

The Firm in the Information Age

Organizational Responses to Technological Change in the Processed Foods Sector

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Abstract

The transformation of production processes that occurred across a range of manufacturing industries during the Industrial Age generated new and more complex requirements for the process of intermediation as well as for the production systems themselves. The development of hierarchical organizations provided firms with the ability to oversee directly many of these new tasks and to create markets that supported them. In contrast, the advent of the Information Age has tended not so much to require the creation of markets *de novo* but has rather altered the nature of existing relationships of intermediation in ways that have facilitated a much wider collection of organizational forms.

*The Firm in the Information Age: Organizational Responses to Technological Change in the Processed Foods Sector*¹

1. Introduction

Just as the late nineteenth century witnessed the decisive transition from the Commercial to the Industrial Age, so the closing years of the twentieth century have seen full flowering of the era that is now increasingly understood to constitute the Information Age (Chandler, 2000). The process of digital convergence (Yoffie, 1997) spanning the telecommunications and information processing industries has created an information infrastructure which, in the years to come, will leave few areas of economic activity unaffected. Already industries such as textiles and apparel have been significantly restructured as a direct outcome of the novel systems of information management provided by the new information and communication technologies (ICT) (Abernathy et al, 1999). Two of the activities in which changes wrought by ICT developments have been felt most acutely involve systems of supply chain management (Hill, 2000) and consumer-driven forms of product development (Harvey, 2000).

Whilst the full implications of ICT for the future shape of economic systems remain a matter for conjecture, an analysis of those vanguard industries where significant change has already taken place illustrate two common trends that have emerged. On the one hand, firms employing the new ICT methods have displayed a tendency towards more networked forms of organization (Nolan, 2000), whilst on the other, a shift has been evident in the relative bargaining power of firms along the value chain moving away from producers towards buyers (Gereffi, 1994; Dicken, 1998; Dobson, Waterson and Chu, 1998). These developments have been founded on the ability of firms to make available products and services that are tailored much more closely to individual consumer requirements and, as a

result, have created innovative, value-enhanced commodities that sell for premium prices.

Of course, value enhancement of products is not a new phenomenon. The impact of technical change in the Industrial Age also facilitated opportunities for adding value, but did so within what was overwhelmingly a process of commodity standardisation and mass production. In comparing the two epochs, therefore, it is particularly instructive to consider a case study in which the organizational implications of value-adding product innovation can be directly contrasted. One such case in point is that offered by the ready-prepared meals industry within the United Kingdom. These meals originally constituted part of the development of frozen foods that made up one of the key Industrial Age innovations within the expanding area of food processing. Since the 1980s, however, an important segment of ready meal production has switched to more varied, chilled versions of the good. Although in many respects this represents a relatively modest step in terms of product development, the actual impact of the change for the food processing industry value chain has been revolutionary because such a shift has been made possible only by virtue of the introduction of ICT processes and their linked organizational responses. And whilst many of the developments identified in this particular case have also been evident outside of the United Kingdom, for example in the supply-chain management strategies of retailers such as Wal-Mart (Gill and Abend, 1996), the specific conditions that arose within the food processing and retailing chain in Britain from the 1960s has meant that it is in this location that the ICT-generated changes in ready-meal product development appear to have had their greatest impact.

In identifying the salient features of this transition, our paper proceeds as follows. In Section 2 the framework of technological change and organizational evolution developed by Chandler (1977; 1990) is considered from the perspective of institutional economics and the recent critique of transactions costs set out by Casson (1997b). In this critique it is argued

that the role of the firm as an intermediary or co-ordinator is best understood in relation to its function as a processor of information. Such a perspective is then adopted to analyse long-run changes in the organization of the value chain within the U.K. food processing industry. Section 3 traces the development of frozen food as a continuous-process innovation of the kind typical of the Second Industrial Revolution and shows how large food manufacturers used a strategy of vertical integration to manage the value-adding chain and create missing markets. Section 4 argues that in the 1960s and 1970s this process of vertical integration was reversed as U.K. food retailers grew in power and as new opportunities to develop frozen food products arose. Section 5 illustrates the way in which high-street retailers, led in the 1980s by the up-market food and clothing retail chain Marks & Spencer (M&S), were able to utilise innovations in supply-chain management to satisfy an existing, but latent, demand for high value-added chilled ready meals. To do so, two contrasting types of inter-firm networks were employed: one that can be termed control-based that was used to manage the co-ordination of the supply chain; the other of which was innovation-based and designed to pool sources of knowledge among food manufacturers, packaging firms and grocery retailers in order to exploit opportunities for new product development. Section 6 concludes by arguing that the inter-temporal comparative case study provided by the U.K. food processing industry serves as an instructive example of the emerging relationship between the ICT technologies and network-based organizational structures that are emerging as intrinsic features of the Information Age.

2. Information and Organization

Frozen food was an outcome of the technologies of the Second Industrial Revolution in which scientific breakthroughs in the production process allowed for the development of continuous-process forms of manufacturing and the creation of various new products whose common characteristic was their standardisation. Frozen food was part of the revolution in

branded, packaged consumer goods that relied on the introduction of proprietary technologies in food processing and allied developments in packaging. As Chandler (1977; 1990) has shown, these developments in technology tended to be exploited most successfully when they were coupled with the growth of business enterprises that featured extensive governance structures and some degree of vertical integration.

In the case of chilled ready meals, by contrast, the main driving force has been the development of non-proprietary technologies in information management. Unlike the case of frozen foods, the development of chilled ready meals utilised established technologies of food preservation and distribution channels, but their successful commercial exploitation opened up new and complex logistical questions due to the relatively short shelf life of the products, and necessitated a reversion to forms of manufacturing based on batch rather than continuous process production methods. These factors meant that in order to realise the potentially high levels of added value in production, the matching of supply and demand over relatively short time periods became crucial and this, in turn, required detailed attention to supply chain management and inventory control systems. Thus, chilled ready meals constitute an example of the type of product which has been spawned by the Information Age. Because the role played by proprietary production technologies was much smaller and the role of information management much greater, it has been the market-making retailers rather than manufacturing firms who have emerged as the leading element in the development of chilled ready meals. As a corollary, the organizational response has tended to involve far less by way of integrated management within a single firm and a much more important role for inter-firm networking arrangements.

