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The rise of the Swedish food sector after WW II- What, why, how and who?

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This work is more or less Gunilla's fault; Gunilla being Professor Gunilla Jönsson and long time friend from Chalmers. If she had not that evening, spring 2000, suggested that I should do something about my previous experience in food and packaging, I would have continued to study other topics on distance, living in Munich. As it turned out, I started as a PhD student at Packaging Logistics at LTH with Gunilla as one of my supervisors and Professor Thomas Ohlsson at SIK as the other. To both of you, my sincere thanks for your patience, trust, comments and many interesting discussions.

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Lund in September 2006

Abstract

Very little radical or really new innovation within the food sector in Sweden is visible today, although the stores are jammed with food in a variety of packages, designs and sizes and under different brands. Most products appear to be based on technologies introduced years ago, and the diversification consists mainly of line extensions, i.e. incremental development. It looked different after the Second World War, when a number of really new food products, technologies and concepts were introduced into the heavily protected and regulated Swedish market.

This research aims to eliminate a gap of knowledge about *What, Why, How* and *Who* in connection with radical or really new innovations in the post-war Swedish food sector - driving forces, involved parties, collaboration, individual contributions, etc. - and to consider whether this knowledge can be of use today, not only in Sweden but in a more general context.

Two groups of experienced people from the food sector were interviewed. One focused on the major innovations, and the other set out to further explore the information from the first group to be able to explain and interpret the why, how and who.

All members of the first group suggested frozen food as the major innovation, followed by self-service and chilled/fresh products, and the second group confirmed this. Frozen food offered something new and better tasting, and a variety of products; the whole concept was unique and the timing was right. The main driving force was the same as for canned food - longer shelf life and convenience - but frozen food required special distribution all the way from producers to consumers and a considerable amount of information. Both frozen food and self-service required suitable packaging and logistics, which had to be developed by a number of companies, that emerged to deal with the task.

Packaging was hardly mentioned as being of major importance, and yet a number of originally Swedish packaging companies have become quite successful internationally. The interviewees did not see packaging development as a special issue, as packaging was developed along with the food. But much of the development in the food sector is to be found in packaging, and hence this development and the driving forces behind packaging were particularly analysed. Driving forces for the packaging development may come from many sources, e.g. new technologies and products/concepts, new consumer or retail demands, legal aspects and changes in society etc. But a new packaging system might also drive new food product applications, once the system has proven itself.

The good collaboration among companies, individuals, and actors in the supply chain stood out as a very positive factor. The food sector in Sweden in the 1940s-60s contained many of the factors mentioned by Porter in his “diamond”, illustrating “the competitive advantages of nations”. The collaboration took place in the form of a network, with the Frozen Food Institute as the spider in the web, and in a cluster, spontaneously formed in southern Sweden. Many enthusiastic individuals, here called “Edisons”, participated in the network. They could contribute in their concrete functions in an organisation but doing more than just their jobs, or they could be

active from the outside. Such a broad participation in a similar innovation has, to our knowledge, not been described before in the literature. People involved themselves, as they really wanted to see this development through, offering obvious advantages to the consumers. With this case as an example, this is where a chance of success starts, with a good enough idea, attracting people from various competences (including people from the outside) and forming a group, in a cluster and/or network and working together. Radical innovations cannot be organised by imposing a cluster as a result of economic development policies or on demand, but require a climate for new thinking and motivation, that is not primarily based on monetary compensation.

In conclusion, we might learn from this study that

- networks as for frozen food could be used to establish other technologies, as were suggested for chilled food in Sweden and found in the UK.
- clusters increase knowledge and collaboration and the one formed around frozen food, a “bottom-up” initiative, worked very well. Other successful examples are to be found throughout the world.
- the “Edison” experience could be an example for developing and introducing other innovations, involving and motivating a wider range of people, also from the outside, including marketing and media and other opinion leaders and from an early stage of development.

Key words: Frozen food, self-service, cluster, network, individuals.

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1 Introduction

A modern food store today appears jammed with food products in a variety of packages, designs and sizes and under different brands. Still, on closer inspection, most products appear to be based on food technologies introduced years ago. In the 1960s, when I started to work in the Swedish food industry, food producers were bursting with enthusiasm and optimism; new products were developed, launched and accepted by consumers that were eager for increased convenience and trusting the industry. Investments were made in developing radical or really new products, either new concepts and/or new technologies, such as frozen food, baby food (dry and canned), mayonnaise, soups (Throne- Holst, 1973; Winnerljung, 1991)) in spite of the rather limited market; in 1966 there were only between 7 and 8 million inhabitants in Sweden. The producers more or less decided what to produce - and preferably during whole shifts to keep costs of production down - and what was produced could usually be sold. Less attention was given to the costs of storage and the whole supply chain.

Today many new products that are introduced by retailers in Sweden are based on incremental development, e.g. line extensions, and often copy competitive best sellers. This is contradictory to the situation in, for instance, the UK, where retailers introduce new products based on their own innovative technologies (Ferne & Pierrel, 1996). Swedish retailers have taken a number of initiatives in other fields, e.g. more efficiently organising and running their business and increasing collaboration across borders etc., when the power in the supply chain was gradually transferred from producers to retailers (Forsberg, 1998; Hollingsworth, 2004), in parallel with an increasing use of IT- based tools. This IT-development has occurred all over Europe and has given retailers access to and control over the information about the purchasing habits and preferences of consumers. Consequently food producers in Sweden today are less well informed about consumers than retailers and do not seem to invest much in their own new technology either, resulting in few really new food innovations visible on the market, apart from new packaging.

The rise of the Swedish food sector started earlier, taking off directly after the 2nd World War, and was made possible by applying innovations from technologies/inventions that had diffused into society over many years, e.g. a wider distribution of electricity into homes and new means of transportation such as cars and airplanes (Schön, 2000). The inspiration for the development of the food sector came from the US, where this sector had developed before the war with self-service stores filled with packed goods like cans, frozen food, milk cartons etc. (Goldblith, 1989). At the same time most food was sold unpacked in Sweden, by weight or volume in shops of country-store type or speciality shops, even though the packaging industry for consumer goods had begun on a small scale. The food industry consisted mainly of sugar refineries, mills, slaughterhouses, margarine industries, chocolate and confectionery and some fruit canning. The embryos of today's modern retailing and wholesale had started much earlier; KF, the co-operative, was founded in 1899 (Giertz & Strömberg, 1999) and ICA, the other major retailer and wholesaler, dates back to 1917 (Wirsäll & Fahlin, 1997).

After the war the food sector expanded, and most of the food products available were produced in the country as the market was heavily regulated and imports and exports of many foods/ingredients were prohibitively expensive. This regulated market might be one reason why many new products were developed and tested, as the risk of competition from the outside was small. In fact the agricultural/food market was protected until 1995, with the exception of bakery, chocolate and confectionery and fish products, which were protected until 1973 (Gabrielsson,

1992). In 1995, when Sweden became a member of the EU, the food industry was the 2nd industrial sector in production value and the 3rd in number of employees, and it was claimed that about 80 % of the Swedish food production was not exposed to international competition (SOU, 1997)!

Since Sweden did not take part in the war, it had an intact infrastructure, a good economy and a great deal of optimism after the war, and the industry could start to expand. The changes were not only industrial, but the society changed as well. As Earle points out “Innovations in the food industry combine technical innovation with social and cultural innovation. It occurs throughout the entire food system, including production, harvesting, primary and secondary processing, manufacturing and distribution” (Earle, 1997). Information gathered about some aspects of the development of the Swedish society in relation to food, packaging/logistics and trade from the 1940s until today is compiled in Appendix A, but with no claim to completeness.

In the food sector in Sweden today some entrepreneurial companies have emerged, developing for instance functional food/ingredients; this is a niche market with legal difficulties regarding claims and marketing that often places new demands on packaging as well. Apart from that development and judging by what is launched on the market, little radical or really new technology/product development – as opposed to incremental development - seems to be in process (Langevik, Sjöholm, Lareke & Östberg, 2003). Part of the explanation could be distrust among consumers towards “unproven” new technologies and products, partly as a consequence of a number of food scandals in Europe but also as a “biological reflex” (Ferrières, 2006). Food insecurity, i.e. the fear of food shortage and misgivings about food quality and health aspects, is part of our historical inheritance (Ferrières, 2006). Those aspects are still valid when new technologies, products, packaging and processes are introduced in order to make safer and healthier food available.

The question is: what might we learn today about innovations by studying the development from 1945 and onwards?

1.1 Purpose and research questions

The purpose of this study was to

- *identify and describe the factors and reasons behind the growing Swedish food sector after the war and particularly those underlying the major innovations*
- and to
- *identify possible ways to proceed today in developing radical or really new technologies and food products, to launch them on the market and be accepted by the consumers*
- by comparing the Swedish food sector now and then.

