Innovation in the Norwegian food cluster

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Executive summary
The study looks at processes of change in the Norwegian food cluster. The food cluster, employing around 170.000 persons, is highly institutionalised and has traditionally benefited from protection from international competition, for reasons of national food security and rural employment and value creation. In contrast to other Norwegian natural resource based industries (like the petroleum industry or the water power industry), the food industry is still dependent upon foreign technological machinery knowledge: Petroleum knowledge and hydro power knowledge has been imported and developed in a quid-pro-quo arrangement with international suppliers of machinery, allowing national giants like Statoil, Kværner and Norsk Hydro to grow up. However, in the food sector, the domestic agrofood monopolies (Norsk Kjøtt, TINE, Felleskjøpet) have filled the role of technological and economic locomotives, where vertical integration with suppliers of raw materials have provided an alternative system for knowledge development and diffusion.

These structures are now challenged from several stances. Increased *international adaptation* and regulation and *trade liberalisation* are two of many important changes taking place in the food cluster today. Other changes are ongoing processes of *vertical and horizontal restructuring* between the different elements in the Norwegian industry, a process of *deconstruction of existing agrobased monopolies* is unfolding, particularly within the grain and dairy sector, increased *professionalisation and organisation among retail distribution* (counter-forcing the traditional hegemony among co-operatives and large corporations), increased *scientification* of the food industry, increased *consumer-orientation, internationalisation* processes (both in the retail chain groups and in the industry), and restructuring of the size structure, with more employment in the largest establishments than before are also important changes taking place.

This paper provides an overview of the Norwegian food cluster, and discuss the trends of change against recent theories of economic development. We claim that there is *no simple way to categorise innovation processes in the food industry*, innovation activities in the food industry is often regarded as low, due to the fact that the industry overall spend comparatively little money on R&D, and it introduces comparatively few new products and processes. In extention of this argument, the food industry is claimed to be supplier-dominated in their innovation activities, as product and process innovation often are based on inputs from machinery suppliers. We claim that *both these interpretations of the food industry innovation processes are misguided*, because they are based on an innovation conception where R&D and product and process innovation are regarded as centre of industrial dynamism. Developing new technological products is not a main force in the food industry, the most profound driving force in the food industry seems to be branding and other market oriented innovations, the building up of trade marks and images of product quality and hygiene.

1 THE NORWEGIAN FOOD CLUSTER

1.1 INTRODUCTION AND SUMMARY

Few researchers recognise food production as an economically important - not to say a dominant - sector in the Norwegian economy. In an international perspective, the food industry is often regarded as being of little significance to economic growth, and there exists few studies about innovation, technological capabilities in - and economic impact from - this industry.

The food industry is normally categorised as a traditional, low-skilled, labour intensive and low-tech sector[1], [2]. Further, food producers are described as technological laggards. If food companies innovate at all, the most important changes are often said to be *supplier-dominated*, changes taking place through implementation of new production equipment and machinery[3]. The food industry is in other words mostly analysed as a technology *user*, playing a somewhat adaptive role to the dominant developments among their suppliers. In this view innovation in the food industry is dominated by capital-embodied technical change, following models that were developed in the early 1960s as part of modern capital theory (f.i. Solow 1960, Arrow 1962).

Ironically, at the same time, it is also a very profitable industry, with comparatively high value added per employee. With it's 500.000 NOKs value added per employee per year (1996), the industry ranks higher than 'high-tech' industries like manufacture of radios and television sets, electrical machinery, medical and optical instruments, manufacturing of oil platforms and machinery and equipment.

How can a supposed technologically backward industry be so profitable? In this paper we try to adapt theories of innovation and technological development to the Norwegian food cluster phenomenon. Our basic argument is that regular innovation indicators, like development of new products and new processes, are too simple concepts to capture the dynamics of the Norwegian food industry. More important to economic development are issues like close relationship to policy-making, protecting the domestic food cluster from international competition for a long period of time, the possibility to draw knowledge from a wide array of research institutions, internal R&D divisions, technological suppliers and market surveillance companies, and wide processes of branding, understood broadly as those processes aimed at making consumers more apt to buy certain products.

The food cluster centres around the Norwegian food processing industry, but includes also upstream activities like fishing, fish farming, ship yards and agriculture, and

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[1] STEP Group (1995), *Innovation performance at industry level in Norway; Food, beverages and tobacco*, W15-95, Oslo

[2] J. Hauknes (1999), Norwegian Input-Output Clusters and Innovation Patterns, *in* Boosting Innovation: The Cluster Approach, OECD Paris 1999

[3] Pavitt, K (1984), *Sectoral patterns of technical change: towards a taxonomy and theory, p.* 343 - 373, Research Policy 13

downstream activities like retail, hotels and restaurants. Cluster employment is about 170.000 persons, or about 10 percent of all Norwegian employment. The food processing industry is a central part of the cluster, and is the largest industry in Norway today - measured in both gross product and employment. The food industry alone represents as much as 21 percent of all Norwegian manufacturing value added, and it stands for the fifth highest value added per employee among all Norwegian manufacturing industries - higher than industries like electrical and optical instruments, machinery and equipment and printing and publishing[4]. In terms of employment, the food industry alone represent about 19 percent of Norwegian manufacturing employment (Table 1)[5].

Table 1: The Norwegian food industry, main figures and share of mfg activities, 1996. Source: Statistics Norway, ukens statistikk, 35, 1998 (NACE 15)[6].

	Companies	*Employment*	*GVP*	*Value added*
Number/amount	1.730	52.450	96.582 mill NOK[7]	23.816 mill NOK
Share of Norwegian mfg	16 %	19 %	25 %	21 %

This paper gives a presentation of the Norwegian food cluster, with emphasis on analysing how changes in the cluster may affect innovation processes in the cluster (Chapter 3), based on recent theories of economic change and technological development.

The cluster approach

As nations vary in geography, history, culture and language, they also vary in industrial structures, institutional structures and knowledge level and directions. This is the reason why processes like mass production and flexible specialisation manifests differently in different countries and in different technological and industrial systems.

This report uses a cluster approach to understand the structure of the food production systems. Cluster analysis are build on two assumptions: That production systems are performed by legally separated units, like companies/suppliers, customers, producers of raw materials, research institutions etc., and that most of these units are inter-linked in some way. The concept of such industrial inter-linkages stems from the Marshallian industrial district in the late 19th century, with a regained focus in Perroux' economic locomotive theories from the 1950s and a third revitalisation through Porter's cluster studies in the late 1980s.

A core feature of all these studies has been the role of inter-linkages between the units in propelling knowledge development and innovation. The dominant work putting this

[4] Statistics Norway (1998), ibid.

[5] The processing industry represent about 1/3 of the total cluster employment, see Figure 1

[6] Include only companies with 20 or more employees

[7] 1.000 NOK = € 122,46 (Nov 1999)

perspective on the policy agenda the last decade was the OECD publication 'Technology and the Economy - the key relationships', (OECD 1992), marking a shift in the perspective on how economic development was to be understood, and which policy implications to be drawn. One of the central outcomes of this work was to bury the linear approach to innovation, replacing it with a so-called interactive model of innovation. The notion of interactivity stems from the perspective that not only R&D, but also factors as external knowledge suppliers, organisational corpus of scientific and technological knowledge, marketing, design, testing and distribution[8] can be important factors to innovation. In recent European economic research, the interactive innovation model has increasingly gained terrain.

The interactive innovation model carries three basic differences from the linear model: i) it is interactive, i.e. the different units in the system have the important ability and power to influence choices and strategies within the other units, ii) it is multidirectional, i.e. there are no mono-directional influence from one unit to another - like from R&D to economic development in the linear model - and iii) there are variations in unit strengths and influence between the units across different production systems; some innovation sources are more important than others across varying sectors. The basic idea of the interactive innovation model is hence a relativistic one; there are more factors - and often more *important* factors - behind economic renewal than R&D inputs.

Within the line of innovation studies, one major path has been to give the interactive innovation model an explicit geographical context. Attention has been drawn towards *national systems of innovation*[9] and *regional systems of innovation*[10]. The basic argument in these studies is that innovation happens more often, or is more apt to be successful, when innovation and learning processes are locally embedded, either within national or within regional borders[11]. However, identifying localised units important to economic development - and the strength of linkages between them - has shown to be a problematic task. Problems of benchmarking do immediately occur; questions of how it is possible to systematically identify active units in an innovation system, what is a strong link and what is a weak link between the different units, (how do we actually identify such linkages in the first place), and how do we compare different systems with one another? With such practical questions unsolved, a problem with the innovation system concept is it's openness and inclusiveness. Eventually, we run the risk of considering all institutions and all companies playing important roles in a system where everything is related to everything. Which of course is analytically useless.

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[8] OECD (1993), *Technology and the Economy*, ibid. p. 25

[9] For an overview of concepts and literature, see C. Edquist, Systems of Innovation Approaches: Their Emergence and Characteristics in C. Edquist (ed.), *Systems of Innovation: Technologies, Institutions and Organisations*, London, Pinter 1997.

[10] For an introduction to the concept, see for example Hans-Joachim Braczyk, Philip Cooke and Martin Heidenreich (eds.), *Regional Innovation Systems*, London, UCL Press, 1998

[11] Asheim, Bjørn (1994), *Regionale innovasjonssystem: Teknologipolitikk som regionalpolitikk*, STEP report 1994:18, Asheim, Bjørn and Arne Isaksen 1996, *Location, agglomeration and innovation: Towards regional innovation systems in Norway?* STEP-report 1996:13, Oslo.

A way to limit interactivities into useful, conceptual magnitudes must in other words allow a perspective where some industries and some links are more important than others. This works grow out of the previous work by Hauknes[12], who used 1993-data from the Norwegian national accounts to quantify and map how different industries are linked to one another through intermediate transactions. Using cut-off levels for link strengths and significant sectors, Hauknes distinguished six Norwegian clusters whereof one is the agrofood cluster[13]. Hauknes' cluster analysis is the point of departure of this analysis.

The advantage of Hauknes' cluster mapping methodology is how it eloquently captures the broad picture of the food cluster. It provides a general description of the whole range of food related activities, from production of fishing boats, via fishing, agriculture and industrialised manufacturing of food to hotels and restaurants[14]. Unfortunately, the disadvantage of the result also lies in the very nature of the methodology. As the method provides an overview of the large volumes of intra-industrial trade of intermediate goods on an industrial level, the mapping ignores lines of communication and co-operation both within the individual industries in the cluster, and between central cluster units and knowledge providers, innovation partners, suppliers of machinery etc. The second method is use of statistical data on innovation, providing a more detailed overview of dynamic interactivity within the cluster. The data are from the Community Innovation Survey, undertaken in 1993 and 1997. The survey includes data for innovation sources and technological partners for all European manufacturing industries, including Norwegian manufactures of food and beverages.

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[12] Hauknes (1998), op.cit.

[13] The others are the oil and gas cluster, the construction cluster, the transport cluster and the paper and graphics cluster, and the information intensive cluster.

[14] As the mapping is based on intermediate goods, a picture of trade with finished goods from manufacturing industry to the stores is not provided.

2 THE NORWEGIAN FOOD CLUSTER

This chapter contains an overview of the Norwegian food cluster. The basic aim is twofold; i) to provide a description of the Norwegian food cluster, and ii) to give an overview of dominant processes of change in the cluster.