In studying the relationship between technical change and organizational form Alfred D. Chandler's work has provided business historians with a most fruitful framework of analysis. For him, the multiunit, multifunctional business enterprises that evolved in the United States

after 1880, in parallel with the technical changes of the Second Industrial Revolution, represented the critical organizational response for the successful transformation to a modern, mass production-based, industrial economy. By investing in advanced methods of production, by organizing management systems in order to control the increased volumes of throughput, and by assuming greater responsibility for generating sales, these new business enterprises sharply raised the efficiency and productivity of the American economy as a whole *vis a vis* its foreign competitors (Chandler, Amatori and Hikino, 1997).

Here an attempt is made to apply Chandler's ideas (1977; Chandler and Daems, 1980) to the growth of the market for frozen food and then to assess their utility as a means of explaining the forms of economic organization that have emerged with the development of a market for chilled ready meals. In revisiting Chandler's earlier work, however, account is taken of the critique that has been levelled at the framework of institutional economics upon which his work has drawn. The Coasian (Coase, 1937) conceptualisation of transactions cost as the factor motivating the growth of the firm, extended through the work of Williamson (1975; 1985), has focused attention on the role of firms in subsuming markets and has, in consequence, led to firms and markets being viewed as alternative systems of economic co-ordination. Under such conditions, the boundaries of the firm are defined in relation to the set of activities, or resource flows, that the firm takes direct responsibility for managing. This notion of the firm as being defined in terms of its management of internalised market transactions – i.e. in ownership terms – displays fundamental limitations when confronted with forms of organization that involve inter-firm networks or long term collaborations. In these cases, co-ordination of resources takes place across the ownership boundaries of individual firms but not under the anonymous conditions posited in conventional theories of the price mechanism.

In reviewing the limitations of institutional economics, Casson (1997a; 1997b) has suggested that greater emphasis needs to be placed on the role of intermediation in defining the fundamental role of the firm.² Since the ability of an institution to effect the process of intermediation is dependent upon the gathering, management and dissemination of various types of information, this reorientation allows Casson to argue that the traditional concept of transactions costs needs to be placed into the broader context of information costs.³ This notion of the firm, as information dependent and constrained, leads Casson to suggest that an approach to institutional economics based on information costs will provide the key to specifying the true nature of the firm: allowing both its internal activities and external relations to be considered within the same methodological framework. Further, Casson points out that the institutional structure of an economy will evolve in response to the changes in information costs over time, thus affecting not only the growth of individual firms but also the way in which these firms relate to their customers, their suppliers and their competitors. How, then, do these ideas regarding information costs relate to the development of frozen foods and chilled ready meals?

3. Development of the Market for Frozen Food in Britain

The development of frozen food occurred in two phases. The first phase, beginning in the 1930s, involved the introduction of quick-freezing as a method of food preservation which could be applied with particular success to white fish and certain green vegetables. In this phase, the use of quick freezing as a method of food preservation carried many parallels to that of high-speed canning which had been applied to other foodstuffs in the 1880s. In each case, the use of packaging facilitated the introduction of proprietary branded goods which were supported by extensive advertising. The second phase moved beyond the simple preservation of foodstuffs into more innovative forms of product development. In Britain from the mid 1950s manufacturers of frozen foods, led by the Unilever subsidiary Birds Eye,

began to introduce a range of value added products such as fishfingers, beefburgers and frozen ready meals (Reader, 1963; 1980; Wilson, 1968).

Although the earliest applications of freezing technology to food preservation were designed to serve the catering trade, towards the end of the Second World War Unilever gained control of the Birds Eye subsidiary of the American General Foods corporation⁴ and began to develop a market in frozen foodstuffs for final consumers. This innovation built directly on the experience of Unilever in the mass production of branded packaged consumer goods upon which the company had built its reputation. At this time, the company was one of a small number of non-American firms to have developed an extensive management structure, with its British-based operation featuring four product divisions (soap, margarine, oil mills and food) overarched by a range of advisory and service departments which served the entire range of the company's international subsidiaries.⁵ These service departments managed activities such as buying, marketing, transport and advertising, and gave the company a great deal of internal capacity to co-ordinate the vertical chain of value-adding activities.

For frozen food to be developed successfully into a mass consumer good it was necessary both to create new markets, upstream and downstream of production, and to put in place mechanisms through which these additional market transactions could be effected. Upstream markets were required in which a sufficient volume of raw materials could be delivered in a way that enabled the process of quick freezing to be applied within a short space of time. Downstream markets were required to store, handle and transport the frozen produce, and retailers were required who were equipped with the necessary storage facilities. Finally, a demand among consumers for the novel product needed to be created and satisfied. Only when all of these markets were in place would it be possible to reap the potential benefits of the new technology.

As a company with a history of backward vertical integration, Unilever's initial approach to the procurement of raw materials featured a degree of self provision. Birds Eye began its processing activities in Britain at Great Yarmouth in conjunction with another Unilever subsidiary, MacFisheries Ltd., a Scottish trawler and fish retailing business for whom Birds Eye produced frozen herring (Wilson, 1954; Fieldhouse, 1978, pp. 31-32). During this early phase, two more Unilever subsidiaries, Batchelors Peas Ltd. and Poulton & Noel Ltd, undertook freezing on behalf of Birds Eye before the company opened two further factories of its own in Lowestoft (fish and vegetables) and Kirkby (meat products, vegetables and fish) in 1949 and 1950. As sales expanded during the 1950s further factories were acquired in Grimsby, Eastbourne and Hull between 1957 and 1959. In tandem with this expansion of productive capacity, Birds Eye entered the broiler chicken industry in 1958, quickly building up its capacity to around 20 farms, and in 1965 it acquired a controlling interest in North Eastern Fish Industries Ltd. to provide a direct source of Newfoundland cod.⁶ This policy of direct backward vertical integration was not utilised in respect of the procurement of the vegetables required for processing. Nevertheless, Birds Eye did develop quasi-backward vertical integration through the use of annually negotiated forward contracts with local farmers, to whom they gave assurances of short term renewal and, in many cases, provided seed⁷ (Wilson, 1968).