The research issues were to find and analyse the answers to the following questions regarding the period from 1945 until today:

- **What** were the major innovations/events behind the growth of the Swedish food sector after 1945?
- **Why** did these major innovations occur and what were the underlying driving forces?
- **How** was the innovative work carried out?
- **Who** became involved in and contributed to the development?
- **What** can we learn today?

1.2 Demarcations

The object of study in this thesis was the Swedish consumer food sector from 1945 until today, excluding the beverage sector and food service. The actors in the consumer food supply chain that were included are: packaging and equipment suppliers, food producers, distributors, the trade and the consumers. The agricultural development is not included, except as suppliers to the food industry. The development of packaging and the driving forces behind it were given special attention, as much of the development in the food sector is seen in packaging.

1.3 The research process

The outline of the work was:

What?	Why?	How?	Who?
Literature study 1 st group interviews			
	2 nd interviews		
	Literature study	Literature study	Literature study
Paper 1: Development of successful food packaging and logistics in Sweden since 1945	Paper 2: Driving forces for food packaging development in Sweden- a historical perspective	Paper 3: Clusters/networks promote food innovations	Paper 4: “Edisons” contribute to innovations
In <i>Logistics Research Network 2004 Conference Proceedings 2004</i> , pp.58-66	In <i>IUFoST 2005</i> , www.worldfoodscience.org	Accepted for publication in <i>Journal of Food Engineering</i> 2006	Submitted to <i>European Journal of Innovation Management</i>

1.4 Outline of the thesis

Chapter 1 - Introduction

An overview of the Swedish food sector after 1945 and the area of research are supplied and the purpose and research questions presented. In addition the demarcations as well as the research process are described, including titles and where the four appended papers fit into the research process.

Chapter 2 - Methodology

This chapter presents the approach and the research strategy chosen and continues with a description of how the methodology developed in order to find the answers to the following research questions: What?, Why?, How? and Who? My background as a researcher is also described.

Chapter 3 - Frame of reference

The area of research is the food sector. Hence this sector and the different ranges of food, mentioned in this study, are described. In addition a brief overview of different ways to preserve food is included, as those are touched upon in the later discussion. “Packaging”, “food supply chain and logistics” are defined, as they are essential parts of the food sector. Then follow definitions and descriptions of innovations generally and food innovations in particular, and a brief overview of the European food industry. The chapter ends with a short discussion of how this research is intended to fill a knowledge gap.

Chapter 4 – Summary of appended papers

The four appended papers, each elaborating on one of the four first research questions posed, are summarised in a sequence, with the paper on one question leading over to the next.

Chapter 5 - Analysis

After the papers discussing the research questions, these are further analysed, including the last question: “What can we learn from the past?” At the end of the chapter the possibilities of generalising the results are discussed.

Chapter 6 - Conclusions

The conclusions drawn on the basis of the study are summarised.

Chapter 7 - Future research

In this chapter areas of further interest to investigate are summarised as questions.

Chapter 8 - References

Chapter 9 - Appended papers

Chapter 10 - Appendices

A: Some important developments in the Swedish food sector and the Swedish society, compiled during interviews and literature studies

B: Participants in the interviews, their names and areas of major experience in the food context

C: Findus/Nordreco - an example of an innovative working climate in the 1960s and 70s.

2 Methodology

The food sector, regarded as a system interacting with the outside society, has been studied. The system approach is based on the assumption that reality as a whole is more than the sum of its parts and that reality is (more or less) objectively available (Holme & Solvang, 1986; Arbnor & Bjerke, 1994). The modern system thinking looks at an organisation as a social system with its own culture and ability to learn and grow in internal development/maturity (Arbnor & Bjerke, 1994).

Within the systems thinking one may for instance look for different driving forces that influence the whole system, positively or negatively. The actions of individuals are seen as the result of the system but are oriented towards maintaining or improving the system.

In order to find the answers to the research questions presented above a strategy had to be chosen. The period to be studied started in 1945, directly after the Second World War, and if it were considered totally historical, the chosen strategy would have been to collect historical data and study the relevant literature, a so-called archival analysis. But as the period starting in 1945 is almost contemporary and knowledgeable people could be found who have been involved or been directly in contact with those really involved from 1945, data could be collected by interviews alongside of literature studies. The emphasis came to be placed on the period from around 1945 up to around 1980 1990. From there on more secondary data and opinions were expressed, partly due to the age of the interviewees and their active time in the food sector and partly due to the difficulty to have a perspective of events close in time.

An alternative to interviews might have been to start with a survey, but a limited number of people to ask were available and the intention was to obtain people's individual opinions in the context of the food sector in its widest sense: food, processing, packaging, distribution, trade, society...

Consequently the data collection consisted of open-ended interviews (Yin, 2003) and literature studies, i.e. qualitative research. Qualitative research is characterised as "multimethod in focus, involving an interpretative, naturalistic approach to its subject matter" (Denzin & Lincoln, 1998). This implies collecting a variety of empirical material and trying to make sense of it, interpreting it in terms of the meaning people bring to it (Denzin & Lincoln, 1998). The alternative is quantitative research, aiming for precision, measurement, broader information and out of the natural context (Holme & Solvang, 1986), which is not the purpose of this study whose aim is to explore, explain and understand what happened, why etc. in the context of the food sector.

The work progressed according to a funnel model, first identifying a number of innovations and events, then selecting the major ones for in-depth studies and then going further into specific issues found in the results. As much of the visible development in the food sector may be observed in packaging development (Ettlie, 1983), this was particularly studied in connection with the major innovations.

My background as an interviewer is that I worked at Nordreco (one of Nestlé's R&D centres at the time) with product development for AB Findus in Sweden from 1966 until 1981, when I left for Nestlé in Switzerland. At that point I was responsible for the development of all non-frozen products for AB Findus in Sweden, where many non-frozen products were more profitable than frozen food. Like most employees working for Findus at that time, I feel very strongly for the company as it was, for the climate for development and collaboration etc. (This climate and the way of working in the 1960s are described in greater detail in Appendix C). From

1983 (starting as a consultant) I worked for Tetra Pak, a very innovative company in packaging and packaging system development, and with some food processing from 1991, when Alfa Laval was acquired. Due to this I have more knowledge about Tetra Pak than about other packaging companies, as can be seen in the information compiled in Appendix A.

2.1 What were the major innovations/events behind the growth of the Swedish food sector after 1945?

The first step was an exploratory study to find out what happened of major importance to the food sector and in the surrounding society. Open-ended interviews (Yin, 2003) were carried out with a group of eleven persons, Group 1, who were selected because of their knowledge, overview and wide and long experience in the food industry, packaging science and development, food processing, logistics or retailing in Sweden, their availability and their international outlook. With these criteria of selection, the ages of the participants in the interviews became rather high, around sixty years or higher. The selection was based on the knowledge and previous experience of the researcher and the supervisors. The names and the different backgrounds of the interviewees are described in Appendix B. All those approached for an interview accepted and offered a generous amount of time and knowledge.

The main question was: ***What were the major innovations/events and changes behind the growth of the food sector (in its widest sense) in Sweden after 1945 and until today?***

The interviewees had to volunteer an answer, which could contain several innovations or major events in society. The answers were followed up with additional questions, e.g. Why do you consider this important?, How did the innovation/event develop?, Where did it come from?, About when did it occur?, What were the driving forces behind it?, Who contributed? and Why did it happen? The answers were then grouped into topics, so that if an innovation/event was mentioned by a respondent as a major innovation or event it was counted as one “vote”. Hence each topic was assigned a number, which can be regarded as an indication but not as a quantitative measurement, as the participants were not selected at random and were not evenly distributed among the actors in the supply chain.

Before and during the interviews the literature was consulted and studied, in particular the development of the Swedish food sector; food and packaging industries, the trade, distribution etc. as well as their history and influences from other areas of society. Most of the information found at this first stage was in Swedish and written by the companies/organisations themselves or commissioned and approved by them. This does not mean that the information is not correct, but that it has to be compared and validated against what was learnt from the interviews and from different literature sources. This comparison between data from the various interviews and literature studies was carried out throughout the study, a so-called “integration of data” (Moran-Ellis et al, 2006) in order to increase validity.

The answers from the first group gave clear indications about ***What*** happened and what was considered important as well as ideas about why, how etc., (Paper 1) but in order to answer the other research questions more detailed information was needed.

2.2 Why did these major innovations occur and what were the underlying driving forces?

An additional group of eight persons were selected on the basis of suggestions from the first group or were identified when analysing the answers supplied by the first group; a kind of “snowball” sampling (StatPac, 2006). This is a technique used for recruiting future subjects difficult for the researcher to access and is often criticised for including biases that one should be aware of. The participants in the second group were more specialised than those in the first group, but otherwise they had a similar background and were of the same age. Their names and backgrounds are described in Appendix B, Group 2.