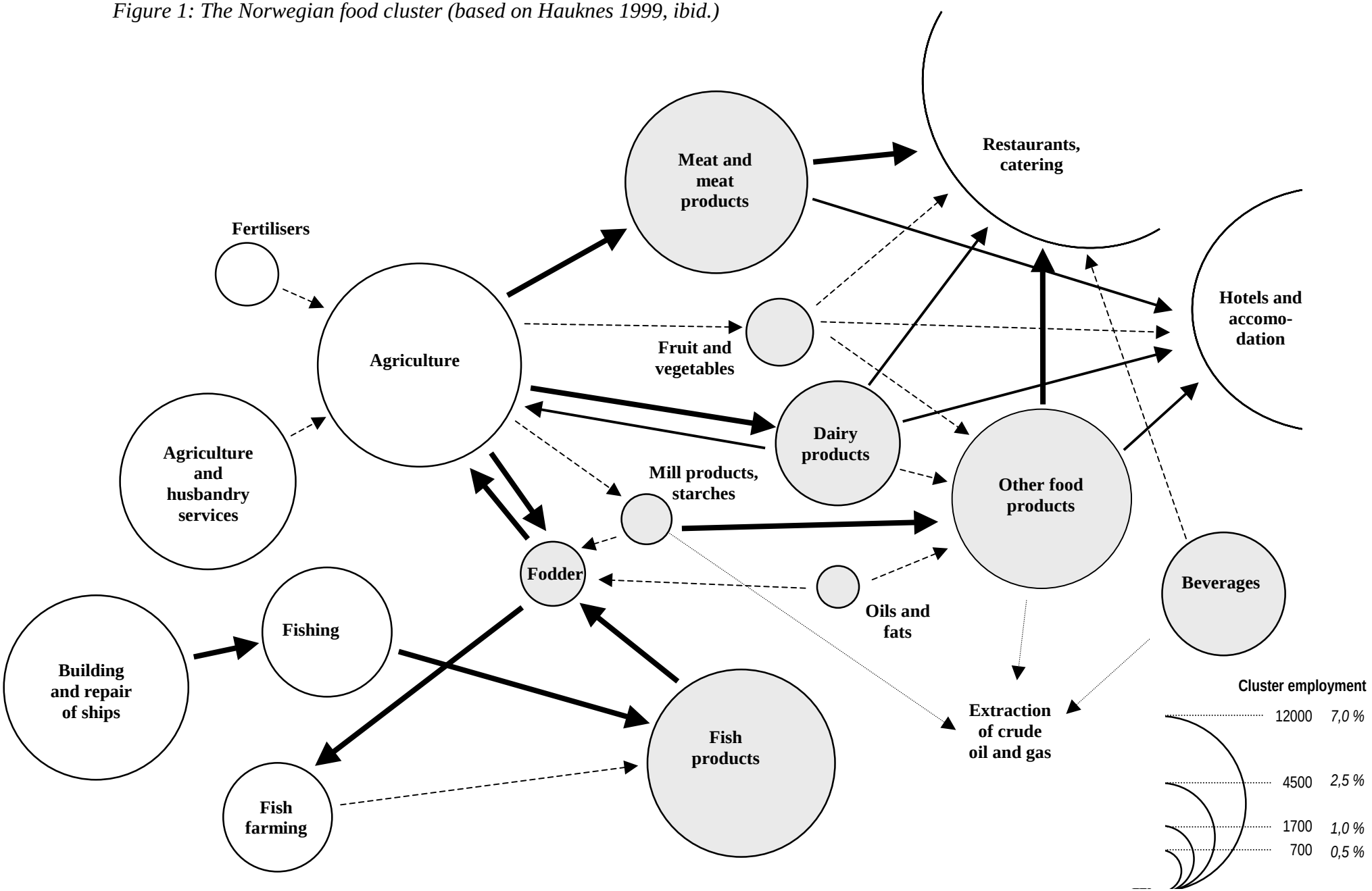
The chapter starts with a quantification of the food cluster, based on the methodology of Hauknes. A central feature of the cluster is the food processing *industry*, and we give a brief introduction to the industry, with emphasis on the industry's role in the national economy. Further, we give an overview of industrial structure, including a presentation of the largest manufacturing food companies, their ownership and the industry size structure. As the food industry can be divided into a sub-set of activities (like fish processing, meat processing, processing of dairy products etc), a more detailed presentation is given of the individual activities, however with a close eye on the industry's integration towards upstream and downstream activities in the cluster. We then follow to look at localisation patterns of the industry, before we look the food distribution system, security regulations and innovation activities and policies.

The empirical findings from this chapter are used as a basis for Chapter 3, discussing how changes in the cluster may affect innovation activities. A main argument is that small companies are structurally vulnerable to the ongoing processes of change in the whole cluster, and that a SME perspective on policy might be needed to maintain industrial diversity. At the same time, large companies have better ability to exploit the specificities of food industrial dynamics, like like-term investments in branding and trade-marks.

Quantitative limitation of the cluster

The industrial extent of - and intermediate relations within - the agrofood cluster is presented in Figure 1. Thickness of the arrow reflects the magnitude of the interrelatedness between the different activities. The size of the circles reflects number of employees in the industry. The shaded circles represent the food processing industry (NACE 15).

Figure 1: The Norwegian food cluster (based on Hauknes 1999, ibid.)



The agrofood cluster separates from the other Norwegian clusters both in two dominant ways: In terms of size and in terms of few linkages to the rest of the economy. Hauknes finds that the cluster is the largest of the six identified clusters. The cluster's share of national employment is slightly less than 10 percent, with about 170.000 persons[15] (1996). The largest employing industries in the cluster are 'Hotels and accommodation' and 'Restaurants and catering', representing respectively 22.000 and 41.000 employees. The following large industries are Agriculture (16.000 employees), fish products (13.500 employees), Building and repair of ships (13.000 employees), and Meat and meat products and Other food products (both 12.500 employees).

2.1 BACKGROUND

Introduction

The second part provides a more focused description of interactivity, with main emphasis on knowledge providers, innovation sources and technological collaborators to the food industry. We find three dominating knowledge providers to the industry; suppliers of machinery, suppliers of market knowledge and suppliers of R&D/scientific knowledge.

What is the food cluster?

A relevant point of departure in describing the food cluster is the food processing industry. The Norwegian food industry consists of companies that turn raw materials into processed goods, like fish products, chocolate, meat products, bottled milk, pizzas, beverages etc. Raw materials are mainly supplied by domestic farmers or fishermen. There is hence a strong interdependency between the food companies and the domestic producers of raw materials. According to Hauknes, 80 percent of intermediate deliveries are taking place inside the cluster, while only 12 percent takes place with other clusters. Compared to the other five clusters, the agrofood cluster is therefore the most 'isolated' one, with a radically lower share of linkages to activities outside the cluster than the other clusters have.

Natural conditions have shown good for production of certain types of raw materials, particularly fishing. Other important natural conditions are soil fertility and plenty of sweet water. Most agrobased raw materials, like meat, grain and milk, eggs, and potatoes are produced domestically, and Norway is practically self-sufficient with such raw materials.

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[15] The North sea activities ('extraction of crude oil and gas') seemingly appears as a part of the food cluster (see Figure). A link is included when flow to receiving sector represent large share of omitting sector total omitted volume. Oil companies are hence included as they represent large volumes in terms of consumption of food stuff (mill products, other food products and beverages). We do not include the sector as a part of the cluster in the further work, as the basic activity performed in this sector is not related to food in any way.

However, when we talk about the Norwegian food cluster, we are actually talking about two (perhaps three) more or less independent sub-clusters, or *production systems.* Norwegian food companies can namely be divided into two broad categories, according to what kind of raw material they use; *agrobased food companies*, producing dairy products, mill products, fruits, meat and grain-based fodder, and *marine based food companies*, like producers of fish products and fish-based fodder. In addition, there is also companies *producing beverages*, where sweet water represent the largest input in terms of volume.

Measured in employment, the agrofood based group of companies is the largest, representing 60 percent[16] - or about 35.000 employees - of total employment in the food industry. Marine based activities covers about 30 percent (15.000 employees), while fairly 10 percent are working with production of beverages (about 6.000). As Figure 1 illustrates, there exist almost none significant linkages between the three different spaces. Production of beverages, for example, appears as a single island in the figure, with linkages neither to producers of raw materials nor other food producers. The fish based production system consists of production of fishing boats, fishing, fish farming, manufacturing of fish products, and production of fodder. Norway has one of the worlds longest coast lines[17], and fish has been an important export item in hundreds of years, and still is. Fish-farming has also grown to be an important industry the last decades, particularly red fish. While the red fish is used for food, very large parts of the white fish are either used to fodder or exported without much proccesing. The most fished fish is *kolmule*, a deepwater cod fish used to fodder. Unprocessed fish (or fish with a low degree of processing, like filleting and freezing) is the most important Norwegian food export item. Most export of unprocessed fish goes to EU countries, particularly Denmark, for further processing.

The agrofood production chain is based on agricultural production, which again uses fertilisers and agricultural and husbandry services as dominant intermediate inputs[18]. From the agriculture activities, the production lines divides into dominant industrial activities like meat and meat production, dairy products and fodder, and to some lesser extent fruit and vegetables and mill and mill products. Grain, fruit and vegetables are mainly produced in the flat areas of eastern and middle Norway, and western parts of Norway (Rogaland). Husbandry is mostly kept in mid and north-western Norway, and is dominated by cattle, sheep, pigs and chickens.

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[16] Including 'other food products', like biscuits, chocolate, catering, coffee and tea

[17] 21.465 km including the fjords, or a bit longer than half the distance around the world (40.000 km)

[18] The only area where agricultural and fish based activities seemingly merge in any substantial way, is in production of fodder. As Figure 1 shows, both 'agriculture' and 'fish products' have dominant links to fodder, and fodder (literally) feeds back to respectively agriculture and fish farming. However, the actual link between the two production chains is weak. Fodder to fish farming is dominated by herring meal and imported soy. Animal (husbandry) fodder dominantly consists of barley and oats. Fodder aimed at husbandry[18] contains mainly 4-5 percent herring meal. For fish fodder, the main agrobased ingredient apart from fish meal is soy, but may also include small proportions of wheat and corn gluten.

The segmentation is mirrored in the national institutional setting of the food cluster. In Norway, you find for example one Ministry of Agriculture and one Ministry of Fisheries. The research institute sector is also quite segmented, with a wide array of institutions serving only one of the sectors. The most dominant knowledge suppliers to the agrobased part of the cluster are Matforsk, Jordforsk, Planteforsk and NLH. The most important knowledge suppliers to the fish industry are Fiskeriforskning/University of Tromsø, Fiskerihøgskolen, Fiskeridirektoratet. An overview of these institutions and the sector they serve is given in Table 2.

Table 2: Norwegian R&D suppliers in the food processing industry, by main sector.

	University/HEI/Governmental	*Research Institute*	*Private R&D office*
Mainly agrobased	• Norwegian veterinary college • Agricultural university of Norway (NLH)	• Matforsk • Jordforsk • Planteforsk • Kontrollinstituttet for meieriprodukter • Norwegian institute for agricultural research (NILF)	• Norsk Svineavlslag • Felleskjøpets fòrutvikling • Norske Meierier/TINE • Potetindustriens Laboratorium • Norsk Kjøtt
Mainly marine based	• Fiskeriforsk/University of Tromsø • Norsk Fiskerihøgskole/ • Fiskeridirektoratets ernæringsinstitutt • Harstad College	• Norconserv • Havforskningsinstituttet • Fiskeriforsk • SNF (fiskeriøkonomi)	• Sildolje- og Sildemelindustriens Forskningsinstitutt (SSF)

The beverage industry is not at all institutionalised in the same formal way as the fish and agrofood systems. However, the beverage production system has - over the last twenty years - increasingly been 'institutionalised' in another way, by increasingly joineing under one umbrella, the Orkla investment group. More about this later.

Main figures

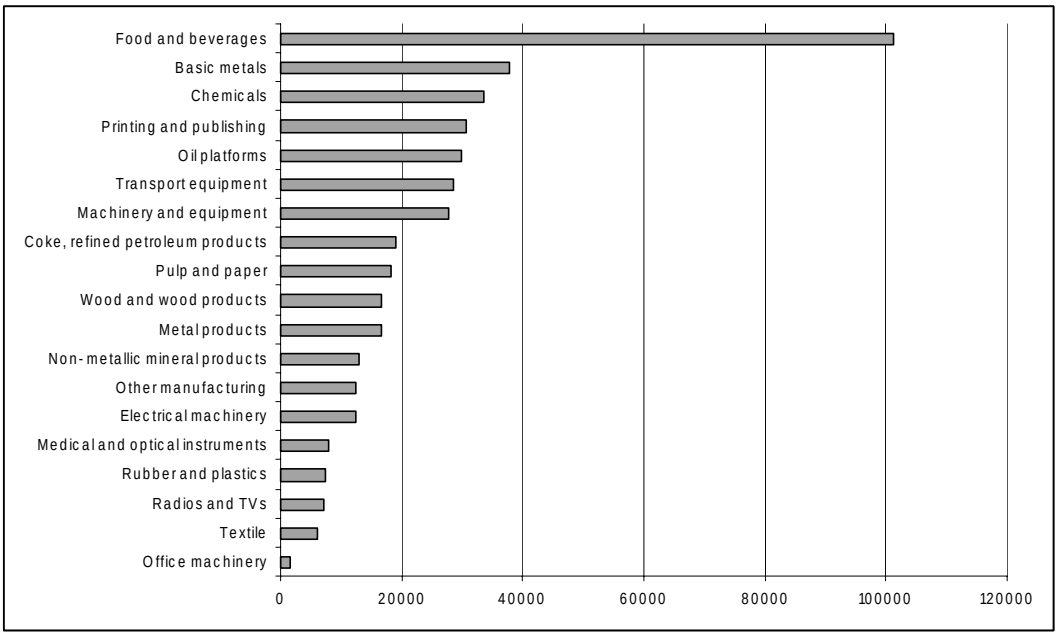
The food industry is Norway's largest manufacturing industry (NACE 2-digit), and it is growing. In companies with 20 or more employees, employment rose from about 49.000 in 1993 to about 52.500 in 1997[19]. The industry has experienced a more positive employment and turnover trajectory than most other industries, and the share of manufacturing employment is today higher than ever before: Employment has risen from about 11 percent of manufacturing employment in 1950 to about 18 percent today. The Norwegian food industry is also more dominating than food industries are in any other western country. Measured as share of manufacturing value added, Norwegian food

[19] Statistics Norway (1997), *Industristatistikk 1997* (Reviced final figures), Oslo/Kongsvinger

industry represented in 1988 eighteen percent. The same figures were for Germany at that time 10,3 percent, Netherlands 14,8 percent, UK 12, 8 percent and France 12,4 percent [20].