The process of creating the necessary markets downstream from the production process was much more complicated and required many of the resources that Unilever had developed earlier to support its other food businesses. Distribution and handling of the products was placed into the hands of the refrigerated division of the company's transportation subsidiary, SPD,⁸ who utilised its national network of depots and vehicles in a closely co-ordinated operation with Birds Eye's own sales division. Only in parts of the country too remote to operate economically were independent wholesalers integrated into the company's frozen

food distribution system, and these wholesalers were prevented by contract from distributing the rival brands of direct competitors. More intractable was the effective creation of markets for the final product. Although Unilever operated a chain of retail stores under the MacFisheries name, a far greater volume of sales was required than this collection of stores would allow. However, in the early 1950s few retailers were equipped with the type of refrigerated containers necessary to display frozen foodstuff and in 1953⁹ Birds Eye persuaded two manufacturers of refrigerated equipment, Prestcold and Frigidaire, to design and market “open-top” display cabinets for use by retailers. In return, the company agreed to limit its sales to those retailers who installed such devices (Monopolies Commission, 1976). Later, Birds Eye developed a policy of leasing refrigerated cabinets to some of its more important retail customers on condition that the equipment was used for stocking Birds Eye products or other products which did not directly rival those of Birds Eye.¹⁰ Meanwhile consumers were bombarded with an array of Birds Eye brand propaganda, price incentives and in-store inducements in an effort to alter their purchasing patterns.

In pioneering the mass consumer market for frozen foodstuffs, therefore, Birds Eye found it necessary to take direct responsibility for creating the wide variety of markets that were required before households could be offered the product in sufficient quantities to make manufacturing worthwhile. The pattern established by Birds Eye tended to be followed by the two main rival firms who developed as competitors in the branded consumer markets during the 1960s, Ross Group Ltd. and Findus Ltd. (a subsidiary of Nestlé). Management of the supply chain in each case was extensive and both companies developed integrated distribution operations, although in the case of Findus this was a joint venture with J. Lyons & Co. Ltd., whilst their links with independent wholesalers were made under conditions of exclusivity. However, this pattern of integrated provision supported by strong brand

advertising became increasingly vulnerable during the 1960s as new forms of organization and market segments emerged.

4. Vertical Disintegration in the Frozen Food Chain

Three developments served to change the organizational structure of the frozen food industry during the 1960s and 70s. One of these concerned the rapid growth in demand for frozen food by the catering trade which led to a pronounced bifurcation of the frozen food industry. The other two were brought about by increased competition in the market for frozen food to households and these involved the development of product differentiation and market segmentation on the one hand and the advancing power of multiple retailers on the other.

Increased use of frozen food within the catering trade had the effect of neutralising the advantages of proprietary brands. By reducing the fixed overhead costs associated with advertising and packaging, the expansion of demand amongst caterers allowed firms with relatively modest turnover much greater scope to enter the industry. These changes also facilitated a broadening of the distribution arrangements within the frozen food industry. Whereas the retailing sector had been supplied through manufacturers' own distribution companies or through exclusive deals with independent wholesalers, the growth of small scale manufacturers serving the catering trade encouraged the establishment of companies specialising in the provision of processing, storage and distribution services to frozen food manufacturers.

Two particular service companies developed in this area; public cold store companies and specialised distributors of frozen foods. The larger cold storage companies, such as Christian Salvesen, Union Cold Storage and Frigoscandia, tended to be integrated concerns that also provided processing and distribution services. Indeed, as the role of independent suppliers expanded, so the freezing capacity of these large storage and distribution companies began to

rival those of the proprietary branded manufacturers.¹¹ Among the distribution companies that began to enter the frozen food business in the 1960s were firms such as W.B. Pellew Harvey and J. Muirhead (a subsidiary of BOC) that developed their own brands and engaged in co-packing arrangements with domestic and foreign processors who lacked sufficient capacity of their own to market proprietary brands directly. In some cases the physical distribution of these products was undertaken by independent transportation companies under contract. Yet more distribution companies were set up by foreign manufacturers of frozen food, such as the Norwegian Frionor and the French Bonduelle company, to serve the UK distribution needs of their parent companies. This expansion of distribution facilities for frozen foods allowed a number of manufacturers with a much more specialised range of products to enter the industry. These included agricultural co-operatives that were formed for the purpose of processing fruit and vegetables, and a number of small manufacturing concerns - mainly subsidiaries of larger food processors - that specialised in manufacturing products within a defined segment of the market (vegetables, fish, meat products and fruit and confectionery) or in some cases specialise in a single product such as frozen potato chips (fries) or pizzas.

The arrangements for the retailing of frozen food also helped to speed up the process of vertical disintegration in the industry. Within the small-scale segment of grocery retailing, the need to provide for relatively small orders led to the development of cash and carry wholesalers who acted as intermediaries between the distributing wholesalers and the retailers. By the mid-1970s, for example, 60 per cent of greengrocers carried a small range of frozen food (Monopolies Commission, 1976). Whilst this trend tended to increase the availability of the main proprietary brands of frozen food, a parallel development in the distribution chain - promoted by the very rapid growth in sales of home freezers during the late 1960s and early 1970s - acted in the opposite direction. As consumers increased their

own capacity to store frozen foods, the average value of their purchases of the products rose considerably. In response a number of home freezer centres were opened in Britain, led in 1968 by the Bejam Group, which combined the sale of home freezers with the retailing of bulk packs of frozen foods. The advent of home freezer centres offered a much improved facility to the smaller manufacturers of frozen food who, as a result, were able to reduce their distribution costs whilst at the same time obtaining increased sales for their products.