The respondents in the second group were asked more specific but still open-ended questions, particularly about what really happened, how and why, the key persons involved etc. At the beginning they were informed about the major results from the first group and asked if they agreed or had other proposals. Then the focus was placed on the major events and further and deeper exploration. Examples of such further exploration were to discuss packaging and the underlying driving forces more in-depth, to recheck the names of persons and functions notably involved in the major innovations and mentioned by the first group and to ask for other suggestions and information about the collaboration among the companies and individuals involved (see Paper 2).

The literature study at this stage focused on the main innovations that had been mentioned, their background and implications for Sweden and the international outlook.

Two issues of particular interest became more evident after the two series of interviews, namely, ***How*** was the innovative work carried out and ***Who*** was contributing.

2.3 How was the innovative work carried out?

The research strategy was to initially explore what happened and then to gain a deeper insight into and understanding of the various parts of the system, i.e. to interpret. The interpretation of the real meaning of a text, either in terms of an article or originating from an interview, can be characterised by a process, a hermeneutic circle (Kvale, 1997). Understanding is reached via a process whereby the interpretation takes place as an interplay between the parts and the whole and ends up in practise - nevertheless it may go on infinitely - when a reasonable meaning is reached, free of inner contradictions (Kvale, 1997).

In the interviews the collaboration between the different companies that became involved and the individuals was mentioned as an important factor. The way it seems to have taken place was compared with references in the literature studied. Topics like networks, clusters and other forms of collaboration had to be investigated and evaluated against our findings. This is described in Paper 3.

2.4 Who became involved in and contributed to the development?

In the interviews the names and functions of certain people and stories about their achievements kept coming up. It was not necessarily the leaders, but many others who seemed to have made extraordinary efforts, that were mentioned. These individuals, who contributed to the major innovations and the development and acceptance of the new products, as well as their functions and positions, had to be further investigated and compared with literature data about development and innovation and in other countries. Some of them appear to have fulfilled roles and functions similar to those of champions, gatekeepers etc. as described in the literature. Different types of

people will fulfil each role, and one person might fulfil more than one role (Craig & Hart, 1992), but usually different people are involved (Rice et al, 1998). A “champion” is most commonly mentioned as a key person for development and tends to diversify into several roles. Other examples of names/roles in a project are: “gatekeeper”, “business innovator”, “technical innovator”, “user champion” and “sponsor”. In conclusion, a variety of roles and individuals are needed in innovation projects, irrespective of these denominations, and this issue is discussed in greater detail in Paper 4.

3 Frame of reference

3.1 The food sector

By “food sector” is generally meant the primary production, i.e. agricultural raw material and other inputs, the industrial production of food products and distribution thereof. It also includes restaurants, catering, machinery for agricultural and industrial purposes, packaging for the food industry and transports of raw materials and finished products (SOU, 1997). In this study food service and beverages are excluded, whereas milk is regarded as a food.

Canned food is food preserved by canning. “Canning is a method of preserving food by first heating it to a temperature that destroys contaminating micro-organisms, and then sealing it in air-tight jars or cans. Because of the danger of botulism, the only safe method of canning most foods is under conditions of both high heat and pressure, normally at temperatures of “ 116-121 degrees Celsius (Wikipedia encyclopedia, 2006).

“Frozen food” is “deep frozen food”, or “quick frozen food” as it is often called in the US, in appropriate packaging, at set and controlled temperatures (below minus 18 degrees Celsius in the stores and lower during distribution and longer shelf life) all the way to the consumer (Svenska Kyltekniska Föreningen, 2000).

“Chilled food” here mainly refers to chilled prepared food, which started to become popular in the 1980s/90s, and which should be stored at a maximum of plus 8 degrees Celsius (Svenska Kyltekniska Föreningen, 2000), according to Swedish law.

“Functional food” is one of the few growing sectors of new food products and aims to maintain people’s health, improve their well-being and create the conditions for reducing the risk of disease (Heasman & Mellentin, 2001). Heasman & Mellentin refer to the following definition of “functional food” provided by the American Dietetic Association (1995): “any modified food or food ingredient that may provide a health benefit beyond the traditional nutrients it contains”, but they also conclude “that currently there is no legal definition for functional food, beverage or nutraceutical in Europe or in the US”. “Nutraceuticals” are defined by the Nutraceuticals Institute (1998) as “naturally derived bioactive compounds that are found in foods, dietary supplements and herbal products, and have health promoting, disease preventing, or medical properties”.

In Europe the following “definition” by ILSI Europe (Asp, 2006) is commonly used: “A food can be regarded as “functional” if it is satisfactorily demonstrated to affect beneficially one or more target functions in the body, beyond adequate nutritional effects in a way which is relevant to either an improved state of health and well-being and/or the reduction of risk of disease.” Or, in the words of N.- G. Asp, “a functional food is a food with health claims” (Asp, 2006).

The above “definitions”/explanations may suggest that “ordinary” food is not functional and does not maintain health, which has caused a large number of controversies about claims and denominations around the world, including Sweden. Nevertheless a whole range of traditional foods are now being marketed on the basis of their health-promoting properties, which has given the producers an opportunity to increase their profit by larger margins than for ordinary food and hence fuelled the debate about functional food even more.

3.2 Food preservation

It goes without saying that food must be safe at the moment of consumption. As most of us rely on the food offered in the stores, much of it has been preserved or protected in some way to have

an acceptable shelf life. Spoilage of the food or food ingredient at the moment of consumption may occur at any stage in the chain from raw material to finished product.

A wide range of preservation techniques aim to prevent or inhibit microbiological growth, such as conserving, freezing, drying, curing, chilling, vacuum packing, modified atmosphere packing, acidifying, fermenting and adding preservatives, whereas others, e.g. pasteurisation, sterilisation and irradiation, aim to inactivate micro organisms (Gould, 1996).

The major preservation techniques to prevent or delay spoilage are, according to Gould (1996): reduction in temperature (i.e. refrigeration), reduction in pH, reduction in water activity and the application of heat. There is a trend towards technologies that deliver less preserved products of a higher quality and appear more natural. In order to achieve that, a combination of technologies, so-called “hurdle” technology, is needed, e.g. refrigeration and/or pH in combination with less heat treatment (Gould, 1996). The hurdle technology involves adding and balancing the different effects of the treatments and is very often used in combination with refrigeration.

Some emerging technologies like high pressure processing and pulsed electric field may inactivate only some bacteria which are then prevented from growing by refrigeration, but the product shelf life might be limited, not by bacterial activity but by enzymes surviving the treatment and destroying the product.

3.3 Packaging

In this study the following definition by Saghir (2002) is used:

“Packaging is a coordinated system of preparing goods for safe, efficient and effective handling, transport, distribution, storage, retailing, consumption and recovery, reuse or disposal combined with maximising consumer value, sales and hence profit.”

Packaging may be primary (in product contact), secondary, tertiary etc depending on its use and function in the supply chain. These functions may vary (Jönson, 2000):

- *logistical*: to facilitate distribution, to protect product and the environment and to provide information
- *marketing*: graphic design and format, legislative demands and marketing, customer requirements/consumer convenience for end use as well as distribution
- *environmental*: recovery/recycling, dematerialisation, one-way vs. reusable, toxicity

The most important technical function of food packaging is the preservation of food safety, which should never be an issue for the consumers. Consumers often choose a certain product because of the attractiveness and functionality of the packaging. The packaging was called “The Silent Salesman” already in the early 1900s (Downes, 1989), indicating the vital role of packaging in the marketing of products (Paine, 2002; Olsmats, 2002).

In food contexts one often talks about a “packaging system”, usually referring to the primary packaging and the filling operation as one system. Value could be added by looking at the integral system of packaging and product as a system and from the customer perspective (Olsson, 2005).

3.4 Supply chain and logistics

A “supply chain” may be described as: “A set of more companies directly linked by one or more of the upstream and downstream flows of products, services, finances, and information from a source to a customer”(Mentzer et al, 2001).

“Logistics” is defined as “that part of the supply chain process that plans, implements, and controls the efficient flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers’ requirements” by CLM, Council of Logistics Management, (Keebler, Durtsche, Manrod & Ledyard, 1999). In other words, it involves the right products at the right time at the right place and full information along the line. The start of modern logistics for food was the distribution of dairy products that was handled by the dairies themselves (in the case of Sweden), but when frozen food appeared, the wholesalers/retailers and the whole supply chain got involved.

3.5 Innovations

Porter (1990) defines an “innovation” as something that “includes both improvements in technology and better methods or ways of doing things. It can be manifested in product changes, process changes, new approaches to marketing, new forms of distribution, and new conceptions of scope”. According to Kotler (from Grunert, Harmsen, Meulenberg & Traill, 1997) “an innovation refers to any goods, service, or idea that is *perceived* by someone as new”, i.e. what is innovative to one person might not be so to another person.