Figure 2 gives an illustrating overview of how dominant the industry is in Norwegian manufacturing industries. The figure shows total gross value of production (GVP) per industry (2-digit NACE code)[21] in Norway in 1997. GVP from manufacturing of food and beverages was over 100.000.000.000 NOKs, almost three times as large as the following industry on the list. The share of total manufacturing GVP was about 25 percent in 1997.

Figure 2: Gross value of production (NACE 2-digit), 1997, in million NOKs. Source: Statistics Norway Industristatistikk 1997 (Revised, final figures).



It is at the same time a very profitable industry. Figure 3 shows an overview of value added per employee in Norwegian food industry. With it's 500.000 NOKs value added per employee per year (1996), the industry ranks higher than 'high-tech' industries like manufacture of radios and television sets, electrical machinery, medical and optical instruments, oil platforms and machinery and equipment (Figure 3).

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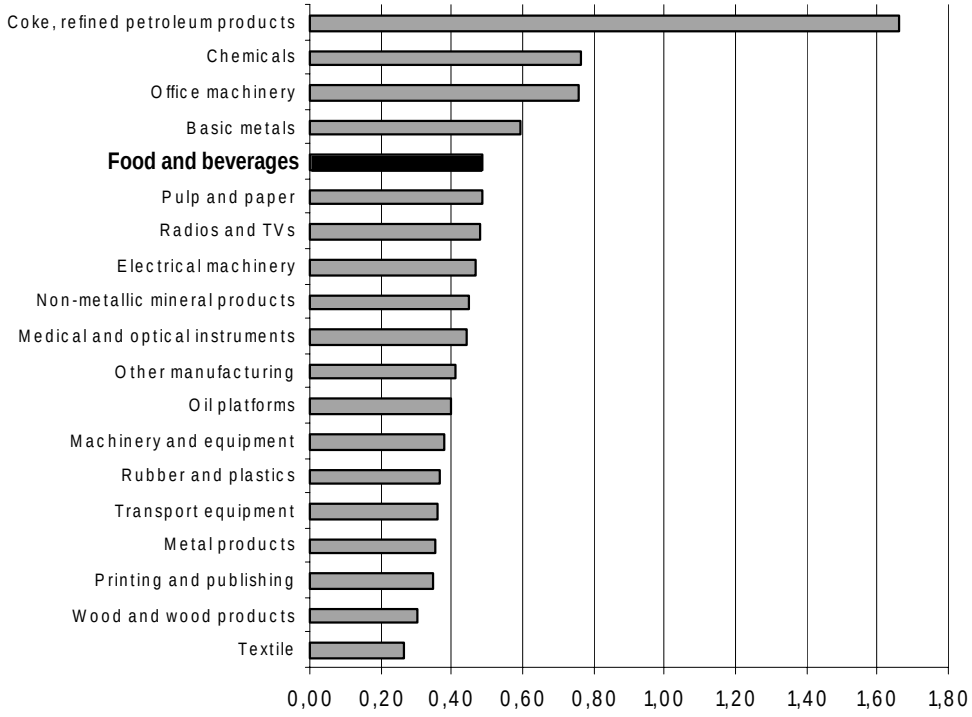
[20] Wyckoff, A. (1994), *Investment, Innovation and Competitiveness: Sectoral performance within the triad*, EIMS publication no. 2., p. 75.

[21] 'Transport equipment' is the sum of figures from NACE 34 and 35. 'Textiles' is the sum of figures from NACE 17, 18 and 19. 'Other manufacturing' consists of 36 and 37. Oil platforms (NACE 34.114/5) is drawn from NACE 34 and treated as a separate industry, according to Statistics Norway's standards.

Figure 3: Value added per employee in Norwegian manufacturing industries, in million NOKs, 2-digit NACE level, 1996. Source Statistics Norway, ukens statistikk, 35, 1998.



An important condition for the food cluster is the regulatory framework. Food regulation mechanisms are complex, ubiqous and interwoven, concerning close to all areas of food production, from breeding, selection and preparation of raw materials, processing, preservation and storing, packing, wrapping and coating, hygiene and safety, quality and nutrition to quality documentation, transport and distribution, trading and sale.

International trade regulations for food

Table 3: Brief overview of regulation of international trade with Norwegian food and food products. Source: Næringsmiddellovutvalget/Nærings og energidept, (1996), Effektiv matsikkerhet, NOU 1996:10.

Event	*Starting*	*Covers*	*Food products*		*Raw materials*	
			Aim	Policy	Aim	Policy
'Initially'	1930s	Sheltering of domestic food producers	Sheltered from international competition	Strong protection through quantitative import restrictions	Sheltered from international competition	Strong protection through quantitative import restrictions
The EEA agreement	1993	Trade with the European Union	Achieve equal possibilities for exchange of manufactured goods, including food stuff. Make Norway adapt to EU regulations	Applies dominantly to agrofood products. Horizontal rules for 'health and honesty' in food production, common veterinary standards and harmonisation of quality (i.e. standards for use of ingredients and additives).	Not included in the EEA agreement, but Norway has duty free access for un-processed fish	
GATT/ Uruguay	1995	World trade	Increase world trade	Change from quantitative import restrictions to (gradually lowered) toll duties. Introduction of minimum import quotas. Lowering export subsidies of national producers.	Increase world trade	Change from quantitative import restrictions to (gradually lowered) toll duties. Allow import quotas.
WTO	1999+	World trade	Increase world trade	Further duty reductions?	Increase world trade	Further duty reductions?

2.2 OWNERSHIP STRUCTURE AND DOMINANT COMPANIES

Norwegian food companies can be categorised in three, according to their corporate status[22];

i) *Corporation controlled companies*, include those companies belonging to national or international groups controlling multiple daughter companies. This group include almost all the largest companies (a presentation of the largest companies, employment and ownership is provided below), and cover the five largest Norwegian food companies - Ringnes, Stabburet, Nidar, Freia and Toro. These companies are vertically integrated in processing, marketing and sales activities, and recognised by a traditional strong market orientation and they were all early to develop brand-names. Relation to raw-material suppliers vary from pure market relations to more stable relations[23]. Orkla-owned companies, for example, has a strategy of developing stable supplier relations[24]. Ringnes, Stabburet and Nidar are all controlled by Orkla, the largest owner-group. Orkla is a Norwegian investment group with ownershares in a wide array of domestic companies, ranging from

[22] Knut Onsager og Berit Aasen (1995); *Innovasjon og renere teknologi - en studie av landbruksbasert foredlingsindustri,* NIBR Notat 1995;117, NIBR, Oslo

[23] Onsager and Aasen (op.cit.)

[24] Nationen, 19.05.99

newspapers to insurance, chemistry, and food. About 6.500 persons are employed in Orkla-controlled food companies, and main emphasis lies within pizzas and baked products, jams, juices, mineral water and conserved vegetables. More about Orkla in the Appendix. Rieber is located in Bergen, and main products are soups and fish products. Rieber & Søn are is also involved in building and construction of roads and production of containers and boxes. The food companies belonging to Rieber & Søn employ about 2.000 persons. There are few international companies located in Norway. Freia is controlled by the American Kraft General Foods/Philip Morris corporation, with about 1200 employees. Nestlé has also a few companies in Norway, producing fish products and baby food.

ii) *Companies belonging to a co-operative structure*, covering producer-owned, regionally located production-companies, joining in a common national distribution, marketing and sales organisation. These are strongly vertically integrated companies, with strong links to producers of raw material (fruit, vegetables, meat, milk, eggs). Companies belonging to this structure are large, like Hedmark-Oppland slakterier and Gilde-Agro Fellesslakterier with 650 and 500 employees. Both these companies belong to Norsk Kjøtt, and three of the ten largest food companies belong to one ore another co-operative. The co-operatives have increasingly emphasised brand-naming the last decades, through Gilde (Norsk Kjøtt) and TINE (milk and milk products). The co-operative's relations to retail stores vary, but are mostly market based. The production monopoly of TINE has forced retailers to sell TINEs products, while the meat co-operative has met consistently resistance from the retailers, which explicitly have said they are looking for competitors to Norsk Kjøtt.

iii) *Independent producers*, mostly small, autonomous familiy-owned companies. These are companies with weak vertical integration both upstream and downstream. Owners are often participating in the day-to-day production. A typical example is *Majonesfabrikken*, located at the heart of Oslo, with 14 employees. The factory produces majonese salads for grocery shops located in the greater Oslo region, and the manager, who runs the factory with his son, is responsible for both production, office management and transport. Ingredients are purchased on marked basis from local suppliers (eggs and oil) and importers located in the Oslo region.

Table 4: Norwegian food establishments and employment, 1996[25]. Source: Statistics Norway employment register, 1996, web-info 1999 and telephone interviews 1999.

Establishment	*Empl.*	*Industry*	*Ownership*
RINGNES AS	1485	Brewery	Investor group (Orkla)
FREIA AS	1223	Other food	Foreign (Kraft General Foods)
STABBURET AS	828	Other food, meat	Investor Group (Orkla)
NIDAR AS	693	Other food	Investor Group (Orkla)
TORO PRODUK SJON	648	Other food	Investor Group (Rieber & Søn)
HEDMARK OPPLAND SLAKTERIER	633	Meat	Co-operative (Norsk Kjøtt)
HANSA BRYGGERI AS	627	Brewery	Var. financial investors[26]
GILDE AGRO FELLESSLAKTERI BA	514	Meat	Co-operative (Norsk Kjøtt)
VESTFOLD-BUSKERUD SLAKTERI A/L	460	Meat	Co-operative (Norsk Kjøtt)
RINGNES E C DAHLS BRYGGERI AS	458	Brewery	Investor group (Orkla)
BØNDERNES SALGSLAG	444	Meat	Co-operative (Norsk Kjøtt)
STABBURET AS	441	Other food	Investor group (Orkla)
FELLESMEIERIET OSLO	411	Dairy	Co-operative (TINE Norske Meierier)
FELLESSLAKTERIET A/L	365	Meat	Co-operative (Norsk Kjøtt)
SÆTRE AS	334	Pastry	Investor group (Orkla)
DENOFA AS	308	Oils	Investor group (Orkla)

Size structure

The size structure of the food industry is very similar to national size structure: Many small-sized establishments and relatively few large ones. There are for example only two food establishments with more than 1.000 employees; Ringnes and Freia (Table 4). From about 2.000 food establishments, the share of large establishments is practically the same as national average for manufacturing industries; five percent of the establishments have 100 or more employees (Table 5). For establishments with 50-99 employees, the share is a bit less than average (five percent, compared to seven percent), and the share of small establishments (less than 50 employees) is consequently a bit higher (90 to 88 percent).

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[25] The dataset does not provide total company employment. Stabburet, for example, is listed in the overview with 828 employees, which only include the largest establishment within the company. Stabburet has a total of about 1400 employees. Ringnes breweries has 2.100 employees.

[26] Hansa Bryggeri was untill recently a part of Orkla, before it was sold to individual investors. The brewery merged with Borg Bryggerier in the late 90s, and largest owner share today is held by Borg Bryggerier Holding (30 percent), employees (7,5 percent), Hamar Papir (7,5 percent) and a group of financial investors (a.o. K-invest, Gjensidige and Norske Liv).

Table 5: Size structure in food industry (NACE 15) and all manufacturing industries, 1997. Source: Statistics Norway, employment register/STEP Group

		Size classes (employees)			
		1-49	*50-99*	*100-199*	*200+*
Comp.	Number of food establishments	1.798	144	69	37
	Share of food establishments	88 %	7 %	3 %	2 %
	All mfg industries	90 %	5 %	3 %	2 %
Empl.	Number of food employees	20.437	9.972	9.225	14.912
	Share of food employment	38 %	18 %	17 %	27 %
	All mfg industries	33 %	14 %	16 %	37 %

1997

How has size structure changed over time? The general answer is that the food industry seems to be relatively stable on an aggregate level, both in employment and number of establishments. Comparing employment data between 1986 with 1997, we find these three trends:

i) The largest changes have been in share of employees working within the different size classes. The share of people working in size small establishments has decreased. The share of employees working in medium-sized establishments has been fairly stable /slightly decreasing. The share of employees working in the largest establishments has increased. In more detail, we find that employment share within the group of establishments with more than 100 employees increased from 40 to 44 percent: For the group of establishments with more 200 ore more employees, the share of employment has increased from 25 to 27 percent, or with about 500 persons. The share of persons working in establishments with 100-200 employees has increased from 15 to 17 percent. At the same time, the small companies are getting smaller: While the total number of small companies is stable, the number of people working in these establishments has decreased. In 1986, 41 percent worked in establishments with less than 50 employees. Today, the share is 38 percent. These shares represent a decrease of about 3.000 persons in 1.800 small companies, or about two persons in each company.

ii) We have also found that the number of employees has decreased slightly between 1986 and 1997[27], but the number of establishments has almost not changed at all (in 1986, there existed 2011 food establishments, compared to 2048 in 1997). The average number of employee per employee has therefor diminished in this period. Arithmetic average number of employees per establishment was in 1986 28,6 persons, compared to 26,6 persons in 1997.