The growth of home freezer centres enabled the industry to overcome the increasing constraint on sales in the retail sector which resulted from the limited shelf space available in supermarkets. During the 1960s these leading multiple retailers gained an increasing hold over grocery retailing¹² and, as a result, accounted for an increasing share of the sales of Birds Eye's products (see Table 1). In response to this development, Birds Eye began to offer discounts to the large multiples relating to turnover and allocation of shelf space. These discounts acted as entry barriers to rival suppliers who were attempting to gain sales through supermarkets and the Monopolies Commission report of 1976 ordered Birds Eye to end them on the proviso that other manufacturers firms also ceased to utilise such a strategy. However, the main threat to the proprietary brands in supermarkets arose less from rival manufacturers than from the multiple retailers themselves. As in other product lines, supermarkets increasingly sought to introduce their own label brands of goods into their freezer cabinets during the 1960s and, led by J. Sainsbury and Marks & Spencer, the multiples' own brands had made significant inroads into the frozen food market by the early 1970s. Although Birds Eye resisted the pressure to re-label their own products for retailers,¹³ other manufacturers proved more willing to adopt an own label strategy.¹⁴ Findus, for example, who supplied products for Sainsbury, Marks & Spencer and other leading multiples, saw the proportion of their gross sales (in value terms) accounted for by retailers' own label products rise from under 7 per cent in 1971 to 16.5 per cent just three years later. The beginnings of the own-

label industry initiated a revolution (F&CF, 1998, p. 10) which was to be the turning point in the relationship between manufacturers and retailers (Morelli, 1999).¹⁵

Table 1: Birds Eye Total Sales to Different Types of Customer by Value, 1970 & 1973

Customer	1970 (%)	1973 (%)
“Top twenty” retail customers	27.6	31.9
Other retail stores	53.5	48.9
Home freezer centres	n.a.	1.5
Individual home freezer owners	n.a.	1.0
Caterers and other buyers	10.8	8.7
Independent wholesalers	8.0	8.0

Source: Monopolies Commission, *Frozen Foodstuffs*, p. 24.

In the two decades spanning the mid-1950s to the mid-1970s, therefore, the frozen food industry in Britain had grown both in size and complexity. Whilst at the outset only a firm with the degree of vertical control over the chain of production such as Unilever could assemble the various components required to raise output to a viable level, by the 1970s a whole raft of firms, small and large, had developed an interest in the market. And although the manufacturing basis of the industry, at least as far as the household sector was concerned, still remained a classic oligopoly, the balance of power within the value adding chain was now shifting towards the retailers. Nevertheless, given the strength of the reputation that two decades of continuous advertising had given their proprietary brands, the frozen food manufacturers continued to control at least this one important lever of competitive power.¹⁶ With the advent of chilled ready meals, however, an important segment of the processed food industry was about to be turned completely on its head.

5. The Chilled Revolution

It was the large manufacturers of frozen foods who first introduced ready meals as they sought to increase the value-added component of their product range and respond to the opportunities presented by a variety of demographic changes, notably increased rates of female employment (Christensen, Rama and von Tunzelmann, n.d., p. 33). From the introduction of TV dinners by Birds Eye in 1969 (Key Note, 1998, p. 12), an increasingly sophisticated variety of products found their way into the freezer cabinets of British supermarkets and other retailers during the 1970s. A list of Birds Eye retail products in 1975 contained a wide range of culinary temptations from the traditional British staple dishes of lamb casserole and cod and chips through to quasi-exotic Asian offerings such as sweet and sour chicken and prawn curry. Unfortunately for the manufacturers, the process of freezing and reconstituting these meals in many cases had a detrimental affect on both the texture and the flavour of the food.¹⁷ If these dishes could be preserved by means of chilling rather than freezing, then the final product that reached the consumer's dinner table could be much improved. However, the logistical difficulties involved in such a process were formidable, since the maximum period of time that could elapse between production and final consumption of such products was a matter of days rather than weeks. Although it might be possible to charge a premium price for such dishes, unless supply and demand could be co-ordinated with unprecedented accuracy the cost in wastage would far outweigh any potential benefits to be gained from the higher profit margin. This need for detailed co-ordination meant that a significant element of competitive advantage was now transferred to retailers.

In Britain, the chilled ready meals market was pioneered by the multiple retailer Marks and Spencer. Their decision to specialise in high quality fresh and convenience food products (Davies, 1999), culminating in the provision of premium-priced chilled ready meals, was to have important consequences for the management of the supply chain and for retailer's

relationships with suppliers in general (Whitehead, 1994). The long-term strategy of Marks and Spencer to differentiate on quality meant that it had been vital for them to forge close relationships with suppliers in order to guarantee standards. This history of collaborative product development with suppliers proved crucial in enabling Marks and Spencer to exploit a latent demand for pre-prepared ‘fresh’ ready-meals during the 1980s (Kumar, 1996).¹⁸ Subsequently similar collaborative arrangements were cultivated by other retailers in the UK grocery market, led by J. Sainsbury, as they successfully sought to emulate the strategy of Marks and Spencer.

Managing the logistics of product distribution had emerged as a major objective of the grocery multiples from the 1970s. During this period, for example, Sainsbury pioneered the development of their own dedicated Regional Distribution Centres (RDCs) as an intermediate stage in the distribution process. These RDCs were owned by one of the growing number of specialist distributors but were operated on Sainsbury’s behalf through a process of subcontracting.¹⁹ Transportation of products from the RDCs to the stores was then largely undertaken directly by Sainsbury’s own fleet of vehicles (McKinnon, 1989). In a similar move, Marks & Spencer formed a joint venture with the distribution arm of BOC in order to distribute its chilled produce. By the 1990s, the RDC pattern had become established with British retailers, although they increasingly contracted out the operation of the centres. More recently, retailers have begun to operate Primary Consolidation Centres (PCCs) to which smaller manufacturers are able to deliver increasingly small batch-driven loads prior to their transfer to the RDCs.²⁰ Through the use of EDI systems, retailers are thus able to manage the supply chain from beginning to end.