An innovation is the commercial result of an invention or discovery that took place many years ago and started to diffuse into society, for instance electricity from the beginning of the last century, and microprocessors, that started being applied from the second half of the last century. “Diffusion is the informal process by which innovations spread to members of a social system” (Duval & Biere, 2002).

Different levels of innovations, from radical to incremental, are described in the literature. Garcia & Calantone (2002) propose the following definitions: “Radical innovations are innovations that cause marketing *and* technological discontinuities *on* both a macro *and* micro level. Incremental innovations occur only at a micro level and cause either a marketing *or* technological discontinuity but *not* both. Really new innovations cover the combinations in between these two extremes.”

Mc Dermott defines “radical innovation” in a similar way, as “the creation of a new line of business, both for the firm and for the marketplace” (McDermott, 1999) and it involves “the development or application of significantly new technologies or ideas into markets that are often non-existent”.

Grunert et al (1997) discuss two major views of innovation. In one view innovation is linked to R&D whereas in the other it is linked to marketing, but it is unclear if any difference is made between radical innovations and other kinds; see above. A distinction is often made between product and process innovations, as they have different objectives, the former to create new products and services, the latter to cut costs or enable production of new products. Utterback (1994) sees it as an evolutionary development over time with process development as a necessary step following a “dominant design” of a new radical product.

3.6 Food innovations

Studies indicate that very little radical or really new innovation is taking place in the food industry (Christensen, Rama & Tunzelmann, 1996; Lagnevik et al., 2003), although a number of new technologies that could be relevant are available. Some examples are gene technology, irradiation, pulsed electric field, high pressure processing, further applications of biotechnology etc. The food industry is historically considered to be good at applying technologies from other industries, e.g. the pharmaceutical industry, biotechnology etc. (Christensen et al., 1996) and the

microbiology behind some of the probiotic bacteria in functional food is an example of such a current application. An innovation could also be a new way of doing things, e.g. new applications of microprocessors, the Internet etc. One example is the growth of chilled processed food in the UK, claimed by Cox, Mowatt & Prevezer (2002) to be driven by the development of non-proprietary technologies in information management and not by new technologies in food preservation.

Nevertheless, since the introduction of frozen food in 1945, no new food innovation of major importance has been observed in Sweden, in terms of the number of new food industries of a certain size since 1945 (Livsmedelsföretagen, 2005), except for one innovation, perhaps: the growth of chilled/fresh products from the 1980s that has promoted the expansion of already existing industries and of the range offered by retailers - maybe driven by the new information technology, as Cox suggests in the UK? But chilled prepared food in Sweden has not reached the volumes and had the impact on the market that can be seen in the UK.

On the other hand it seems as if new technologies are sometimes developed more easily by new actors in new applications and via new/different outlets than the traditional ones. Examples in the food area are, for instance, high pressure processing that became commercially used for guacamole in food service in the US, and new fast food outlets with chilled products, produced nearby and directly distributed to the outlet (Ohlsson, 2006). Still most new technology-based firms are claimed to have spun out from existing companies, whereas a smaller proportion is accounted for by academics, who are less experienced in marketing, consumer needs and attitudes etc. and hence the projects tend to be more long-term and risky, as in the biotechnology industry (Bower, 2002).

3.7 An overview of the European food industry

Traill & Grunert have participated in and edited a number of case studies of the European food industries (Grunert et al, 1997). There was practically no evidence of the firms being active in networks but it was found that retailers are important to product innovations and that suppliers (machinery, equipment, ingredients) are vital to process innovations. They suggest product orientation and process orientation as two ways to achieve innovations and market orientation as a complement to both.

Martinez & Briz (2000), who investigated the Spanish food and drink industry, found more evolutionary innovations than revolutionary ones and that retailers increasingly required products to be innovative. A great number of the Spanish food and drink companies are subsidiaries of big multinationals, which introduce products that are often developed and tested elsewhere. The products developed by Spanish firms were to a large extent combinations of product and process innovations and incremental in nature. The factors Martinez & Briz (2000) found to be most important behind innovations were: production efficiency and cost cutting activities and market orientation and product & market diversification. As a result they found that process innovations are most common in the Spanish food and drink industries. They refer to the UK, where the retailers are identified as the drivers behind new products, and suggest that the food manufacturers should adapt the strategy to include proprietary elements that can be protected, i.e. be more unique.

Menrad (2004) analysed Germany and innovations in the food industry against a comprehensive review of current literature. The food industry in Germany is focused on the German market, and the market for food is almost stagnant. Internal R&D departments are a major source of innovations, but there are few people employed in R&D and many small or

medium companies lack R&D departments. It is particularly small and medium size companies that combine process and product innovations. Federal and private research organisations are important as a knowledge base, but they are not well co-ordinated and do not co-operate enough. Specific regional clusters do not seem to exist. Menrad (2004) notes that “The highest number of new products was registered in beverages, confectionary, snacks, dairy products and frozen food which all showed declining trends in recent 5 years”. Only about 3 % of the new products could be called “truly innovative”, which is similar to studies in other markets, and 19 % of all food innovations introduced on the German market between 1999 and 2001 were targeted to functional food and an additional 18% to convenience products. For a new product to be accepted and listed by the retailer, the producer often has to withdraw another one of his products, due to limited space and sales.

Menrad (2004) adds that “the interaction between food industry companies, the supplying industries, end-users (both food retail companies and individual consumers) as well as research institutions play a crucial role for successful innovation activities.” He believes that the food industry seems to be moving in the direction of network-oriented systems and that strategic partnerships with other companies are essential for the future.

In conclusion, development in Europe is mainly incremental with only a few percentage “truly innovative”, collaboration in networks and strategic partnerships in the supply chain is vital for the future although not yet well developed and more unique products might be a way to go for the food producers - and/or else for the retailers, as in the UK.

3.8 Filling the knowledge gap

Evidently few really new or radical food products are appearing, either on the Swedish market or on many other European markets. Yet there are new technologies that might find interesting applications in the food sector, rendering both new products and new packaging systems. Against this background, a comparison is made in this study between the booming years after 1945 and today’s situation and against the current literature in order to identify ways and means of facilitating the development and introduction of new food innovations. In other words, the aim of this study is to fill a gap of knowledge about developments in the Swedish food sector after the war, the driving forces, the parties involved, collaboration, individual contributions etc. and to analyse and discuss if this knowledge can be of use today, not only in Sweden but in a more general context.

4 Summary of appended papers

What?	Why?	How?- cluster& network	Who?- “Edisons”
Paper 1: Development of successful food packaging and logistics in Sweden since 1945	Paper 2: Driving forces for food packaging development in Sweden- a historical perspective	Paper 3: Clusters/networks promote food innovations	Paper 4: “Edisons” contribute to innovations
<i>In Logistics Research Network 2004 Conference Proceedings 2004, pp. 58-66</i>	<i>In IUFoST 2005, www.worldfoodscience.org</i>	<i>Accepted for publication in Journal of Food Engineering 2006</i>	<i>Submitted to European Journal of Innovation Management</i>

Paper 1: Development of successful food packaging and logistics in Sweden since 1945

This paper describes the development of a modern Swedish food sector after WW II, focusing on *What* happened of major importance as judged by a number of knowledgeable people.

The first and basic step in the study was to lay a puzzle of new technologies, retailing, distribution etc. that were introduced after the war and of changes and trends among consumers and in society. The result was that all of the interviewees considered the development of frozen food to be the major innovation, followed by the introduction of self-service and chilled products. These innovations required suitable packaging and distribution, which had to be developed by a number of companies, that appeared to meet the challenge.

Findus became the leader in frozen food, Frigoscandia took the lead in freeze technology and equipment and Åkerlund & Rausing and Esselte Pac developed the packaging for frozen food. At this time after the war, other packaging such as the cans produced by PLM for food - licensed from the US - became very popular. Plastics were further developed as packaging materials in their own right as well as in combination with cartons, not only for frozen food but also for liquid products like milk, laying the foundation for Tetra Pak that developed out of Åkerlund & Rausing.

The need to grow and expand drives many successful companies, but the possibilities for the food industry to expand internationally were limited, as the market was heavily regulated until Sweden joined the EU in 1995. However, the supporting innovations in packaging and equipment could be exported, if competitive enough. Knowledge could also be exported and consequently Nestlé bought Findus in 1962, using the brand and the competence to expand within the sector of frozen food, primarily in Europe.

The contribution of this paper lies mainly in the overview of the development of the Swedish food sector since 1945 and in the identification of the major innovations, i.e. frozen food and self-service and later chilled food, that required new packaging and logistics all along the supply chain.