[27] The figures from 1986 cover all companies in the ISIC 31 category. Production of tobacco is therefor included, an industry not included in the 1996 figures. There are two dominant tobacco producers in Norway, with a total of about 800 employees. The inclusion of these companies in the 1986 data explains parts of the 'decrease' in employment over the past decade.

iii) The total number of enterprises - and the share of establishment in different size classes - has been stable.

2.3 THE GEOGRAPHY OF FOOD COMPANIES

The geography of the food industry is of particular interest, in three ways. Firstly, food employment in general plays a dominant role in almost all regions. Secondly, the Norwegian food industry is market by a distinguished regional division of labour. Thirdly, there is a pattern in terms of how different activities, like manufacturing, marketing and R&D activities, within large companies are localised.

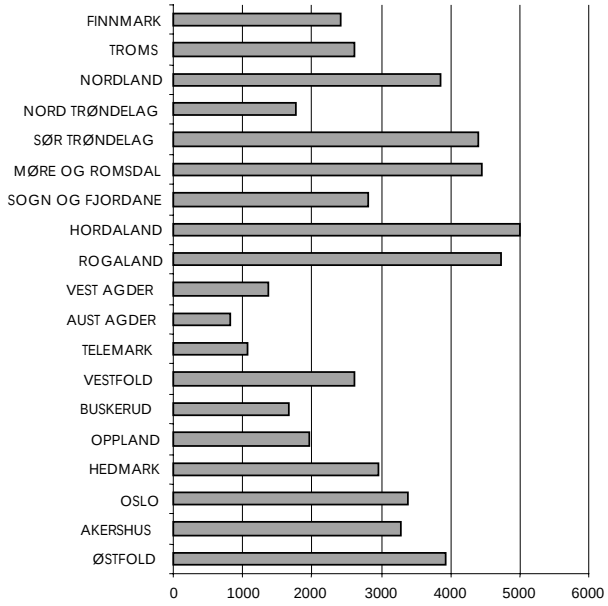
Firstly, the food industry seen as a whole is not confined to particular regions. It stands for large quantities of employment in almost all counties. With the exception of the three southernmost counties (Vest-Agder, Aust-Agder and Telemark), each county has at least 2.000 employees within food manufacturing (Figure 4). The largest 'food counties' measured in number of employees, are Hordaland and Rogaland, and Møre og Romsdal and Sør-Trøndelag. Large companies in these counties are Toro produksjon, Hansa bryggerier, Norway Foods (Hordaland), Tou bryggerier, Agro fellesslakteri, in addition to several dairies and producers of fodder (Rogaland) and E C Dahls bryggerier and Nidar (Trondheim). Employment measured as share of total employment in manufacturing industries (Figure 5), we see that the food industry is particularly dominant in the most rural counties, including the northernmost and coastal ones, like Finnmark, Nordland, Troms, Møre og Romsdal and Sogn og Fjordane.

Secondly, the food industry is marked by a regional division of labour. We have already touched briefly upon this. Fish processing is most important in the northern and north-western area of coastal Norway, and the large share of food employment in these counties (see above) is mostly found within fish processing. Meat and dairy industries are most important in central and eastern Norway (Hedmark, Oppland, Nord-Trøndelag, Sør-Trøndelag and Østfold). Pastry products are produced in Oslo and Sør-Trøndelag. Oil and fat production are located in Østfold. Fruits are processed in the larger surrounding area of the capital region (Vestfold, Hedmark, Oppland). Production of beverages are mainly localised to four main towns in each part of the country.

Thirdly, there seems to be a general pattern of how large food companies locate their different activities. For large companies production is regionalised, while market divisions, research and head office is located in the Oslo region. Maarud, producing potato chips, taco stuff and pommes frites, has production facilities at Disenå between Skarnes and Årnes, while sales and marketing is located at Rodeløkka in Oslo. Nestlé has a market and sales office at Billingstad in the outskirts of Oslo, with Findus factory at Hammerfest in Finnmark and baby food production at Hamar. TINE Norske Meierier is owned by several dairies located in different regions of the country, but have sales division, market division and research division in Oslo. Frionor has a marketing and research division in Oslo and a production location in Trondheim. Mills has head office in Oslo, with production in Fredrikstad, Drammen, Lillehammer, Trondheim, Finneidfjord in addition to Oslo. Fjordland, producing dairy products and prepared meals, is solely an administrative company, with all employees located in the Oslo office

(administration, economy, marketing and sales), renting production capacities from manufacturing units belonging to Fjordlands owners (TINE, Norsk Kjøtt /Gilde and Prior).

Figure 4: Employment in the Norwegian food industry, number of employees by county, 1996 (N=55.113)[28]. Source: Employment register, 1996, STEP Group / Statistics Norway



Regional innovation systems in the food cluster?

Regional innovation systems consist of systems where an industry branch is particularly dominating, and where companies participate in innovative networks, often reckognised by some kind of cultural unification. The most known successful regional innovation systems are Silicon Valley, some industrial districts in Northern Italy and Cambridge. In a quantitative study of Norwegian regional inovation system, Isaksen discovered 13 such food clusters in fish processing and none in agrofood[29]. Seven of the fish processing clusters were located in the two northernmost counties (Troms og Finnmark), while the rest were located in western and north-western Norway (Sør-Trøndelag, Møre og Romsdal, Sogn og Fjordane and Hordaland). The clusters were identified through employment statistics, where employment in one region and one industry was three times higher than national average, and included at least 10 companies and 200 employees. These results echo the findings above, where we stated that the fish processing industry is of particular domination in the northern-most counties.

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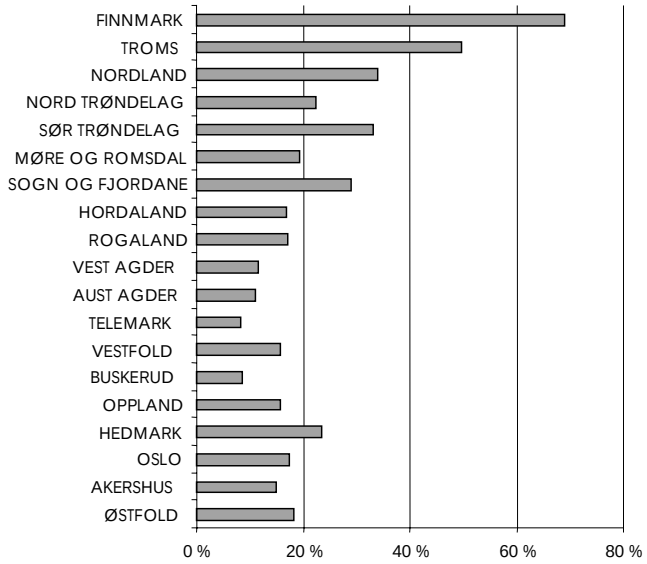
[28] Measured in number of employees living in county and working in the food industry

[29] A. Isaksen (1996); *Regional Clusters and Competitiveness: the Norwegian case*, STEP report R-16-1996, STEP Group, Oslo

Figure 5: Food industry employment as share of industrial employment, by county, 1996 (national average = 21 percent)[28]. Source: Employment register, 1996, STEP Group / Statistics Norway.



The disadvantage of Isaksen's model is that it does not say anything about the relations between the companies in these regions. Neither does it illuminate how and to which extent knowledge suppliers play a role in food innovation. So who are the core suppliers of external knowledge, where are they located and what fields do they operate in? In a survey performed by STEP Group in 1997, Norwegian food companies were asked which research environment they regarded as important knowledge providers to their field of production. The result is presented in Table 6. The table shows dominant knowledge areas in the food industry, and more than 30 knowledge providers in these areas. The most important ones are described later in this paper.

Several aspects can be derived from this table. Firstly, we see that the most frequent found knowledge suppliers are located in the Oslo region. These knowledge suppliers include Jordforsk (Ås), Planteforsk (Ås), Matforsk (Ås), Norges Landbrukshøgskole/NLH (Ås), Norges Veterinærhøyskole/NVH (Oslo) and University of Oslo (UiO). Particularly seems Matforsk to be the most extensive knowledge supplier to the food industry, which according to the table supplies almost all food-related activities with scientific knowledge. The list also includes Oslo-based branch-institutes, like research laboratories at TINE Norske Meierier and Norsk Kjøtt. In addition, the main bulk of market monitoring companies and trend analysts are located here. We also remember from earlier that machinery suppliers are mainly located in the Oslofjord area.

Table 6: Knowledge areas and suppliers to the Norwegian food processing industry (Oslo-based companies in bold)[30]

Knowl. area	**Selection and preparation of raw materials**	**Processing**	**Preservation and storing**	**Packing, wrapping and coating**	**Hygiene and safety**	**Quality and nutrition**
Knowledge suppliers	**Matforsk**, Norconserv, **NLH**, **NVH**, **Jordforsk**, SSF**, Planteforsk, Felleskjøpets fòrutvikling**, Havforskningsinstituttet, **Norsk svineavlslag**, Norges fiskerihøgskole, Fiskeriforskning, **UiO (biol.), NIVA**	**Matforsk**, Norconserv, **NLH**, **NVH**, NTNU, SINTEF, **Norske Meierier**, Potetindustrienes Laboratorium, UiT (biologi og geologi), Gastronomsk Institutt	**NLH**, **NVH**, **Matforsk**, Norconserv, SINTEF, NTNU, **Norsk Kjøtt, TINE,** Næringsmiddeltilsynet	**NVH**, **Norske Meierier**, **Matforsk**, Norconserv, **NLH**	**Norsk Kjøtt**, **Norske Meierier**, Potetindustriens Laboratorium, **NVH**, **Matforsk**, **NLH**, SSF, Plantevernet, Næringsmiddeltilsynet	**Matforsk**, Norconserv, **NLH**, **UiO**, **NVH**, **Norsk Kjøtt**, **Norske Meierier**, Fiskeridirektoratet, Fiskeridirektoratets Ernæringsinstitutt**, Felleskjøpets fòrutvikling,** SSF

Knowl. area	**Quality control and quality documentation**	**Transport and distribution**	**Trading, market analysis, trends, sale**
Knowledge suppliers	**Norske Meierier**, **Kontrollinstituttet for meieriprodukter**, Norconserv, **NVH**, **NLH**, **Matforsk,** Næringsmiddeltilsynet	SINTEF, NTNU, N**LH**, **Matforsk**, **NVH**, **UiO,** Næringsmiddeltilsynet	**BI**, **NLH**, **SIFO, NILF,** Fiskeriforsk, SNF, (fiskeriøkonomi), Norges Fiskerihøgskole, **NMH**, HiH, **AC-Nielsen, MMI/4 fakla, Feedback Research,**

The Oslo region (includes the two counties Oslo and Akershus) is also the area where we find most food corporation head-quarters (see 2.3). Some economic geographers believe that such geographical proximity embed potentials to better communication between the different units, leading to increased knowledge exchange and better and more frequent innovation process. Isaksen[31] states for example that *"there is an tendency to find entrepreneurial and innovative activities concentrated to certain places"*, where *"company dynamics are often related to the company's geographical and functional surroundings. The geographical surroundings include relations to collaborators and institutions"*. The statistical material suggest to some extent that it is possible to describe the Oslo region as a regional innovation system. We saw in Figure 8 and Figure 9 that Oslo-based companies in larger extent than Noregian food companies in general reported technological co-operation with domestic partners, in particular suppliers of machinery and equipment and research institutes (geographical surroundings). Oslo-based food

[30] Based on STEP Group / Trine Bendix Knudsen et al. (1999), in *Stortingsmelding 39* (The Government's report to the Storting), 1998/99. Complimentary information added from the Norwegian Research Council project catalogue 1999 (biotechnology and processing) and interviews with Oslo-based companies the same year.

[31] Isaksen (1999), ed; *Regionale innovasjonssystemer*, STEP report R-02-1999, STEP Group, Oslo.

companies also had more often collaboration with external suppliers of machinery (functional surroundings).