The principal technologies that drove the development of the chilled ready meals sector were not standardised production technologies, but generic IT systems and software which enabled the close co-ordination of independent firms. Control over logistics was a

prerequisite for the detailed management along the chill chain that the development of a viable market for chilled ready meals required. The critical step in the process, however, came with the introduction of computer controlled systems of inventory management during the 1980s. Given the ability that electronic point of sale (EPOS) systems gave retailers to record and replenish the limited space on chilled shelves, a system of stock management was put in place that enabled Marks & Spencer to exploit the latent demand for chilled ready meals among its customer base.

The gradual adoption of 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.²¹ Grocery retailers, constrained by the perishable nature of their produce, were the first to move from inventory based systems to customer driven systems (MacDonald, 1994). The ability of being able to use Electronic Data Interchange (EDI) between organizations in real time is a key feature of being able to manage inter-firm systems of co-ordination (Hughes and Merton, 1996; Maltz, and Srivastava, 1997; Mason-Jones and Towill, 1998; Abernathy et al, 1999). This ability to manage the supply-chain allowed retailers to switch to customer demand-driven²² systems of replenishment (Smart, 1995; Winters, 1996; Fernie and Pierrel, 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 (Buck, 1990; Fernie 1997; Bourlakis, 1998), and the domination of the supply chain by retailers at the expense of manufacturing firms, who saw their distribution services decimated (Whiteoak, 1993).

The changes in supply chain management have created different forms of organization to that observed in the frozen food industry, leading to a system of IT co-ordinated inter-firm networks (see J. Sainsbury (1999b) for a technical look at the management of supplier chains). Using J. Sainsbury as a representative example, retailers were able to sell chilled

ready meals in small batches as a direct result of their control of the supply-chain. Having developed subcontracted distribution facilities during the 1970s, Sainsbury began to absorb this function directly into their own operations by building and managing their own RDCs during the 1990s. By moving their direct management backwards into the chain of logistics (Ferne and Sparks, 1998), Sainsbury 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. The move also enabled the company to contract directly the services of distribution companies allowing them to wrest control over the supply chain still further, often at the expense of the manufacturers who were obliged to relinquish some of their responsibilities (Cooper, Browne and Peters, 1994, p. 113). As a result, Sainsbury were 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.

More recently still, increasingly sophisticated information systems provided by customised inventory management software have allowed retailers such as Sainsbury to move still further towards the indirect control over the value-chain. The management of the distribution centres owned by Sainsbury 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 (warehouse) 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 organizational structure which actually constitutes a network of independent firms revolving around the hub played by the retailer's head office. In Sainsbury's terms, this arrangement represents the inverse of the concept of "hollowing-out", since it allows the company to maintain control over the critical system-wide information

whilst enabling them to relinquish direct responsibility for its management.²³ And whilst this arrangement requires the management of many times the number of discrete transactions that would be involved in conventional subcontracting, the costs of managing these transactions has been sharply reduced by the development of computerised information management systems: thus an integrated information network has begun to replace a corporate hierarchy as the efficient method of managing large numbers of discrete transactions in the Information Age.

Development through co-ordination

The pricing and positioning strategy adopted by Marks & Spencer towards the marketing of chilled ready meals saw them promoted as a substitute for restaurant food and, in particular, for take-away meals. The products therefore featured attractive packaging and were marketed as high quality premium priced products. Persuading its existing customers to purchase chilled ready meals does not seem to have posed significant problems for Marks & Spencer. The company had already developed a range of chilled products such as meat pies and quiches under its own St Michael brand name and expanding this range into full meals, or meal centres, was a logical step which required marketing only at point of sale. Indeed, rather than using advertising to inform customers about the new products, Marks & Spencer were far more concerned with the issue of obtaining information about the kind of products consumers would like to try; thus shifting from one-way to two-way product information flows. A proprietary chargecard scheme was introduced that enabled the company to obtain more detailed information relating to individual buying patterns and this group of customers were invited to special in-store events to allow the company further insights into current consumer trends.

As high value products, the success of chilled ready meals critically depended upon the continuous development of new product ranges and this, in turn, required the pooling together of widely distributed sources of knowledge. Sainsbury, who followed Marks & Spencer's lead into chilled ready meals during the late 1980s (Ferne and Pierrel, 1996), assembled new product development teams that included employees from food manufacturing and packaging companies as well as their own staff. These teams monitored purchasing patterns and studied eating trends in restaurants before using the information gained to innovate a new range of products.

Despite having no manufacturing capability of their own, British retailers have been able to compete head-to-head with branded manufacturers, such as Unilever (Ferne, 1997, p. 391; Ferne and Pierrel, 1996; Senker, 1986). In new product development (NPD), for example, British retailers are unique in having large internal departments of NPD and food technology and hygiene to develop products. Lacking direct access to manufacturing facilities, these teams developed products in collaboration with suppliers who were, perforce, obliged to absorb directly many of the costs incurred.

The chilled food manufacturing companies with whom Marks & Spencer and Sainsbury collaborated were generally not the earlier pioneers of frozen food, but mainly smaller firms who were able to engage in systems of batch production. For the retailer, the advantage of being able to utilise these small manufacturers is the rapid and flexible development of new products. For the manufacturer, meanwhile, the retailer can supply ideas as well as technical help and access to its network of specialists. This activity has produced specialist food companies who are essentially part of the supermarket sector's value chain.²⁴ For example, Noon Food Products is supplier of chilled Indian-style ready meals to Sainsbury (and other retailers) but does not undertake the branding, marketing or distribution of its products.

Despite this reliance upon their customers to undertake this function, Noon Food Products had generated annual sales of £25m (Key Note, 1998).

Together with companies supplying ingredients, these firms were given responsibility for developing new recipes for dishes that would be suitable for chilling and re-heating. Of particular importance in supporting the growth in demand for chilled ready meals was the rapid expansion in household ownership of microwave ovens. This had consequences not merely for the manufacture of ready meals, but also for the forms of packaging used. Indeed, innovation in packaging contributes the main element of propriety technology that has been instrumental in the development of chilled ready meals. Microwavable meals necessitated the development of containers featuring different degrees of “transparency” in terms of their ability to transmit, reflect and absorb microwaves. This led to the innovation of “active”²⁵ forms of packaging which are able to control or influence the effects of microwave heating. Thus new product development in the chilled ready meals segment has involved the formation of collaborative teams drawing on a wide range of information and knowledge. However, with access to the critical information on consumer purchasing patterns and control over the allocation of shelf space for products, it is the retailers who maintain leverage over the process of product development and it is they who stand to gain most from the flexibility to change suppliers which such collaborative, rather than formally integrated, systems of organization facilitate. This shift in power along the supply-chain reflects the ability of information rich retailers to identify and assimilate control over high value-adding activities. And unlike the food manufacturers, whose standardised products required large scale advertising support to launch, the food retailers were able to market their products directly and at low-cost in-store.

