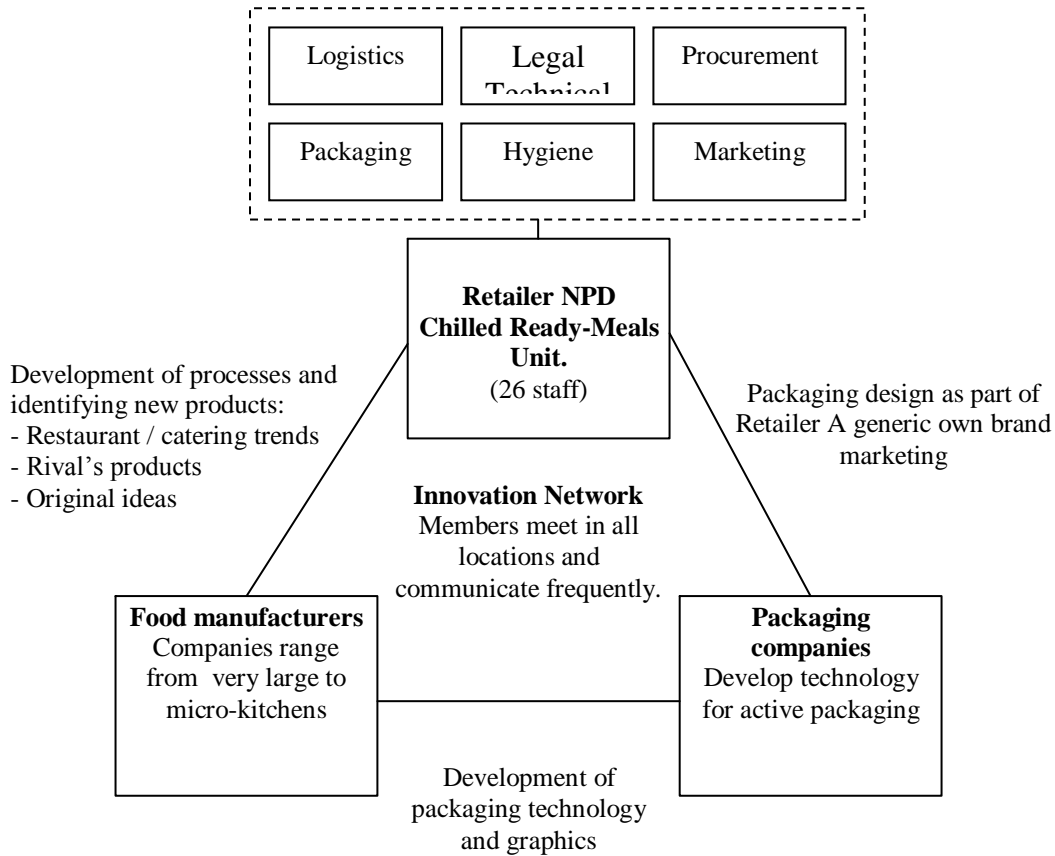


Figure 1

Supermarket contractors collect from suppliers at fixed rate per pallet. No Minimum drop size. Many large manufacturers act as primary consolidator.

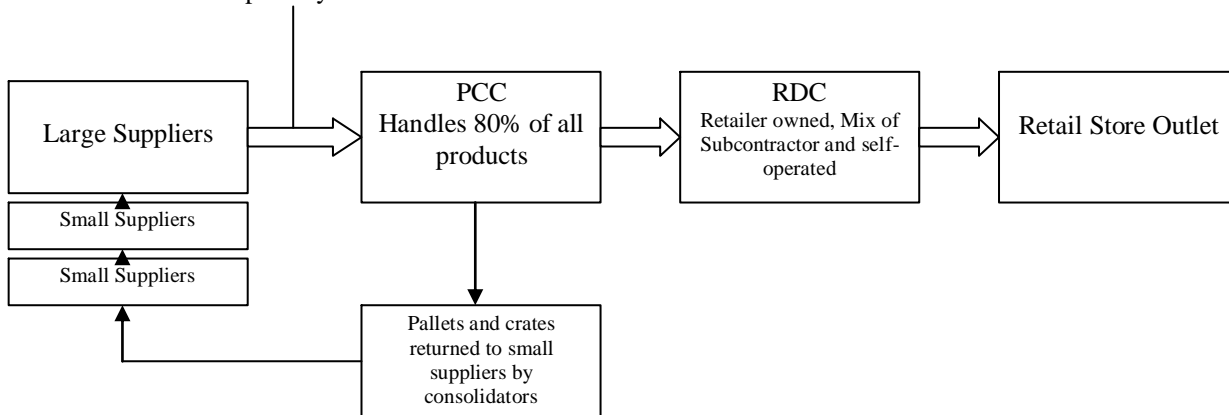


Figure 2

Movement of Goods \Rightarrow Movements of Pallets \rightarrow