However, the main argument against the region being a regional innovation system is that food employment as share of total employment is relatively low; about 18 percent of manufacturing employment in Oslo (national average is slightly higher) is found in food companies - representing 14 percent of total Norwegian food employment.

2.4 DISTRIBUTION SYSTEM AND MARKETS[32]

A large part of domestically produced food products reach their markets through wholetrade and subsequently through stores. Such stores consist dominantly of retail stores, but also include restaurants and hotels, bakeries, fast food restaurants, kiosks and gas stations. Total turnover for retail stores[33] and hotels and restaurants[34] in Norway is about 120 billion NOKs, sales of grocery products, food and beverages from gas stations not included. Retail store turnover represents about 80 percent of this turnover, and this is where we will keep our focus. As with the food industry, the mass market distribution system is marked by a converged ownership structure. As much as 99 percent of grocery turnover[35] is now taking place within the four retail groups; NorgesGruppen (33 percent), NKL (25 percent), Hakon Gruppen AS (28 percent) and Reitan-Gruppen (13 percent). NKL is membership controlled, whilst the three others are familiy-owned.

The most predominant change within the last decades' development of chain groups has been the entering of low-price chains like Rimi and Rema, which increasingly dominate the market. Rimi (Hakon-gruppen) is the single largest chain with 14,6 of total grocery turnover. Rema (Reitan-gruppen) is the second largest with 12,6 percent. These chains are both price-focused and their product arrays are limited. The top-down structure gives the local manager no powers to sell other products than what is decided by the group owners.

The chains also vary in degree of integration with the group. Dulsrud (ibid.) separate between three forms of integration:

i) *Voluntarily chains* are chains where acquisition of food products / other products is arranged through a varying degree of *co-operation*, but where the individual shops still have a relatively large freedom and control over what they sell.

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[32] This section is mostly based on A. Dulsrud (1999); *Markedstrender og utvikling i distribusjonsmønsteret*, in Borch, O. J. and E. P. Stræte (op.cit.)

[33] Retail is here defined as those companies categorised under NACE 52.1 (retail stores with broad product array) and 52.2 (specialised retail stores for food and beverage products), according to Statistics Norway. Source: SSB (1996); *Wholesale and Retail Trade Statistics 1996*, C531, Oslo-Kongsvinger, Table 5

[34] Not including accomodation. Covers those companies categorised under NACE 55.1-5 (Hotel and restaurants). Source: Statistics Norway (1997); *Hotell- og restaurantvirksomhet, registerstatistikk*, Oslo-Kongsvinger

[35] Including non-food items.

NorgesGruppen, for example, includes about 15 large and small chains, most of them of this type. NorgesGruppen includes supermarket chains like AKA/Spar, Meny, Jens Evensen and Lorentzen. This category also cover the stores belonging to NKL, a co-operative owned by local grocers.

ii) *Satellite chains* are chains where stores are owned - and product array is determined - centrally in the chain, and where profits go to the chain owner. Such stores are run by managers hired by the chain, and the managers have little or no influence on the product array. A typical example is Rimi (Hakon-gruppen).

iii) *Franchise chains* are chains where independent managers run their own store under a common chain with few people working in the umbrella organisation. The managers have separate The managers in franchise chains don't have - like with satellite chains - much freedom to determine the product array. The main difference is that profits goes in a larger extent back to the store. Example of a franchise chain is Kiwi, a low-price chain under NorgesGruppen.

Integration also has a *vertical* dimension. Upstream, the chains have integrated with wholesalers and to some extent with national manufacturers of private brands or other regional suppliers, a completely new situation compared to before, where retail stores were loosely integrated. Between wholesale and retail, this vertical integration has gone very far. All the largest wholesalers have agreements with one of the chain groups. Hakon-gruppen uses Hakon-gross, a buy-up of former wholesale groups like Staff, Køff Nord, Køff Sør, and others. NorgesGruppen uses Joh. System A/S, which also owns 50 percent of NorgesGruppen. The strongest vertical relations between wholesale and retail are found in NKL and Reitan-Gruppen, which owns their own wholesalers. NKL owns NKL Vareforsyning, while Reitan-Gruppen owns Rema-gross.

All groups have vertical relations to producers of private label products. These relations are, however, more often contractual and not based on ownership. NKL is the group with tightest relations to manufacturers, owning mills, bakeries and conserves companies. Reitan-Gruppen uses Grans as their producer of beverage on private label and Nordfjord Kjøtt AS as supplier of meat products. NorgesGruppen uses Lerum as stable manufacturer of juices, jams and beverages under their private label Eldorado.

Vertical and horizontal integration has had direct implication on how different food products access the shelves. Companies without any vertical relation to the groups must re-negotiate supplier agreements once a year. For all food companies, market access is initially based on how many groups or chains the company manage to enter. For large producers of well-known brand-names, for example - like TINE, Coca Cola, Gilde and Freia - entering the Norwegian store shelves is almost guaranteed. For these producers, there is an initial mutual dependency with the grocery chains: The chains need the well-known brand-names, the brand-names need the chains. For other companies, like Fjordland, maintaining their relation with the chains can be a more vexatious task. Fjordland is a medium-sized producer of prepared meals and dairy products, which used to have a large share of turnover secured through supplies to Hakon-gruppen. However, one day Fjordland received a fax from Hakon, stating that Fjordland 'was too expensive

for the group, and was out of business with Hakon'. Overnight, forty percent of Fjordland turnover had disappeared.

Gaining access to the store is only one part of the process of reaching the market. Inside the store, there are other deciding factors: Products' location in the store, number of competing products in the store and how much shelf space is offered. The basic difference from earlier is that these are all factors the chains are more in control of than before. Competing private label products is one such developments. NKL is the oldest chain group in Norway, and has used private label products for a long time (their 'blue and white' products was introduced in the seventies). As an increasing share of stores are part of a chain, emphasis on private labels products has increased. All groups use private labels, and private labels is found in an increasing number of products, like beers an mineral waters, conserves, jams and juices, pizzas, pet food, coffee and meat products, in addition to non-food products like washing cloths, toothpaste and soaps.

As some of the retail groups are increasingly aiming at the Nordic and Eastern European markets, the contracts with the groups becomes even more important over time. Reitan-gruppen has for example opened shops in Denmark and Poland[36], and Hakon-gruppen is a co-owner of the Swedish ICA. Recently a leveraged buy-out of ICA/Hakon-gruppen from the Dutch Ahold was proposed.

2.5 THREE EXTERNAL KNOWLEDGE SUPPLIERS TO THE FOOD CLUSTER

In this section we look more closely at the manufacturing part of the food cluster, illuminating the most central, external knowledge suppliers to the food processing industry. We find three such important supplier categories. These are suppliers of machinery, consumer bridging companies (like suppliers of trend analysis and market surveillance) and suppliers of basic and applied R&D knowledge. We give a detailed presentation of the importance of these knowledge providers and give an overview of relations between these knowledge suppliers and the industry part of the food cluster.

Suppliers of machinery and equipment

New machinery and equipment is the single largest innovation cost for food companies, if we judge by 1993-statistics. Investment costs represent about 50 percent of total innovation costs, a higher share than what we find in heavy machinery-based industries like pulp and paper and metal production (Figure 6). Norwegian food companies are mainly using machinery from Danish, German, Dutch, British and Japanese companies, most often acquired through Norwegian retailers localised near the Oslo-fjord area[37]. Most relations between the industry and suppliers of machinery are market-based. However, not so with the most central machinery retail company, Landteknikk AS, with about 250 employees. The company is located in Oslo, Stavanger and Trondheim and supplies the food industry with complete process chains and machinery, consulting

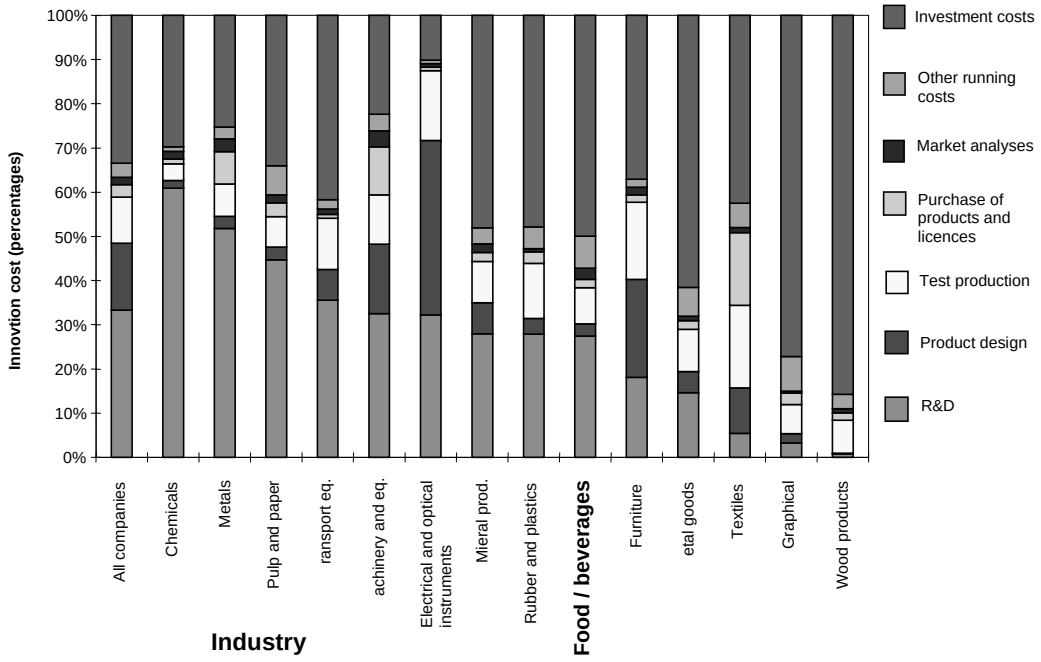
[36] See for example http://www.kappa-design.cz/plany/rema.htm

[37] Aasen and Onsager ibid.

services and a broad array of equipment (of which some are produced in Norway [Trondheim]). Landteknikk serves the whole food industry, but is owned by the agrobased co-operatives: The largest shareholders are TINE Norske Meierier (90 percent) and Norsk Kjøtt (8 percent), but also Grønt and Eggsentralen/Prior participate in Landteknikk.

The fact that suppliers are important sources to innovation in the food industry is often used as argument to describe the food industry as being very advanced: *"The considerable size of this industry implies that many of its firms will be especially responsible for making use of innovations developed in other technologically more advanced industries..."* [38], and that *"(t)here is a high degree of dependence* [in the food industry] *on those developments in high-tech areas, like information technology, biotechnology and advanced materials."*.[39]

Figure 6: Innovation cost shares in different Norwegian industries 1992. Source: Community Innovation Survey, Norway, STEP Group / Statistics Norway.



An illustrating example is Frya dairy (Østlandsmeieriet). Frya was the second dairy in the world upgrading to SattLine, a process automation system for dairy production based on compatible PC systems (Windows NT/Ethernet), autumn 1999. The picture below is

[38] Jesper Lindgaard Christensen, Ruth Rama and Nick von Tunzelmann, *Innovation in the European Food Products and Beverages Industry*, European Innovation Monitoring System Publication 35, IKE Group, Aalborg University (DK), 1996.

[39] Christensen, op.cit.

taken at Frya, and shows two operators controlling the new automation system, supplied by Landteknikk. The picture illustrates how a seemingly ‘backward’ industry can be ‘advanced’ through implementing and using new technology.

Figure 7: Surveillance of the automation system at the Frya Dairy (Østlandsmeieriet)

Further, if we ask Norwegian food processing companies how often they undertake technological development projects with different partners, one of the most used partners are suppliers of machinery and equipment. Figure 8 shows the share of innovative food companies reporting different types of domestic technological collaborators in the period of 1995 to 1997. Figures for Norwegian food companies and Oslo-based food companies only, compared to national average for all companies, marked with circles. Suppliers of machinery and equipment founds the second most important domestic partners for both groups of companies. For foreign partners (Figure 9), suppliers of equipment and machinery is the most frequent used partner for both Oslo-based companies alone and for all Norwegian companies together.