The ability of retailers such as Marks & Spencer, Sainsbury and Tesco to exploit the market for chilled ready meals on the strength of their own label brands has been an

important factor reinforcing the increasing relative strength of the multiple retailers over the food manufacturers (see Table 2). Indeed in the case of Tesco this emphasis on quality and high added value was instrumental in enabling the firm to drastically improve its market image during the 1990s. By 1997 the sales of chilled ready meals from these three large retailers made up 80 per cent of the total sales of such products, with Marks & Spencer alone accounting for 48 per cent (Key Note, 1998, Table 14).

Table 2: Relative Shares of the Ready-Meals Market

<u>Ready Meals Market</u>	<u>Market Share (%)</u>	
Frozen Ready Meals , of which:	53%	
Branded Manufacturers share of frozen market		80%
Retailer Own-Brand share of frozen market		20%
Chilled Ready Meals , of which:	47%	
Branded Manufacturers share of chilled market		5%
Retailer Own-Brand share of chilled market		95%

Note: One manufacturer (Birds Eye Walls Ltd) has 26% of the frozen market share. Three retailers (Marks & Spencer, J. Sainsbury and Tesco) account for 80% of the chilled market (48%: 16%: 16%).

Source: Table derived from figures in Ready Meals, Mintel, 1998.

The market for chilled ready meals illustrates with particular clarity the way in which more efficient systems of information management, resulting from the development of ICT, have raised the ability of retailers to exert control over the value chain in the food industry. However, unlike the earlier forms of control exercised by large manufacturers, based on vertically integrated organizational structures, the multiple retailers operate through management systems that take the form of inter-firm networks. This can be seen quite clearly in the case of new product development. Inter-firm collaboration takes the form of long term strategic alliances with companies whose core competencies are complementary to those of the retailers. The key consideration in this case resides in the mutual benefits that can be gained by all the participating firms through a process of ongoing collaboration. The inter-

firm alliance thus takes the form of multi-disciplinary teams whose common objective and continuous interaction help to facilitate mutual trust. However, the critical information which determines the commercial success of this collaborative process is the market-making role performed by the retailer and it is the control of this information that allows leverage over the network as a whole.

6. *Conclusion*

The technologies of the Second Industrial Revolution spawned and supported the development of mass production industries. One of the great strengths of Chandler's work lies in its recognition that these technological changes would most readily bear fruit if the vast increase in the volume of production occurring at the plant level were accompanied by organizational innovations in systems of management. The large scale American business enterprise constituted the institution through which this enhanced level of management could be brought into effect. Large firms played a variety of roles in the development of the American economy during the first half of the twentieth century. For example they marshalled together the capital investment required to support new technological breakthroughs and they formed the enterprises in which the art of management - and many modern business skills - could be disseminated to a wide body of new white collar workers.

In his book *The Visible Hand* (1977), Chandler places his emphasis on the role played by these large corporations in replacing the market mechanism as a means of economic co-ordination. Such a role was considered to be important whenever transactions costs acted to reduce the ability of the price mechanism to perform its co-ordinating role efficiently - a situation that arose whenever the quality of the market-based information flowing between economic agents was unreliable. Thus the administrative hierarchies of large business corporations arose as a response to problems of information within those industries whose

operations and output had been rapidly transformed by the process of technological change. However, it is clear that the transformations wrought by the Second Industrial Revolution did not only act to undermine the price mechanism by generating transactions costs, they also necessitated the formation of entirely new markets - or markets capable of transacting much larger volumes of business - both upstream and downstream from the production process. Management hierarchies were a successful innovation, at least in part, because they provided firms with the ability to generate and serve these new markets by creating specialised functional departments to deal with market and distribution type activities such as sales, purchasing, traffic and advertising. Thus rather than viewing the administrative hierarchies of large business enterprises purely as a substitute for the market mechanism, it is important to recognise also the role that firms played in facilitating the development of entirely new markets.

In his more recent work, Chandler (1992a; 1992b) has identified the limitations of Williamson's transaction-based approach in defining the essential nature of the firm, but has tended to place his emphasis on the physical and human asset base of the firm (i.e. the stock of firm-specific knowledge which the development of the modern industrial enterprise undoubtedly served to expand and which in turn enabled it to broaden the activities within its managerial compass). Where this revision fails to diverge fundamentally from Williamson's transaction cost approach is in the contention that firms and markets constitute alternative systems of resource allocation and co-ordination. Hence, Chandler (1992a, p. 489) argues merely that it is "the specific nature of the facilities and skills [of the firm that] are more important than bounded rationality and opportunism to the shaping of decisions as to internalising transactions and, therefore, in determining the boundaries between firm and market." In the Information Age, however, it is the role played by inter-firm networks in blurring the very boundary between firm and market itself that becomes the key feature

(Ebers, 1997). Now, firms and markets no longer stand in simple counterpoint to one another, but rather utilise mechanisms such as ICT systems and relational contracts to form quite different forms of corporate architecture (Kay, 1993). Some of these mechanisms, involving long-term trust relationships for example, hark back to earlier systems of economic co-ordination (Lane and Bachmann, 1998); those dependent upon the use of information management systems, by contrast, are purely a creation of Information Age technologies.