Paper 2: Driving forces for food packaging development in Sweden- a historical perspective

Co-author: Annika Olsson

The purpose of this paper was to describe the development of packaging alongside food products and what the driving forces were, as a number of originally Swedish packaging companies have become quite successful internationally over the years.

It came as somewhat of a surprise to us that examples of new packaging were so rarely mentioned among the answers about the major innovations in the food sector. In the follow-up questions of **Why** etc. in the interviews, the respondents described a situation where a simultaneous development of the food and the packaging was necessary when introducing frozen food.

Having been active in the packaging industry, we felt that this had to be further analysed. The answers and comments made by the interviewees regarding packaging and distribution were collected with the objective of identifying some of the driving forces behind the development of new packaging for food. The packaging development was set against the general development of society and particularly against the phases one could discern in Swedish society from 1945 up until today. After the war the food producers were in the driver's seat, and new food technologies, such as freezing and refrigeration in combination with other types of treatment, served as drivers for new packaging and distribution. Self-service, introduced by the trade, also drove the development of packaging, as packaging was essential for this whole concept.

A packaging system may also drive product development. One such example is the can, which, once it was available, was tested and modified to accommodate a number of products. Another example is the aseptic carton system, which has more or less created the market for orange juice in Europe, besides being tried and used for a number of other products. There were other trends mentioned by the interviewees that could be seen as driving forces for the packaging industry but with a wider impact on the supply chain, e.g. demands on safety, tamper proof and traceability.

In conclusion, the driving forces for packaging development might come from new technologies and new requirements placed by the product/concept, new consumer or retail demands, distribution requirements, legal aspects and changes in society as well as from competition and globalisation. But a new packaging system might also drive new food product applications, once the system has proven itself.

Paper 3: Clusters/network promote innovations

Co-author: Christina Skjöldebrand

This paper describes the collaboration that took place in order to develop and introduce frozen food and self-service stores.

In the interviews the good collaboration among the companies, individuals, and actors in the supply chain turned out to be as a very positive factor, although neither cluster nor network was ever mentioned. One purpose of this study was to “identify possible ways to proceed in developing radical or really new technologies and food products ...”, i.e. we had to analyse **How** the collaboration was organised in order to discuss what we could learn.

Porter's “The Competitive Advantage of Nations” (1990) inspired us to compare the situation in Sweden with factors in his “diamond”, many of which could be found in the 1940s-60s in the food sector in Sweden. This comparison led over to clusters and networks as examples of collaboration that could be identified. In 1953 a Frozen Food Institute was established and became the spider in a web/network of interested companies and individuals. A spontaneous

cluster of food industries and supporting industries with links to the network assembled in the south of Sweden.

Theories on networks and clusters were not often described in the literature in the 1950s, but it is interesting to compare our findings with the more recent literature. The Swedish cluster was a “bottom-up” initiative (Fromhold-Eisebith & Eisebith, 2005), developing over time and declining as the technology passed its maturity. The likelihood of more food innovations in Sweden by using networks and/or clusters is further discussed against the background of today’s situation, i.e. that the power in the supply chain now lies with the retailers.

In conclusion, a network of interested individuals and organisations formed around the Frozen Food Institute, a spontaneous “bottom-up” cluster formed in the south and both ceased in importance when the technology became a commodity.

Paper 4: “Edisons” contribute to innovations

In this paper the focus is on the individuals involved in getting the major innovations developed and accepted.

In the interviews many respondents described problems and events along the way of getting frozen food in particular on track. Names of individuals were mentioned, and a number of people started to become visible. I call them “Edisons”, since they have contributed to the development of frozen food and self-service and made their introduction a success, and since some of them are mentioned as answers to the question *Who*? The “Edisons” were characterised as passionate enthusiasts, who made extraordinary efforts and did more than their jobs required, and they could even be contributing from the outside. To my knowledge nothing similar has been described in the literature.

An “Edison” may display similarities with other functions in organisations, e.g. champions etc. from the literature, but more are required than just doing one’s job. An “Edison” can be anywhere, inside or outside organisations. The activities of the outside “Edisons” were mainly focused on achieving acceptance and success and on information.

Today the attitudes in society towards the industry and new technology are more negative than in the past, and that needs to be overcome if new food technologies and products are to have a chance to succeed. But there are also signs of companies opening up towards society. People are better educated - but more individualistic - and new tools, made possible by IT- technology, are available for information and communication.

One lesson to be learned from this study is to involve and motivate a wider range of individuals to contribute to developing innovations, also from the outside. This includes involving marketing, media and other opinion leaders sufficiently early in the projects to humanize the technologies with the consumers in focus, which will require a change of attitudes, an ability to motivate people and a creative and open climate.

In conclusion, a number of individuals, “Edisons”, contributed to the success of the major innovations that were radical, or at least really new, in nature. The “Edisons” came from inside or outside the organisations and became enthusiastic and motivated to contribute. Whether this experience can be repeated today and, if so, what might be required is further discussed.

5 Analysis

5.1 *What* were the major innovations/events behind the growth of the Swedish food sector after 1945?

Table 1: Results of interviews with the 11 persons in Group 1 about the major innovations/events in the Swedish food sector since 1945

Innovations/events	No of respondents mentioning as major
Frozen food technology	11
Self-service stores	8
Chilled/fresh food	8
Dual income households	7
Political decisions	6
Distribution	6
Food safety	6
Information gaps	6
Traceability	5

The above innovations/events were followed by, in descending order: globalisation, computerisation (ordering, labelling, inventory etc), new eating & purchasing habits, retailers' own brands, aseptic process & packaging, microwave, nutrition, canning, plastics, car availability, immigration, individualism, quality guarantee, cartons for liquids, smart packaging systems, low-price shops, ecology, the EU.

The numbers present above are indications and not quantitative measurements. Nevertheless they indicate clearly the impact of frozen food on the entire food sector. Packaging became essential also for self-service, and a controlled supply chain had to be organised (Papers 1 and 2). The above results regarding the major innovations since 1945 are supported by Fri Köpenskap (Rosengren & Franck- Leppäkoski, 2003), a trade paper, whose review of the last 60 years of Swedish food trade established frozen food and self-service as the major events during the first 30 years. During the next 30 years applications of information technology were seen as the major innovation.

Keeping in mind that the interviewees were around 60 years or older and most active in the food sector until around 1980-1990, the perspective of innovations occurring after that time cannot be as detailed as for the earlier period. Consequently, later applications of, for instance, the information technology and new services, products and processes were not that visible to the interviewees, as is evident from Table 1, and hence, the collected information is insufficient regarding this aspect.

If we look at the UK, the first country to introduce frozen food in Europe as early as before the war, the technology in the UK took off with the introduction of the brand Birds Eye after the war (Geroski & Vlassopoulos, 1991). Birds Eye became the market leader due to their innovativeness, not only in products and production but also in raw materials and education of consumers and retailers - much the same as what Findus did in Sweden. But according to Geroski & Vlassopoulos (1991) the "special asset", as they call it, at Birds Eye was control of their own distribution. This asset started to erode in the mid-1960s due to a shift in power from producer to

retailer and the introduction of retailers' own brands, as well as the appearance of specialised distributors of frozen food and public cold storage companies. Control of the infrastructure was only temporary, and it was only initially that control over distribution served as an entry barrier to competition (Geroski & Vlassopoulou, 1991). Findus in Sweden also started with their own distribution to major cities (Bäckström et al., 1992) but discontinued it after a few years, using Frigoscandia and other distribution and storage companies. But the UK analysis points at the need of having special assets in order to keep the lead. Findus had an asset by working closely with Frigoscandia, who became world leaders in developing freeze technology and equipment. They used Findus as the prime mover for testing and using the equipment, but gradually the technology and equipment became available to others, depriving Findus of that special asset. During the interviews people who had worked at Findus or Frigoscandia were asked whether, to their knowledge, Findus ever considered developing the technology and equipment themselves. The answer was "no" or a comment like "it would have been too costly", particularly on behalf of only one customer, i.e. Findus. Hence a former technical director at Findus founded Frigoscandia, a company, now part of FMC, which is still the world leader in freeze technology (Paper 1).