Figure 8: <u>Domestic</u> technological co-operation: Share of innovative food companies reporting technological co-operation with Norwegian partners the last three years (weighted figures), in Oslo and whole Norway, compared to national average (circles). Source: Community Innovation Survey 1997, STEP Group / Statistics Norway

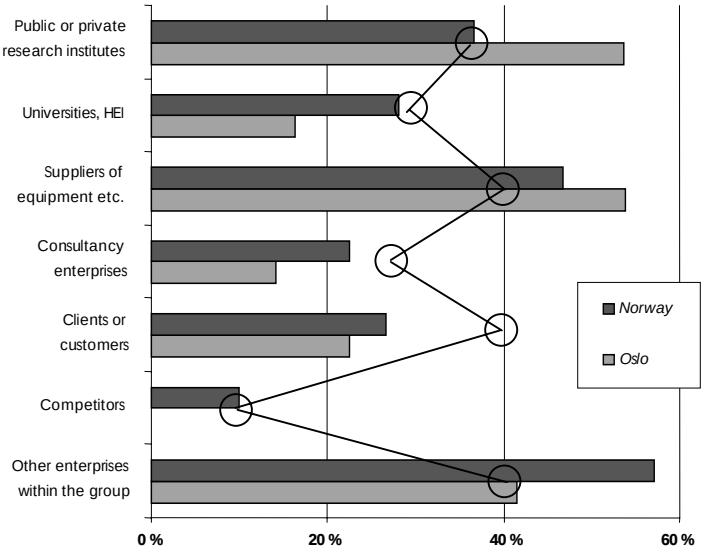
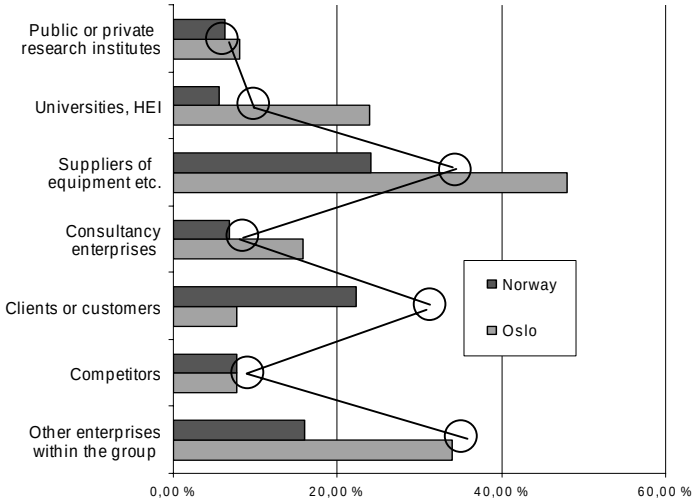


Figure 9: <u>Foreign</u> technological co-operation: Share of innovative food companies reporting technological co-operation with foreign partners the last three years (weighted figures), compared to national average (circles). Source: Community Innovation Survey 1997, STEP Group / Statistics Norway



The figures above also demonstrate that suppliers of equipment and machinery found an important, but not the only kind of technological partner for the food industry. The reality is more complex. The food industry draws upon knowledge from a wide array of internal

and external knowledge suppliers. Sometimes food companies collaborate with competitors and consultancy enterprises. Between 10 and 20 percent of the companies reported they had had such co-operation the last three years. More important, however, is the role of enterprises within the corporation and Norwegian research institutions, like universities and research institutes. If we look only at co-operation with Norwegian partners, about 40 percent of the companies had collaborated technologically with at least one of these three kind of partners. Customers are also important: ¼ of the companies had collaborated with customers.

Cohen and Levinthal[40] claim that in order to absorb such external knowledge, companies have historically had to establish receiver competencies - or absorptive capacities, as they term it - that enable putting external knowledge into useful and innovative practice in the company. The pattern of collaboration is also a reflection of how food companies collectively have arranged their organisation to receive external knowledge: There exist for example strong receiver capabilities for knowledge from scientific suppliers, for new machinery and for ideas stemming from within the group. As we will show, the food industry also carry capabilities of putting knowledge from market monitoring into innovation activities.

We therefor argue that labels like both ‘supplier dominated’ and ‘process innovative’ should be used with caution when describing the food industry. We find reasons to believe that the idea of the food industry being a supplier-*dominated* industry is not an accurate description of the food cluster, as the supplier-dominated perspective literally refers to a situation were the industry’s innovation activities are dominantly as technology users, shaped by technology developed by suppliers, describing the industry as playing a somewhat *adaptive* role to technological developments taking place exterior to the industry.

These figures demonstrate firstly that there are other, very important sources to innovation in food industry than suppliers of machinery. Secondly, technological co-operation is most often based on inter-action, not monodirectional flows of goods and ideas from suppliers to receivers, suggesting that the food industry is more deliberately product or process innovating than the domination perspective of Pavitt indicate. In line with the interactive model of innovation it is rather clear that suppliers of machinery deliver machinery that stand as a result of both the competence of the suppliers and the needs of the buyer. A better understanding of the acquisition process is that the process is *interactive*, not marked by monodirectional domination. Thirdly, looking back at Figure 6, we find that the investment share (i.e. investment in machinery) is only twice the share of R&D expenditures. Suppliers are in other words not dominantly 'steering' the industry, they are just twice as important innovation expenditures as the second next innovation source, namely R&D. Fourthly, the share of innovation costs to capital investments in food processing is at the exact level as (in Pavitt’s taxonomy) ‘scale-intensive’ industries (like Metal products and Rubber and plastics). The figure also show that the food industry

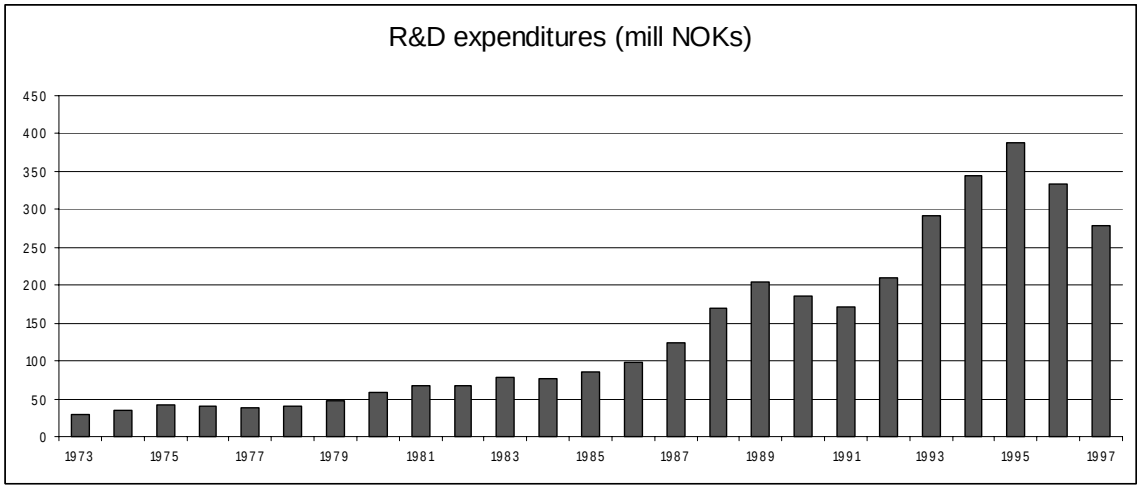
[40] Cohen, W. M. and D. A. Levinthal (1990); Absorptive Capacity: A New Perspective on Learning and Innovation, Administrative Science Quarterly, 35: 128-152

spends relatively lesser shares on capital investments than scale-intensive (and not supplier-dominated) industries like Metal goods, Graphics and Wood products. Fifthly, the Norwegian 'science-based' industries (still according to Pavitt's taxonomy) only spend four percent points more on R&D than a 'supplier-dominated' industry like the food industry (more about R&D in the next section). And lastly, another important input source to innovation is market analysis. 'Food and beverages' is one of the industries spending the largest share of innovation expenditures on such analysis. More about this later.

Research and development

The use of R&D in the Norwegian food industry has increased profoundly the last decades. After a stable period in the 1970s, R&D expenditures in Norwegian food companies started to rise in the 1980s and 90s (Figure 10). The rise came in two bursts; one in the last half of the eighties and the second in the first half of the nineties. In both these periods, the total amount of R&D was doubled within few years, followed by a 'down period'. From 1986 to 1989, the amount was doubled from 100 mill NOKs to 200 mill NOKs. From 1991 to 1995, the amount was more than doubled, from 175 mill NOKs to almost 400 mill NOKs[41]. After 1995, the level sunk to pre-1993 level. In 1997, the food companies spend 282 mill NOKs per year.

Figure 10: R&D expenditures by Norwegian food companies (ISIC 31; Food, Beverages and Tobacco), 1973 - 1997, in million NOKs (current prices). Source: OECD ANBERD database for R&D expenditures, national currencies, 1999.

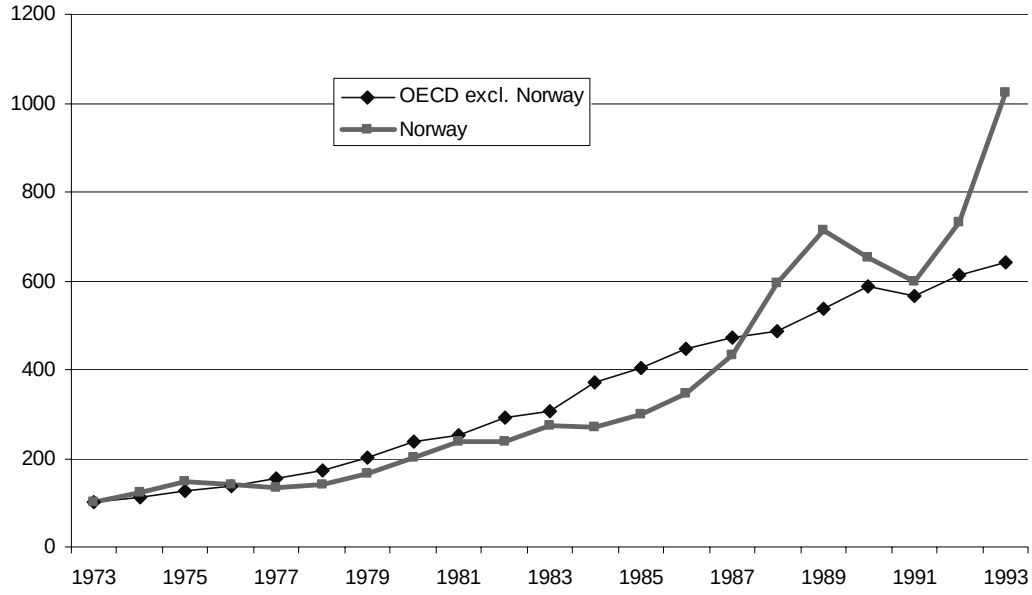


The increased use of R&D is in line with international trends (Christensen et al, op.cit.). Figure 11 provides an indexed overview of R&D performed by both Norwegian and

[41] The reason for the last rise is partly the Governmental 900 mill NOK aid to structural change, given to the food industry in the advent of both a possible EU membership and the possibility of increased liberalisation of international trade markets.

OECD food companies[42] between 1973 and 93 (1973=100). The OECD figures do not include Norway. R&D in OECD-countries has experienced a stabile increase from 1972. The increase has been on about 500 percents in these twenty years, or about 25 percent per year in average. The annual change in Norwegian R&D is more fluctuant. Until 1985, the annual changes were more or less in line with the development in the other OECD countries. After 1986, the two 'bursts' illustrated in Figure 10 make Norway diverge from the OECD average.

Figure 11: R&D expenditures index (PPP$, 1972=100) for Norwegian food companies, compared to OECD average, 1973 to 1993. ISIC 31 (Food, Beverages and Tobacco). Source: OECD ANBERD database,1999.



R&D investments by food companies is - compared to other industries - rather low. Holding total R&D expenditures against the immense size of the industry, we find immediately low ratios. R&D share of sales is for Norwegian food processing companies 0,316 percent[43], which clearly makes it a 'low-tech' industry. The R&D level is less than one third of the share 'needed' to label the industry 'medium-tech', according to the OECD classification. Similar results appear if we compare R&D expenditures by industry employment: While the food industry represent about 20 percent of manufacturing employment, the share of manufacturing industries' R&D is only about 3 percent (Table 7). The industry's share of R&D man-years is also much lower than the share of industrial employment.

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[42] ISIC 31; Food, beverages and tobacco

[43] R&D total 1997: 282 million NOKs. Total turnover 1997: 89.194 million NOKs (Source: NIFU 1999 op.cit.).

Table 7: R&D financed by food companies. Source: Norges forskningsråd (1999), Det norske Forsknings- og Innovasjonssystemet, Norges Forskningsråd, Oslo. Table A-6-10. Only companies with 50 or more employees.

	Employ-ment	*Units with R&D (%)*	*R&D man-years*	*Internal R&D*[44]	*External R&D*	*Internal to ext. ratio*
Food industry	55.113	30	186	126,5	45,5	2,78
All mfg industries	288.242	42	4978	3900,5	1696,2	2,30
Food share of mfg	19,1 %	-	3,7 %	3,2 %	2,7 %	-

In such a comparison, it looks like if the industry spends few resources on R&D. This is, however, to say it at least, a statement that need some modification. First of all, the food industry has other, important ways to innovate, like acquisition of machinery and utilising marked knowledge (as we shall see).