Viewing the primary economic function of the firm in a market economy as that of intermediation, following Casson (1997b), enables the question of transactions costs to be placed in the wider context of information management. Firms in the United States during the Industrial Age gathered information not merely concerning the systems of mass production that they pioneered, but also about the marketing channels that were needed to ally mass production with systems of mass distribution. Utilising this market-based information frequently required the firm to take responsibility for co-ordinating the various functions along the value chain and thus led in many industries to a process of vertical integration. However, such vertical integration would only endure if the new markets that had been created in this way could not be served efficiently by other firms or if the problems of transactions costs that arose from unreliable information flows could not be dealt with in some alternative fashion. If either of these two conditions broke down then the industry was liable to experience a subsequent period of vertical disintegration.

In the case of frozen food the impact of technical innovation occurred at the production stage and required corresponding changes in the provision of raw materials, in the systems of distribution, wholesaling and retailing, and in the patterns of household consumption. The creation of these various new markets was therefore a prerequisite for the successful exploitation of the technology of quick freezing. Unilever and its subsidiary companies were well placed to co-ordinate the flows of information needed to effect these new processes of

market intermediation. Once the new production technology had been successfully established, however, opportunities arose for this process of intermediation to be undertaken by other actors operating at different stages of the vertical chain. In particular, during the 1960s and 1970s the multiple retailers were able to alter the mix of information that reached the final consumer by adding their own label products to the range of proprietary brands manufactured by the large food processors and, by such means, gain increasing influence over the information flows that operated within the industry as a whole.

The position of the retailers was further strengthened by the technical innovations that ushered in the Information Age. Enhanced systems of information management gave retailers who invested in the appropriate technology far greater control over the process of inventory management and allowed them to introduce products featuring much shorter shelf lives such as in the case of chilled ready meals. With improved systems of stock management and easier access to current consumer buying patterns and eating trends, retailers were also able to initiate a process of continuous product innovation by pooling knowledge with food manufacturers and packaging companies through the use of strategic alliances featuring multi-disciplinary teams. Competitive advantage in the chilled ready meals sector has been gained less through technical advances in the process of production, and more by retailers' ability to manage the co-ordination of their supply chain, even when competitors have access to the same suppliers and contractors. The successful innovation of chilled ready meals depended on the information management facilities that arose as a result of the ICT revolution, but it did not require large investments in the creation of new markets. Rather, it had the effect of changing the nature of the existing processes of intermediation that retailers previously engaged in. Increasing use of ICT enabled the outsourcing of the management services in warehousing and logistics but without sacrificing control over the information flows that stemmed from them. It also encouraged increasingly collaborative links with

complementary firms within the vertical value-adding chain to allow pooling of complementary sources of knowledge to take place which, whilst it operated to the mutual benefit of all the parties involved, did not oblige retailers to surrender the critical information regarding patterns of consumer demand. And, crucially, ICT supported a shift from one-way to two-way processes of information exchange with customers, allowing future purchasing trends to be anticipated and accommodated.

Although the chilled-ready meals market is primarily a British phenomenon - and the UK grocery retail market clearly exhibits distinctive national characteristics (Morelli, 1998b) - there are two factors which make a study of the market more generally relevant. First, the relationships described in the chilled-ready meals sector are to some degree being replicated abroad by the firms in the UK case study. Sainsbury, for example, through control of the US east coast retailer Shaw's,²⁶ is attempting to leverage its competitive advantage through supplier relations, own-brand development and centralised supply-chain and inventory control. In 2000, Shaw's own brand accounted for 40% of turnover,²⁷ and ready-cooked meals and prepared foods have also been successfully introduced into the market.²⁸ Second, the third-party contractors who have been instrumental in pioneering the U.K. supply chain developments (Fernie, 1995), such as Excel, BOC, Christian Salvesen and Tibbet & Britten (formerly SPD) are rolling-out the technology of ICT supply-chain management into the European and US fast-moving consumer-goods markets. Offering their services as logistics chain managers, these companies enable firms without sophisticated ICT capabilities to join the supplier-chain and hence the infrastructure supporting the relationships described in this paper, both in terms of control and innovation networks, is in the process of becoming more generalised.

In summary, therefore, the transformation of production processes that occurred across a range of manufacturing industries during the Industrial Age generated new and more complex

requirements for the processes of intermediation as well as for the production systems themselves. The development of hierarchical organizations provided firms with the ability to oversee directly many of these new tasks and to create the markets that supported them. In contrast, the advent of the Information Age has tended not so much to require the creation of markets *de novo* but has rather altered the nature of existing relationships of intermediation in ways that have facilitated a much wider collection of organizational forms.

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Notes

¹ Our analysis of the frozen food industry is developed from primary and secondary sources, as referenced. The contemporary study of the chilled food industry has been informed by a series of semi-structured interviews from actors along the value chain, (including retailer new product development managers, retailer logistics managers, third-party logistics contractor managers and trade association officials with a global overview of the industry). Due to the closely-knit nature of the UK food industry, several actors interviewed also had previous experience with manufacturing companies. Interlocking testimony was used to maximise the data from the actors interviewed. The interviews were important to examine in detail the operation of network linkages within the chilled ready-meals. Interview material was supplemented by a study of the available literature and industry information from public sources. Owing to the confidential and sensitive nature of information in the grocery-retail and supplier sectors, our industry sources have not been attributed directly.

² See Casson and Cox (1997) for an examination of how the process of intermediation contributes to an economic theory of networks.

³ Other writers, cf. Fransman (1998), have also noted that the Coasian approach to the firm is one based essentially on information problems and have contrasted this with approaches originating in the work of Nelson and Winter (1982) which view the firm as a repository of knowledge.

⁴ A subsidiary of General Foods, the Frosted Foods Company Inc., had first set up a British operation in June 1938 and two months later this subsidiary set up Birds Eye Food Ltd. Unilever's interest in the operation began in 1943 when it acquired shares in the British registered Frosted Foods Ltd. In 1951 Unilever became the majority shareholder in Birds Eye, and full ownership was achieved in 1957 (Monopolies and Mergers Commission, 1976, p. 21-2).

⁵ The advantages of managerial economies of scope, and the persistence of these functional divisions in Unilever has been outlined by Maljers (1992).

⁶ Eventually direct control over the provision of chicken and fish was abandoned as overproduction and falling prices during the late 1960s and early 1970s made such investments uneconomical.