In our results chilled/fresh products were considered important by the interviewees, scored as a shared number two on our indicative list, and yet the development of this product group has not been discussed in greater detail in this study. The main reason is that chilled prepared food appeared later, as a follow up of and competitor to the successful frozen prepared food. It was, however, more convenient: easier to prepare, ready-to-eat if need be, and sometimes of higher quality than frozen food - but with a shorter shelf life, requiring refrigeration and usually more expensive. In the UK frozen ready-made meals have gradually been replaced by chilled versions (Ready Meals info, 2004). Cox et al. (2002) wrote, "Frozen food was part of the revolution in branded, packed consumer goods that relied on the introduction of proprietary technologies in food processing and allied developments in packaging", which, as we have described, happened also in Sweden. According to Cox et al. the driving force in the UK behind chilled ready meals is the development of non-proprietary technologies in information management rather than new technologies in food preservation. They point out that the short shelf life of chilled products and the delivery on demand that can only be controlled by the retailers have contributed to the shift in power over to the retailers. This has also meant a change from mass production back to batch processes of a size determined by the demands of the retailers and controlled by them. The chilled prepared food sector is continuing to grow in Sweden as well but is not seen as threatening the frozen counterpart, according to Djupfrysningabyrån (2002). Still the development in the UK is, according to Cox et al. (2002), an application of the possibilities offered by new information technology, a technology that is mentioned by Fri Köpenskap (Rosengren & Franck- Leppäkoski, 2003) as the major innovation during the last 30 years in Sweden. Maybe we are just lagging behind in Sweden ...

In their nomination of the "Top 10 Food Science Innovations 1939-1989", Food Technology (Staff Report, 1989) listed two frozen items and some other innovations and issues also mentioned in Table 1 above and/or to be found in the compiled information in Appendix A. The Food Technology list from 1989 looks as follows:

1. Aseptic processing and Packaging
2. Minimum Safe Canning Processes for Vegetables
3. The Microwave Oven
4. Frozen Concentrated Citrus Juice
5. Controlled Atmosphere Packaging (CAP) for Fresh Fruits and Vegetables
6. Freeze-Drying

7. Frozen Meals
8. Concept of Water Activity
9. Food Fortification
10. Ultra-High-Temperature (UHT) Processing of Milk and Other Products

Microwave ovens initially came to be linked to convenient thawing and preparation of frozen food and gained quick acceptance. Aseptic processing and packaging had a breakthrough for milk when UHT processing was innovated: it is not, however, a success for milk in Sweden, although the system is a Swedish invention. The concept of water activity is closely linked to hurdle technology (Gould, 1996) and usually combined with refrigeration, i.e. chilled products. CAP is sometimes combined with refrigeration and even more so when designated MAP (modified atmosphere packaging).

In conclusion, the answers to the question “*What* were the major innovations/events?” seem well supported by other research for the earlier part of the period studied, but not sufficiently updated for more recent innovations, e.g. new applications of information technology in the food sector.

5.2 Why did these major innovations occur and what were the underlying driving forces?

Inspiration for new food products came mainly from the US (Goldblith, 1989). The Swedish food industry started to boom after the war, as the country had a good and intact economy and looked to the future with optimism (Paper 2). The interviews give the impression that the developments of product and packaging for frozen food proceeded hand in hand without friction and by trial and error.

This way of cooperating, i.e. food and packaging together, was highly appreciated but became less common over time and was greatly missed by the food producers and retailers, as expressed by the interviewees. My interpretation is that the cooperation gradually ceased as the packaging companies grew bigger and more successful, whereas the Swedish food industry, including retailers, could not export or import freely before 1995. The packaging companies could, however, and started to expand abroad (Papers 1 and 2), finding other and bigger partners to work with. This opinion is not verified in the literature from that time, which does not deal with cooperation between food producers and packaging companies, or by the interviewees, who only see that the cooperation worked well. Still, this way of integrating the development of product and packaging, applied here to frozen food, was very effective and has recently been evaluated and analysed as a valid suggestion also for today (Bramklev, 2003). The originally Swedish packaging industry has become quite successful internationally, for example PLM (now Rexam), Å&R (now Amcor) and Tetra Pak.

Hence the interviewees did not see the development of new packaging and packaging material as very revolutionary but rather as a consequence of the needs of the new technologies. The acceptance of frozen food was linked to such trends and changes in society as continued urbanisation, an increasing number of dual income households (Magnusson, 1997) and changing life styles and purchasing habits (Robertson, 1990), which set the stage for demands for increased convenience (Paper 2). Actually the can was considered one of the first convenient food packages, with processing built into the product (Downes, 1989), and was introduced in Sweden after the war by PLM, buying a license from the US. Although frozen food became the major

innovation, canned food boomed into the 1970s and is still around, being an example of a packaging system that meets the requirements of preserving and making food available over time and at different locations. According to PLM, every new step towards adapting the can to a new food opened up a new market, i.e. the packaging system drove the development of the product. But the reverse could also be claimed; every new product drove the adaptation of the can, once the packaging system was available.

The main driving force for frozen food was the same as for canned food, i.e. longer shelf life and more convenience, but frozen food required special distribution all the way from the producers, including frozen-food cabinets in stores and at home and a considerable amount of information about the products, their use and preparation. With all its complications, frozen food still offered something new and better tasting, a variety of products ranging from semi-prepared ingredients to prepared food; the whole concept was unique when introduced, and the timing was right.

5.3 *How* was the innovative work carried out?

The spontaneous formation of a food cluster in southern Sweden for frozen food fits well with newer theories about cluster formation and aggregation of competencies (Porter, 1990, 1998; Cappellin, 2004; and others, see Paper 3) and the same goes for participating in networks (Barringer & Harrison, 2000, and others). But with the extended opportunities of information today, similar collaborations in the future might be less limited to one spot and become more of a virtual cluster. According to Gordon & McCann (2000), network is one of the three basic forms of clusters, and the members are not necessarily geographically located together - although this does facilitate the work.

In the case of frozen food earlier in Sweden, both a geographical cluster and a network were identified. The cluster was of a “bottom-up” character, spontaneously formed around a new technology and the resources available, but also around resources that were attracted to the area. Collaboration was built up among all the interested parties in the cluster, as well as in a network with individuals inside and outside of companies.

Clusters develop over time and have a life cycle (Rosenfeld, 2003), reaching maturation and dying if no new products have been identified early enough. This happened to frozen food. The different frozen products of different brands today are distinguished by quality and “excitement” versus price, i.e. the excellence of the chefs in making the recipes and of the purchasing people in sourcing, in relation to other companies. With no special “asset” the technology has passed its maturity, and the supporting cluster and network that once promoted frozen food in Sweden have changed and ceased to be of particular importance (Paper 3).

A similar network, like the one with the Frozen Food Institute as the spider in the web, points at possibilities to establish similar functions for other technologies, which was also suggested by some respondents for chilled products in Sweden today. In fact, Cox et al. (2003) identified two inter-organisational networks for chilled ready meals in the UK, one control network and one network for innovation. The roles of those networks are different from what is described here for frozen food earlier in Sweden, with retailers in the UK being in the lead and since it is based on the knowledge now available to the retailers in their interface with the consumers. There is a similar situation, i.e. that retailers have the best knowledge about consumers, in many European countries, including Sweden.

Judging from the outside it seems as, with the shift of power from producers to retailers, the strong motivation to radically innovate among producers has diminished and been replaced by complaints about the impact of retailers' own brands and whether they, the producers, should produce retail brands beside their own ones. One question then: must the supply chain "always" look the way it does now? The answer is not straightforward, but look at all factory outlets found in for instance the clothes sector! Food is different - maybe, with for instance different demands on logistics due to different temperature demands - and the retailers possess a formidable weapon, de-listing, if the producers do not oblige. That, combined with the high retailing concentration in Sweden, makes the retailers strong and the producers dependant. The retailers are growing even stronger, now collaborating over the borders in networks and strategic alliances with other retailers and suppliers as a result of globalisation and participation in the EU (Elg & Johansson, 1996; 2001).

On the other hand the catering sector, "away from home", (not studied in this work) is growing, has other distribution channels than for consumer products and offers possibilities for producers to innovate: products, processes, technologies, services etc. Here innovations combining product and packaging, e.g. edible packaging and packaging with innovative service functions, could be of interest. Other areas of expansion for the producers- and innovative retailers, as in the UK - would be to develop "special assets", as once for frozen food in Sweden and in the UK, and to develop unique offerings with proprietary elements, as suggested in Spain (Martinez & Briz, 2000).

5.4 Who became involved in and contributed to the development?

The main conclusion drawn from investigating the above question was that a number of individuals, from the inside and from the outside, became involved and contributed (Paper 4). These individuals are here called "Edisons", and to my knowledge nothing similar, regarding the numbers of outsiders, has been described earlier in the literature. One reason that so many people from the outside committed themselves was that frozen food offered obvious benefits for the consumers, another reason being the very positive attitude and trust towards the industry at the time.

The need to involve people from the outside is also discussed in the literature nowadays: Chesbrough (2003) describing the era of Open Innovation, Thomke & von Hippel (2002) suggesting a "tool kit for customer innovation", Yakhlef (2005) wanting market actors (Paper 4). In his analysis of the German food sector, Menrad (2004) states that the food industry seems to be moving in the direction of networking and strategic partnerships with other companies, and sees this as essential for the future.