Secondly, the size of the industry make the R&D activities undertaken or financed in sum very large. An illustrating example is the fact that the food industry spent in 1997 as much as 282 million NOKs on R&D[45], which is three times higher than total Norwegian R&D expenditures in the ICT industry[46].

Thirdly, there is also a broad array of domestic non-industry financed research on food going on. Most of this research is basic research aimed at developing or monitoring raw materials, like Jordforsk, Planteforsk, Havforskningsinstituttet and Landbrukets Forsøksringer. However, twelve of the fifteen institutes report they perform some industry-financed research. The total number of research man-years performed is at least 1.000, most probably around 1.400.

Two important non-industry sources of finance are Norwegian Research Council and Ministry of Agriculture. However, a very important feature of the food research system are financial means distributed by Omsetningsrådet. Omsetningsrådet (*the sales council*) receives, as mentioned before, financial means from a small tax on sales of Norwegian agroproducts. Some of these means are used to finance information offices on meat and vegetables, and some of the means fund the research institute sector serving the agrofood cluster. In the Table, we see that particularly Landbrukets Forsøksringer, MATFORSK, Norconserv and Mat og Miljøanalyse report these finacial sources as important.

We have seen that Norwegian R&D expenditures in food companies have risen markably the last decade or so, and -more interestingly – steeper than OECD average. Does this mean that industry-financed R&D expenditures are higher than other OECD countries? It depends of course on how we measure R&D-expenditures. Table 8 provides an overview

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[44] Million NOKs

[45] Source: NIFU (ed.), (1999), Det norske Forsknings- og Innovasjonssystemet, Norges Forskningsråd, Oslo. Table A-6-10, and OECD Anberd 1999.

[46] Manufactuyring of office machinery and computers (Nace 30) spent about 90 million NOKs on R&D in 1997 (NIFU ibid.).

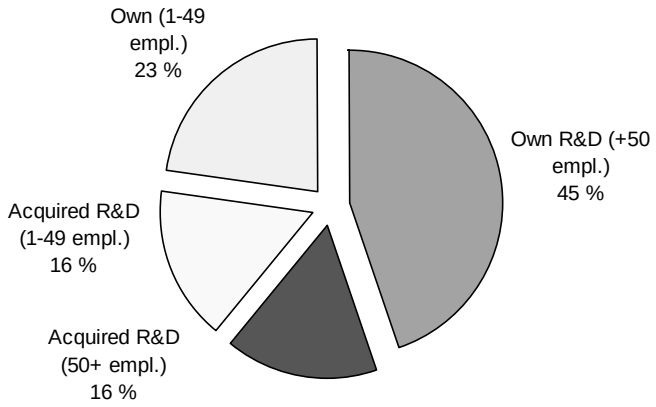
of R&D expenditures as share of food industry gross product in ten OECD countries in 1993. The Norwegian share is 1,4 percent. Norway's share is lesser than the shares of Finland and Netherlands only, with respectively 2,1 and 2,6 percent. For the other countries, like Canada (0,5 percent), France (1,0 percent), Sweden (1,5 percent) and USA (1,1 percent), Norwegian food industry has a similar or substantially higher R&D share. Using other measures will give other results. Figures from 1993 indicate that food-company financed R&D as share of turnover is lesser in Norway than in most other OECD-countries[47].

Table 8: Industry-financed R&D expenditures as share of gross product in the food industry in ten OECD countries, 1993. NACE 15+16. Source: NIFU (1999), op.cit.

Country	*Canada*	*Denmark*	*Finland*	*France*	*Japan*	*Netherlands*	*Norway*	*Gr. Britain*	*Sweden*	*USA*
R&D as share of gross product (%)	0,5	1,2	2,1	1	1,8	2,6	1,4	1	1,5	1,1

Most industry-financed R&D is performed by large companies. Sixty percent of total R&D expenditures in the industry is financed by companies with 50 employees or more. Compared to the national average of 90 percent[48], this is still a very low share. Small food companies represent in other words a much higher share of R&D expenditures than what we find in most other industries. The major bulk of research is performed in-house (Figure 12). Two thirds of large company financed research, and 50 percent of small company financed R&D, are performed in-house, adding to a total of 2/3 of all R&D expenditures. About 1/3 is acquired externally.

Figure 12: R&D expenditures 1997, by company size and performing unit. Total = 282 million NOKs. Source: Norges forskningsråd 1999: Det norske Forskningssystemet - statistikk og indikatorer 1999, Norges Forskningsråd, Oslo

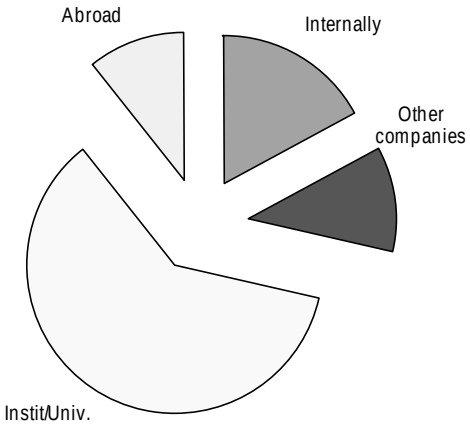


[47] STEP Group (1995)

[48] Total R&D expenditure by mfg industries was 8.905 NOKs whereof 927 mill NOKs financed by companies with less than 50 employees.

Of externally acquired research[49], the largest knowledge suppliers are domestic universities and research institutes: About 60 percent of external supplied R&D comes from these kinds of institutions. About 20 percent is acquired from within the group, while respectively 10 percent each is acquired from foreign suppliers (research institutions, universities, companies, from foreign divisions within the group) and other domestic knowledge suppliers, most likely consulting companies and branch institutes (Figure 13).

Figure 13: Externally acquired R&D, by supplying sector, 1997. Total = 92 mill. NOKs. Source: Norges forskningsråd 1999, Det norske Forskningssystemet - statistikk og indikatorer 1999, Norges Forskningsråd, Oslo



Market analysis

The third important source to innovation we will describe is what we broadly term 'market analysis'. The industry products address themselves to individuals or certain groups of end consumers (in contrast to other inter-industrial activities like suppliers of oil platforms, ship yards, suppliers of machinery, production of pulp and paper etc). From a systemic viewpoint, this means that the industry has to develop and use a particular set of means to establish links with their 'product users', links that are somewhat different from what we see in regular industry-industry links. Population trends and analysis, pre-manufacturing product testing by test groups and nation-wide marketing are core features in such a linking with consumers.

Market analysis are more important to the food industry than what it is for most other industries (Figure 6). The reason is that food companies are consumer-oriented.

[49] *Innkjøpt FoU*

According to the Christensen et al., the main driving force in food industrial innovation is not suppliers of machinery, but increasingly the market: Customers needs and consumer trends are heavy influential to the product portfolio in the food industry, and hence in which way innovation takes: *"(T)he 'supplier-dominated' label is no longer adequate. Firms in this industry assess product innovation as being as important as process innovations in their goal of innovation, and see market developments as more important than either. Clients and customers - not suppliers - are regarded as the most important single source of information leading to innovation."*[50]

In other words, we must understand the dynamic of the industry not only as a *user* of technology, in the Pavittian way, but also as a responsive and market conscious manufacturer, in which the food industry is a thorough listener to input signals from market patterns, tastes, changes in consumption, new sociological and economical settings etc. The food industry is *demand-driven*, and knowledge-input about markets and trends are central elements in the inter-active innovation model of the food industry.

A typical example is Nestlé AS, a major producer of baby food. The Swiss company has a Norwegian head office in Oslo, and the market director reports that in order to keep an overview of potential markets for baby food, they keep constantly a close eye at Norwegian birth rates. Although Nestlé produces most of their products in Switzerland[51], like coffee and Lion, the market director states 'we are the local eyes and ears for the corporation'. Nestlé also procures market analysis from external market analysts, like 4 Fakta/MMI and AC Nielsen.

A similar use of external knowledge providers is reported from TINE Norske Meierier. TINE's latest and biggest product innovation was introducing Ox, a milk-based drink in a fancy, magazine-inspired wrapping (including news text, brief information, colourful pictures, cool design) and with unusual tastes (like milk with liquorice taste), aimed at adolescents. TINE's field work was impressive. Both TINE's market division and research division were involved in developing the different tastes and visual shaping of the product. People from the public relation company Bates Group was hired in to develop the basic design of the container. A separate web site was established for the product (http://www.ox.no). The container magazine was regularly changed by an external editor company. The trend consulting company Magic Hat supplied TINE with trend analysis, and external consultancies performed youth panel tests and analyses.

Market surveillance and trend analysis can therefor be important knowledge input to the industry. From Figure 6, we see that expenditures on 'market analysis' is about four percent of total innovation costs. This is not only larger than most inter-industrial industries, it is also higher than other consumer-oriented industries like chemicals (in which pharmaceuticals is incorporated) and consumer electronics.

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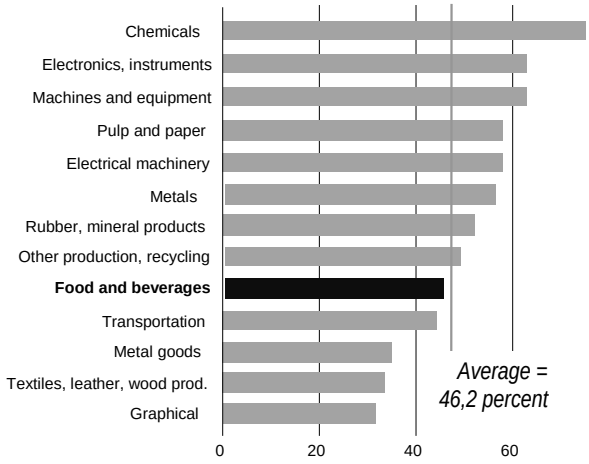
[50] Christensen, op.cit.

[51] Nestlé is also a dominant manufacturer of baby food. Nestlé baby food for Norwegian markets is produced domestically (Hamar), according to current regulation for such production.

2.6 PRODUCT AND PROCESS INNOVATION PATTERNS IN THE FOOD CLUSTER

In a Norwegian all-industry survey from 1997, 45 percent of the food companies said they had performed an innovation the last three years (Figure 14). The food industry is neither particularly more innovative nor particularly less innovative than other Norwegian industries. Average share of innovative companies for Norway as a whole is 46,2 percent. The share of food industry companies performing innovation is higher than what we find in other Norwegian industries like textiles, metal goods and graphical industries (35 percent of them reported to be innovative) and production of transport equipment (44 percent), but lower than industries like metals, pulp and paper and machines and equipment (appr. 60 percent). Further, there are also evidence that food companies - when they first innovate - often introduce radical innovations: *"Despite its 'low-tech' reputation, a striking observation from the study is the radical nature of both product and process innovation in the industry over the past twenty years or so.*[52]

Figure 14: Norwegian industries and share of companies reporting innovative activities, source: Community Innovation Survey Norway, 1997, STEP Group / Statistics Norway, N=1972[53].



Product and process innovations

Why is the food industry not innovating more often? How can the industry be so profitable if it is not innovating? The reason may partially be found in the sheltering of the industry, as we saw in Chapter 1. Another aspect is that the very definition of

[52] Christensen (1996), op.cit.

[53] Share of companies in sample reporting innovation. In this sample, large firms are better represented than small firms. Since the probability of being innovative increases with firm size, the actual /weigthened innovation share is a little lower for all industries than presented in the figure. Average weighted share for all industries is appr. 40 percent, in the individual industries the share is between 3 - 10 percent less than presented in the figure. For the food industry, the difference is about minus five percent.

innovation in the Innovation survey is too narrow. A typical categorisation of innovation in 'typical' industries are 'product' and 'process innovations', or 'organisational changes'. Such innovations do of course also take place in the food industry, and they are often important. We have briefly mentioned TINE's immense work behind the launching of a new milk-based drink as an example of how a new product develops.

In a more broader perspective, a trend in product development is the increased emphasis on prepared meals[54]. The basic reason behind this development is competition from restaurants, which are large and increasing processors of raw materials (see Figure 1). People spend generally more time at restaurants than before, as a result of a combination of increased welfare, less spare time and increasingly continental eating habits. Fjordland is a typical company illustrating this point. Fjordland was established as a co-operation between TINE, Gilde/Norsk Kjøtt, Prior and Hoff in 1994, and has today 50 employees and an annual turnover on 335 million NOKs[55]. Fjordland produces prepared meals like Fjordland Biff Stroganoff with rice, Meatballs with mashed peas and potatoes and Indian Carry Chicken with rice. The four owners have traditionally been producers of separate products, like milk and milk products (TINE), meat products (Norsk Kjøtt), eggs (Prior) and fried potatoes (Hoff); together they are capable of producing products that are in line with recent consumption trends.