⁷ Seed was supplied to ensure standardisation and for quality control. The arrangement also ensured exclusivity for Birds Eye, and meant that this activity was essentially quasi-integrated into the Unilever structure. The response of growers was to form committees such as the Processed Vegetable Growers Association to negotiate with Unilever on their behalf.

⁸ SPD (Speedy, Prompt Delivery) was developed from the acquisition and development of several contract haulage firms. In 1984 Unilever decided to divest itself of its logistics division, and John Harvey Jones (who had been instrumental to the acquisition of Tibbet and Britten into the group in 1969) led a management buyout of the group to become the Tibbet and Britten Group (T&B).

⁹ The standards for refrigerated storage in retail were agreed in 1953, (F&CF, 1998).

¹⁰ Large retailers, such as J. Sainsbury, were quick to begin to develop their own refrigerated cabinets in order to display a larger selection of stock (Bridget Williams, Sainsbury's Archivist, personal correspondence). This capacity eventually led to the ability of retailers to offer own-brand products, as discussed in the main text.

¹¹ It was estimated that by 1973 Salvesen's freezing capacity amounted to around one-third that of Birds Eye. (Monopolies and Mergers Commission, 1976, p. 14).

¹² In 1961 multiple retailers with 10 or more stores accounted for 26.9 per cent of grocery retail sales in the United Kingdom; by 1971 their share had risen to 44.3 per cent. (Morelli, 1998a, Table 1).

¹³ Although Birds Eye did re-label products for the generic (unbranded) market (F&CF, 1998).

¹⁴ The first own-label frozen food produced for retailers own brands was frozen fish, supplied by Ross (then a marginal manufacturer in Frozen foods) in 1957 (F&CF, 1998, p. 13).

¹⁵ The position of own-brands within the UK market, as high quality / high value products, has been seen as a key factor in explaining the different profit structures within UK grocery retail. For an examination of international retail margins see Fernie and Pierrel (1996) and Burt and Sparks (1997). The Office of Fair Trading has examined the profitability of UK retailers (Graham and Steele, 1997) and Morelli (1999) makes some suggestions as to the welfare considerations. Despite the British sector being more developed, the drivers in the food processing sector are acknowledged to be similar in the European and North American markets (Keh and Park, 1997; Kumar, 1997; Geulph Food Technology, 1999) making the examples based on the UK experience especially interesting.

¹⁶ The frozen food market is still dominated by the 'big four' companies, all subsidiaries of multinational firms; Birds Eye Walls Ltd, Nestlé Holdings (UK), Ross Youngs and HJ Heinz Company Ltd UK. In the high value-added frozen ready meals segment, for example, Birds Eye has the majority share with 26 per cent of the market (Key Note, 1998, p. 20).

¹⁷ This was despite attempts by Birds Eye to improve the perceived quality of ready meals by introducing the Menumaster range in the 1980s (Key Note, 1998, p. 12). The Menumaster range was originally introduced

for caterers in 1976 (F&CF, 1998, p. 34), reinforcing the link between the frozen catering and customer frozen foods divisions in Birds Eye, and shows how developments in catering filtered through to the development of consumer products.

¹⁸ Unlike Unilever, who actively supported the introduction of freezer technology in an attempt to enable consumers to participate in the frozen food market, Marks and Spencer merely sought to exploit existing but unsatisfied demand.

¹⁹ Sainsbury contracted out the operation of its RDCs “lock stock and barrel” in the 1970s for two primary reasons. First, the period was one of organised labour unrest, and with inflationary pressures on wages increasing industrial action, contracting out removed Sainsbury from labour management problems in distribution. Second, the period was one where Sainsbury (and the other large retailers) were using their resources to expand the number of outlets and geographic spread.

²⁰ Very small crate-based deliveries (rather than pallets) can be made by manufacturers to PCCs. Crates can accommodate partial boxes, ideal for the delivery of very short shelf-life low-volume products such as ready meals. The efficiency therefore does not come from standardised delivery and economies of scale, but in accurately matching short-run supply and demand.

²¹ The development of these generic IT systems was co-ordinated 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.

²² Information as to customer buying patterns and trends is gathered from store data and loyalty card information. Data warehousing is becoming common in the late 1990s, as retailers continue to gather information as to the buying patterns of consumers. Data mining technologies allow them to develop bundles of products and promotions to exploit consumer demand (Harvey, 2000). The retailers use this knowledge for product development. They are 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.

²³ In order to check the performance of subcontracted services, retailers maintain some fully owned logistics support services to facilitate benchmarking, and to reduce the negotiating power of the subcontractors further (Chaplen, and Wignall, 1997).

²⁴ Currently the chilled ready meals manufacture sector is comprised of over 180 firms, ranging from a few large companies such as Northern Foods and Hazlewood, to micro-kitchens employing less than five people. Grocer (1997).

²⁵ The importance of packaging in the chilled pre-cooked foods sector emphasises the hygiene issues which play an important part in the development of the product (Chilled Food Association, personal correspondence). Products which include many ingredients, with differing heating characteristics, and may be either heated by oven or microwave, present specific risks. Thus the development the correct form of dual-ovenable (suitable for conventional gas, electric and fan ovens as well as microwaves) modified atmosphere packaging is critical (Key Note, 1998). Packaging must be co-ordinated not only with the food processor, but with the retailer, who will use the packaging as part of their generic own brand marketing strategy.

²⁶ In 1983 Sainsbury acquired a 20% stake in Shaw’s, and then a controlling interest in 1987. Since then it has acquired several smaller regional supermarket groups, and the Star Markets group in 1999. Consolidating the acquisitions into the Shaw’s group and brand, Shaw’s is at present the second largest food retailer in New England, with 168 stores.

²⁷ Shaw’s has some 5,000 own-brand products. Shaw’s profits have increased from £41m in 1997 to £80m in 2000. J Sainsbury (2000).

²⁸ Chilled ready-meals themselves have not so far been as successful in the US market. Despite this, the collaborative arrangements described in the paper are important in developing high quality convenience food more suitable for the US market.