In order to establish and maintain networks and other forms of collaboration with many actors, the new information technologies are available but can be further developed to create meaningful ways of communication and information - both ways. If, for instance, the information by retailers in Sweden was more transparent and shared among the actors in the chain, the possibilities to innovate and develop together should increase. A shared knowledge might for instance lead to new ideas about "better ways of doing things", one way of innovating according to Porter (1990).

An innovative culture and an innovative climate are two important conditions for being able to create and develop innovations (Amabile, 1997; Ahmed, 1998). These did exist at Findus in the 1950s -70s, according to my own experience and as verified by other employees at Findus.

My personal experience from working with development for AB Findus (from 1966 to 1981) is described in Appendix C.

5. 5 Can we learn from the past?

The core of this study has been to identify the major innovations and changes that made the Swedish food industry start to boom after World War II, and from there on to explore why, how and who made it possible. The underlying reason is that food is central to most people. Throughout history it has been linked to fear of food shortage and to food quality and health aspects (Ferrières, 2006), but also to really new or radical innovations that have improved the availability, the safety and the choices of food. As pointed out by Earle (1997), innovations in the food industry are combined with social and cultural innovations; changes in society occur as a consequence of other changes - and the other way round. This has been explained in this study, partly in order to see the differences in the current situation.

The results from the study might therefore be relevant today as well in the context of *How* it was done - clusters and network - and *Who* contributed - “Edisons”. The ideas behind clusters, physical or maybe virtual, are valid today, as is networking, and both were important when frozen food and self-service were introduced. Collaboration is even more important now that national borders have become less important when moving goods, services and knowledge. In this perspective some experiences of this work can be seen as an early confirmation of some of what has later been written about clusters, i.e. promoting knowledge in the beginning and reaching maturity and dying after a certain time and if no new ideas come up in the meantime (Paper 3). But it is worth noting that in our case a “bottom-up” kind of cluster was formed spontaneously in southern Sweden and not instigated from “above”, from the government for example. People who became involved really wanted to see this development through, since it offered obvious advantages to the consumers. I believe the chances of success starts there, with a sufficiently good idea, attracting people from various competences, including from the outside, and forming a group, working together in a cluster and/or a network. Radical innovations cannot be organised by imposing a cluster as a result of economic development policies, according to myself and others (Feldman & Bercovitz, 2005; Audresh, 1998).

The actual experience of having particular outside “Edisons” involved in development and “marketing”, as for frozen food, is new, but the idea of opening up to the market and to society is not, and is gaining more acceptance, according to the literature (Paper 4). Going as far as inviting real “outsiders”, e.g. representatives of the press etc., might not be very easy to accept or implement. If benefits for the consumers are not obvious from the start, outsiders might not bother. Still, if we take the example of gene modification, which seems to be here to stay, at least in the pharmaceutical industry, and which might offer some benefits for some food area in the future, who would ever buy a product labelled “gene modified”? Some reflections on name, true benefits to at least some consumers, competition etc. by good marketing teams, journalists, scientists and others might show if it is worthwhile to investigate and develop further.

The “Edisons”, the individual efforts, are essential and need to be encouraged and mobilised, sometimes also from the outside - and it is individuals who will eventually buy the products. An innovation cannot be ordered but requires a climate for new thinking and motivation, that is not primarily based on monetary compensation. “Edisons” may develop in various places.

5.6 Generalisation of results

An accumulation of knowledge and competences took place in the cluster and network that were formed around frozen food and brought it to success. The importance of clusters was actualised by Porter in 1990 and has since been strongly discussed and debated. This study confirms the importance of a specific cluster for frozen food in the past. It cannot be generalised that a cluster is therefore necessary for a really new innovation but generally the need to collaborate with the right kind of people/competencies remains, and examples of successful clusters, including ours, are to be found all over the world.

The network for frozen food, seen as a “hub and wheel configuration” (Gordon & McCann, 2000) with the Frozen Food Institute as the hub and information as the product, worked remarkably well, and some interviewees proposed a similar construction for chilled products in Sweden, in order to secure quality and safety.

On the basis of this study of Sweden and of the literature, the results of identifying “Edisons” can be generalised as far as to claim that a variety of motivated and enthusiastic individuals are needed in an innovation project, something which is common knowledge and confirmed here. In addition, if a project is seen as good enough to also attract the right outsiders, the chances of acceptance and success on the market should increase considerably.

6 Conclusions

The following conclusions can be drawn from this study regarding:

What were the major innovations/events behind the growth of the Swedish food sector after 1945?

- The major innovations after the war were frozen food and self-service and, from the 1980s, chilled food.
- Frozen food and self-service required a parallel development of packaging and logistics, including a totally new distribution chain and storage facilities from the start to the end of the supply chain.
- When frozen food was launched in the UK by Birds Eye, the company had a “special asset”, control of their own distribution, whereas Findus “special asset” was the close cooperation with Frigoscandia. Both Birds Eye and Findus lost their special assets when the technology became a commodity and competition entered.
- Frigoscandia with frozen food technology and equipment and Tetra Pak with the aseptic packaging systems are examples of companies who have maintained their lead with unique offerings.

Why did these major innovations occur and what were the underlying driving forces?

- The economy was good and an accumulated need of changes after the war, inspired by the US food sector, was evident; the timing was right.
- Frozen food offered a unique concept when introduced; better tasting, a wider variety of convenient products all year round and with possibilities for home-freezing.
- After the war producers drove the development of new technologies and products and the supplying industries to develop their parts.
- A packaging system may drive product development to a certain extent, since the packaging system, once installed, may be tried for “everything” and adaptations and developments may become necessary.
- The driving forces behind packaging development might come from new technologies and new requirements placed by the product/concept, new consumer or retail demands and new distribution requirements, legal aspects and changes in society and from competition and globalisation.

How was the innovative work carried out?

- A cluster and a network became the basis for collaboration around frozen food, involving companies in the supply chain as well as individuals, inside and outside of companies.
- Clusters are frequently described in the literature as a way to increase knowledge and collaboration, and a spontaneous “bottom-up” kind of cluster worked well for frozen food.
- Clusters have a life cycle, reaching maturation and dying if no new products have been identified early enough and this happened to frozen food.
- The situation in the Swedish food sector in the 1940s-60s conformed quite well to Porter’s “diamond” and theories of factors promoting competitive advantages, i.e.

the nation's position regarding production and skilled labour, home demands for products and services, related or supporting industries, domestic rivalry, the role of chance and of the government.

- The power has gradually shifted from producers to retailers with the help of new information technologies, giving retailers the best knowledge about the consumers. Consequently retailers' own brands have been introduced, competing with producers' brands.

Who became involved in and contributed to the development?

- A number of enthusiastic individuals, "Edisons", contributed to the development of frozen food and self-service, making extraordinary efforts and doing more than their jobs required, some also contributing from the outside.
- The participation of such a wide range of individuals in an innovation project such as frozen food, also from the outside of companies, has not been reported elsewhere in the literature.
- Intrinsic motivation and a creative climate are needed as well as a more open attitude in the industry towards the outside – and the reverse: to build up trust among consumers towards the industry.

What can we learn today?

- To really develop an innovation and make it successful will require involvement and collaboration over the borders of knowledge and experience, in the future most likely over national borders as well, and in order to gain acceptance the development must involve opinion leaders and consumers of the future.
- A fruitful collaboration to create something really new or radical in the food sector will be possible only if the supply chain becomes transparent and the information shared, i.e. costs, sales figures, trends, consumer habits etc., between all actors.
- Networks of the kind experienced for frozen food could be used to establish other technologies, as was found in the UK for chilled food and as was suggested for chilled food in Sweden of today.
- The "Edison" experience could be used as an example to develop and introduce other innovations, involving and motivating a wider range of people, also from the outside, including marketing and media and other opinion leaders, from an early stage of development.
- An innovation cannot be ordered but requires a climate for new thinking and motivation that is not primarily based on monetary compensation.

7 Future research

As a follow-up to this study it would be interesting to investigate the following issues:

- How could the food industry further develop their own technologies to achieve unique products, e.g. to make bread and dough of the highest quality after frozen or refrigerated storage or to apply separation and recombination techniques to develop new products or improve the quality of existing ones?
- What is actually happening in the pharmaceutical and biochemical sectors and in information technology that could offer opportunities for the food sector in the future?
- How do the food producers, retailers and packaging companies of today look at the future concerning really new or radical innovations in the food sector and their chances of success – also economically? Who is expected to, or will, take the lead, and how is the collaboration going to be organised and the right individuals included in the work, i.e. finding the right balance between top-down commitments and bottom-up motivation and initiatives?
- Would the media, e.g. the trade press and scientific journals, be willing to participate in an innovation project from the start – or to participate in a case study of what it would take to gain acceptance of e.g. gene modified food or irradiated food?
- How would younger people, i.e. those who started to work in the 1980s – 90s, answer the questions posed in this study about the period from around 1980?
- How will/should future supply chain (-s) look like for selected food products and services?
- What about catering, “away from home”, growing all the time and offering new possibilities in all areas of innovation: technologies, products, packaging, logistics and other services, as it is less bound by established routines?

8 References

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10 Appendices:

- A:** Some important developments in the Swedish food sector and the Swedish society, compiled during interviews and literature studies
- B:** Participants in the interviews, their names and areas of major experience in the food context
- C:** Findus/Nordreco - an example of an innovative working climate in the 1960s and 70s.

Appendix A:

Some important development in the Swedish food sector and society, compiled during interviews and literature studies

1940- 1949

Food & food producers	Packaging & logistics	Retail, wholesale & society
1944: first frozen food by KF	1941: Å&R Satello ("paper can")	1943: Fri Köpenskap appears (ASK)
1945: Findus enters frozen food with direct distribution	1944: Tertahedron invented (Å&R)	1945: ca. 50' registered private cars
	Cellophane + carton used for frozen food	1946: SIK (food& pack.institute) starts
	License for food cans by PLM	1947: First self-service store, KF
	1947: ASK builds freeze storage; Birds Eye first customer	1949: Last food rationing ends

1950-1959

Convenience food starts to be popular	1950/51: Helsingborgs Fryshus (Frigoscandia) founded	Golden years in economy
1950: Frozen retail ca. 1' ton	1952: Tetrahedron launched (Å&R)	1950: ca. 20 % active in agriculture
1950: Vinborg's Ättiksfabrik enters frozen prepared food	1953: Tetra Pak was founded	1951: 1st hamburger bar
Canned prepared food growing	Å&R (in 1955) with "Expresso" and EsseltePac with "Ving-hermetet" packaging for frozen	1953: Frozen Food Institute founded
1955: Unilever into the market with frozen food via Bjäre		1956: TV premier, no ads allowed
1956: Felix launches frozen food		

1960- 1969

Freeze dried coffee on the market	1961: Aseptic Tetrahedron presented	1960: Self-service: 5400 shops
Instant potato powder launched	1962: Euro pallet (by T. Thorhag)	1961: start of record multiflat house building; freeze storage facility recommended from 1964
Unsaturated margarine	1962: Pure Pak from the US launched	1961: LTH (technical univ.) starts
UHT process for milk	1963: Tetra Brik	1963: first supermarket by KF
Indra frozen food for catering	1965: Å&R sold to Swedish Match	Increase of married women in workforce, in 1964: 36 %
Dafgård frozen prepared food for catering and retail	Shrink film available	1967/68: 25 % of all households with a freezer and 88 % with a refrigerator
1962: Findus sold to Nestlé	1966: Fri Köpenskap organises competition "Package of the Year" (-1988)	Computerisation starts to be applied
	Rigello plastic bottle for beer (TP)	

1970-1979

Frozen pizza	Steriflex, flexible can by Å&R	Ca. 5 % active in agriculture
"Light" products	Aseptic pouches	1972: SLV formed (governmental "FDA")
Convenience grows	Tetra Brik Aseptic	1973: Start of oil crisis and end of booming economy
McDonalds goes to Sweden	Plastic pot for margarine by Ceka	1973: Dagab formed
	1978: Letpak, plastic can by Å&R	1979: KF blue-white low cost private label

1980-1989

Unconventional proteins	Plastic grows	1980: 64 % of married women in workforce; 73,4 % of all women
Aseptic particulates	De-regulation of transports	Barcodes, EDI, EAN
Chilled prepared food	Environmental packaging issues	Concern about environment
New Sweeteners	Tetra Pak head office moves abroad	1988 ca. 3500' registered private cars
	1983: Å&R buys Esselte Pac	Microwave ovens penetrate market
	MAP (Modified Atm. Packaging) coming	1988: Dagab sold to Axel Johnson AB
	Tamper evidence requested	1989: ICA launches private label

1990-2002

1991: Findus buys Indra	Plastic bottles	1992: over 95 % of households with a freezer
"Less" processing; "fresh" products	1991: Tetra Pak buys Alfa Laval	Safety!
Irradiation of spices allowed	1996: FMC acquires Frigoscandia Equipment	1995: Sweden joins the EU
Functional food & ingredients	1999: Rexam, UK, buys PLM	1999: Axfood formed (from D-group, Dagab, Hemköp)
Low fat and specialties	2001: Tetra Recart, a "carton" can	2001: The Bergendahl Group formed
Food service and take away grow	2002: Triton owners of Frigoscandia Distribution	
2000: EQT buys Findus (frozen)		

References: Magnusson, 1997; Giertz & Strömberg, 1999; Bäckström et al., 1992; Packmarknaden, 2003; von Platen, 1995; Olsson, 1993; Chrona, 2002; Å&R 1993; Stark, 1999; Murray, 2003; SCB, Westerberg, 2005; Paulsson, 2005; Rosengren & Franck- Leppäkoski, 2003.

Appendix B:

Participants in the interviews

The main areas of experience of the persons interviewed - of interest for this work- are briefly described below, but do not give full justice to the vast experience they possess.

Group 1:

Name	Company/Institute	Main areas of Experience
Nils Bengtsson	SIK	Food, processing, packaging, R&D
Ulf Brasen	Indra, Alfa Laval, Tetra Pak	Food, processing, marketing
Roland Fahlin	ICA	Retail, management
Sven-Göte Gustavsson	ICA	Retail, distribution, logistics
Bennie Hansen	PLM	Packaging, management
Lisbeth Kohls	ICA	Retail, consumer services
Magnus Lagnevik	School of Economics and Management	Economic and market research
Göran Löndahl	KF, Frigoscandia	R & D
Christina Möller	KF	Retail, consumer services
Erik von Sydow	SIK, Nordreco, Nestlé	Food, processing, packaging, R&D
Göran Tegner	Government, Frozen Food Institute, Findus, KF	Information, publications etc

Group 2:

Name	Company/Institute	Main areas of Experience
Göran Brulin	National Institute for Working Life	Sociology, economy, "factor X"
Östen Dahlgren	Findus	Development of frozen food
Karl Evert Flinck	Marabou, Findus, Nestlé	Technical, management
Torsten Nilsson	Findus	Manufacturing, packaging
Kjell Olsson	Findus, Frozen Food Institute	Marketing, information
Bengt Persson	Å & R (Amcor)	Packaging
Gunnar Söderling	Findus, Nestlé	Marketing
Holger Westerberg	Fri Köpenskap ("Free Trade")	Editor, writer for the trade press

Appendix C:

Findus/Nordreco- an example of innovative working climate in the 1960s-70s

Below are some personal experiences by me, the interviewer, from working at Nordreco AB with development on behalf of AB Findus in Sweden from 1966 to 1981. Some information from some interviewees in the study is also included.

Findus, until somewhere around 1962 when Nestlé bought it, did not have an organisation plan, which was seen as an invitation by the employees to participate whenever needed. Nordreco, a Nestlé development unit, was established in 1962 primarily for development of frozen food, including securing raw material. Frozen food started with berries and vegetables, so the agricultural department of Nordreco became very important. Nordreco was also assigned to develop the rest of the Findus range, as imports were very restricted. Hence the activities by Nordreco for Findus in Sweden had limited importance for global Nestlé, as long as the activities were profitable and promoted the Findus brand.

In 1962 the CEO at Findus had a technical background. The CEO at Nordreco was an expert in agriculture and surrounded himself with people with chemical/agricultural and technical background. At that time, with economy of scale, full shifts and positive consumers, this set-up worked fine. Development was in focus: as an example in our planning we at Nordreco had to leave 20 % of everybody's time free to allow for unscheduled development activities in order to insure that trials and experiments were not interrupted too early, and that free creativity was encouraged.

The era of modern marketing entered in the late 1960s. The link between Nordreco R&D and Findus marketing became very strong, as particularly one young marketer entered and introduced weekly meetings (even if only for five minutes), sharing of sales figures and other data about the products including analysis of raw material and finished products etc. Joint taste testing at the weekly meetings was one examples of this modern approach and having regular presentations and taste sessions with top management was another. Special follow up of the contribution of new products to market share and profit was done each year in order to boost the interest in development, and goals for the future were agreed upon. As an example, the target for my team was a "real" success every 3 years in the area of milk formulas and cereals for infants and adults- and we succeeded, most of the time.

Some people missed the dominance of the technical side and felt that incremental development became more common when the emphasis on marketing increased, but generally the development of "our" sector became a very shared and prioritised activity for all involved. Nothing as radical as frozen food came out of the work of the 1960s but, within the cereal range for example, some really new product and process development took place, resulting in new investments in production technology and facilities.

Around 1980 some of this free spirit disappeared, for reasons unknown to me, but it was extremely motivating while it lasted - and a very strong brand on the Swedish market was built.