A change of process would typically be to implement new machinery, like the recent activities at the Ringnes Gjelleråsen brewery. Production of soft drinks has been profoundly automated the last decade, with German mechanical machines and Japanese robots gradually taking over manual tasks, like lifting, loading, moving and storing loads of bottles. The storage room at Ringnes is immense, including several hundred 13 meter high shelves filled with a seemingly chaotic mixture of empty bottles ready for cleaning and refill, and loads ready to leave the factory. The storage room is completely automated, and a computer keeps perfect track of which are tour and which are return bottles, and at the same time making sure that the right kind of bottles is brought from the shelves and put at the right conveyor belt; either leading to the cleaning machines or to one of the 20 truck ramps further down the hall. What was earlier performed by 15 factory floor truck drivers is now run by one computer an two controllers.

Product and process innovations in the food industry are often interdependent activities. The CIS Survey (1997) showed that Norwegian food companies rarely performed product innovations without performing process innovation at the same time. The dominant share of innovating companies reported that they had performed both process and product innovation the last three years. Very few companies reported that they had performed product innovation only. This could indicate that when food companies start producing a new product, they predominantly have to undertake major investments in equipment and machinery. It could also indicate that when food companies perform product innovation, the innovations are rather radical and need a whole new set-up of the production line. This perspective is also argued for in Christensen at al (1996), stating that the food

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[54] Christensen at al, op.cit.

[55] Fjordland homepages (www.fjordland.no), dec. 1999.

industry has particularly been strong in introducing radical innovations the last two decades. There are in other words a seemingly strong complimentarity between product and process innovation in the food industry – much stronger than in other industries.

A central process innovation the last decades has been the profound improvements and changes in transport[56]. The changes has taken three forms. Firstly, there has been gradual improvements in trucks and cooling systems, which have increased the potential for extending the transport routes for food - or a toning down of space, if you like. Secondly, there has been a development in logistics activities. This change has taken two forms; there has been an increased division of labor between the people in charge of logistics on the one hand and the truck drivers on the other, and - related to this - an increased professionalisation of the logistics people and the technology they use, in the shape of satelite based control systems which are opening up for more economic flow of goods[57]. The third development has been the retail chains gradually taking over transport services through their vertical integration with wholesale (more about this in 2.4).

Formal and informal innovations

Product developments range from extremely informal to very formal. The difference between formal and informal seems to vary with company size. Large companies, both the corporate controlled and the companies belonging to a co-operative structure, tend to formalise product development through use of market divisions, research divisions, external and internal market analysts and external research suppliers. The above mentioned case of TINE's Ox drink illustrates the formal way of developing new products. In the process, TINE involved their market division and research division, in addition to external knowledge suppliers like trend analysts and web designers. This is an indication not only of a formalisation of the innovation process, it is also a sign of a highly professionalised innovation process. The same applies for product development in Maarud, a major snack provider, owned by Freia / Kraft General Foods. When Maarud develops new products, it is in close co-operation with their Nordic sister companies of the food innovation process, using test and development laboratories and staff, sometimes involving several hundred variations of product taste to find the right one. In Ringnes, product development takes place in the company's product development department in Gjelleråsen, involving a range of persons, mainly chemists and market analysts. Product development in Fjordland, owned by large co-operatives, is taking place in the owners R&D laboratories, in addition to co-operation with market agencies and scientific knowledge suppliers like Matforsk and Norconserv[58].

At the other end of the scale, we find small companies with rather informal innovation processes. Majonæsfabrikken is an artisan factory with 14 employees, located at the heart of Oslo, producing mostly private-label, high quality majonese salads for the

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[56] Ørstavik, F. (1998), *Innovation regimes and trajectories in goods transport*, STEP-report R-09-1998, STEP Group, Oslo

[57] Ibid,p.

[58] Fjordland homepages, op.cit.

supermarkets in Oslo and the surrounding region. Both father and son works in production. The company often develop new products by copying competitors salads; if they see a new type of salad from the competitors (like Denja or Mills) in the grocery shop, they buy it, determine the ingredients by smelling and tasting the salad, and decide whether 'to go for it or not' based on how they find the product.

Branding and consumer trust

Interpreting 'innovation' as a major effort to increase or maintain profits, innovation in food companies separates from innovations undertaken in other industries. The basic difference in between food industry and other industries is that innovation may very often be to keep a product exactly the way it is, focussing on maintaining or increasing the product's market share by familiarising the product to consumers. Familiarising products in order to develop stable customer-industry relations is a business developing method termed 'branding'. The basic idea behind branding is that customers will be more apt to consume products they already trust, products they know (or think they know) or at least have heard of. Branding is mostly done through regular commercials (television, radios, journals, newspapers), but also through distributing product samples (like small attachments to journals or newspapers) or by sponsoring activities, like sporting activities or music concerts. The emphasis on branding is illustrated from what followed in the wake of the above mentioned Ox drink developed by TINE. The product ultimately turned out to be a failure. In spite of TINE spending million of Norwegian kroners on product development and market analysis, the adolescents did not buy the products. TINE's response to this is to pursue a strategy of continuing building up the brand name of their most famous cheese product, Norvegia. This cheese is one of the most selling cheeses in Norway, and also one of the most sold foreign cheeses in the US.

We find branding in most consumer-oriented industries, not only the food industry. Typical examples are Swatch watches, Bosch car batteries and window wipers, Hundai cars and Nokia mobile telephones. However, branding is more important to the food industry than most other industries. Not necessarily because the threshold of trying new products are higher per se for food products than for other consumer goods (we know that the share of Norwegians eating 'non-traditional dinner' are slightly decreasing[59]), but because eating and drinking is a process of putting manufactured items into in your mouth and swallow it; eating is ultimately a very private and bodily event. This requires a high degree of consumer trust in the products or the producing company. Branding is a way of creating this trust. Branding takes place by for example attaching short, simple and positive messages to product names ('probably the best beer in the world' [Carlsberg], 'Guinness is good for you'), or using happy and satisfied people eating or drinking the product (like for examples in the jolly commercials for Lipton's Sun Tea or for Coca Cola Company products more generally)[60].

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[59] Stræte (op.cit.)

[60] This sterotypic mode of publiction has been brilliantly ironised in a series of commericals for Solo, a traditional Norwegian orange-based soft drink manufactured by both Ringnes and Hansa. The spot's show

International food brands are particularly important for beverages, like Carlsberg, Heineken, Tuborg, Coca Cola and Nestlé. In Norway, there exist a wide array of brand names that most people would recognise. These brands can analytically be divided in two; product brands, like Farris (Ringnes' sparkling mineral water), M (Freia's chocolate) and Grandiosa (Stabburet's Pizza), and portfolio brands / company brands, like Freia, Nora (jams and juices produced in Norway by Stabburet), Eldorado (a wide array of imported canned fruits and vegetables, in addition to juices, soft drinks and jams produced in Norway), Gilde (Norsk Kjøtt's meat products) and TINE (milk and a wide array of butter and cheeses). Several of these names, like TINE, Gilde and Eldorado, are all relatively new names, established as pure marketing brands for companies that go back a long time. TINE[61], for example, is the marketing name for what used to be called Norske Meierier, Gilde is the marketing name for meat products from companies organised as Norsk Kjøtt, and Eldorado is NorgesGruppen's private label.

Barriers to innovation

Quantitative industry-studies of barriers of innovation are important to understand how the industry innovates, and which factors companies consider as important hampering factors to renewal and innovation. In an all-industry survey from 1997, Norwegian companies were asked to respond if any of nine given factors ever had been a hampering factor to innovation activities during 1994 to 1997.

Food companies separated from most other industries by emphasising *organisational relations, lack of market information, too strict standards and regulations* and *market failure for new products and processes*[62] as factors being important barriers to innovation. The industry did not separate markably from other industries in factors like *lack of qualified personell, lack of technological information* or *too high innovation costs.*

This picture harmonises with what we have seen so far. The food industry is dominated by large, traditional companies, as seen in 2.2. Large companies are often marked by embedded organisational resistance to change, and according to the survey, it seems that the food companies are more resistant to change than companies in other industries. In the survey, public regulations on how food production can be undertaken is also often regarded as an active barrier to innovation. The very fact that food production is a consumer-oriented industry is also reflected in the market's failure to accept innovative products barrier for new products and processes. The very fact that market failure is a profound resistance to innovation in the food industry is in itself an interesting observation, as it underlines our suggested interpretation of the food industry as a dynamic industry, but that the problem is more that new products have trouble in finding new markets fast enough, either in the population or among retail chains.

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different people in unhappy or uncomfortable situations (for example a boy sadly waiting in vain for his date), drinking Solo, with the slogan 'probably the only soft drink that does nothing but satisfy your thirst'

[61] [tee:ne]

[62] Nås et al (1999), *Innovasjon i norsk næringsliv,* STEP report R-04-99 ???

Conclusion: A new concept of innovation?

Innovation, narrowly understood as new processes or new products, can sometimes form a relevant concept of how to understand renewal in the food cluster. However, in a perspective where innovation is understood as *major effort to maintain or increase profitability*[63], new products and processes becomes inferior to more profound processes that are not thorougly captured by regular innovation concepts - not to say regular innovation surveys. Such activities include for example long-term processes of increased scientification, long-time improvement in transport technology and logistics, development of industrial hegemonies, maintained protection from import through political influence, branding and the profound changes in vertical and horisontal alliances undertaken in the food cluster. These are all changes that seems vital to the system's s performance, and represents activities that are performed to maintain or increase profitability.

The simple, but still important, conclusion from broadening the innovation definition is that a low-tech industry with low share of R&D expenditures compared to other industries, may still be quite innovative and dynamic, and even high-tech. Only in terms of advanced knowledge, we have demonstrated that i) the food industry is an advanced proquirer of market intelligence, ii) the industry may draw upon knowlege from a vast backbone of basic research institutions, iii) advanced technology is imported to the industry through suppliers of machinery, iv) branding is for the food industry a seemingly much more intelligible way of 'product innovation' than constantly introducing new products, and that v) changes in vertical and horizontal alignments in the cluster are important dynamic activities (see also J. Hauknes, Innovation – A need for new concepts? prepared for the NIS network and innovative firms focus group)

2.7 SUMMARY

The food cluster plays a major economic role in the Norwegian economy, in terms of share of manufacturing value added and regional employment. The cluster consists of three more or less independent value chains; manufacturing of beverages, manufacturing of agrofood products and manufacturing of fish products. Particularly the agrofood and the fish production value chains are two independent, and geographically and institutionally segregated production systems. However, within the individual chains there are tight relations between the units, particularly within the agrofood part of the cluster. Horizontal integration between suppliers of raw material (like milk and grain), vertical integration between producers of raw materials and manufacturers (TINE, Felleskjøpet) and 'extra-horizontal' alignment between the agrobased co-operatives (like the joint distribution system LFD, the joint ownership of machinery supplier Landteknikk and the joint ownership of producer of prepared meals Fjordland).

- Ownership is professionalised. The increasing share of employees working in large companies are working in companies owned by investor-groups or joining

[63] Hauknes (1999), Innovation in Norwegian service firms, STEP Report forthcoming

horizontally integrated co-operatives with co-ordinated, centralised marketing, sales, distribution and research and development activities. The innovation process is formalised in the largest companies, in areas like market monitoring, branding and research and development. External R&D is often acquired from research institutes and universities. The industry is increasingly consumer-oriented, and private companies provide food companies with market analysis and trend patterns.

- There is a well-defined geographical division of labour among different parts of the individual food companies. Production is often regionalised, and localised near raw material sources (like for agrofood processing and fish processing) or located in the biggest towns (like for mineral water and chocolate). Marketing, sales and R&D are activities predominantly located in the capital area.

- Many SMEs perform research and development compared to industrial average. The industry has collectively a high R&D/gross product compared to the food industry in other countries industries.

- The industry is profitable; it has the fifth highest levels of value added per employee in Norway. The food industry shows an extensive use of advanced technology developed by other industries. Product quality control is highly institutionalised, and go long back in time.

The system is under change. During the presentation of the food cluster we have pointed to these changes:

- There is a process if increased scientification of the food process going on. Food companies have spent an increasing amount of money on R&D the last two decades. Scientification processes also enter the industry indirectly through acquisition of equipment and machinery, and through use of new additives[64].

- Still fairly sheltered, the Norwegian food industry are awaiting processes of harmonisation and liberalisation of international trade. Still, ongoing processes of de-monopolisation take place, particularly in manufacturing of fish products, grain and dairy products.

- Increased employment in the largest establishments - establishments persistently owned by corporations or joining domestic co-operatives - suggesting tendencies of hegemonies building, which again is associated with professionalisation of production, marketing and branding processes.

- Increase in professionalisation and organisation among stores through chain powers, counterforcing the hegemony process among manufacturers of food products.

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[64] Christensen op.cit.

- Ongoing processes of vertical and horizontal restructuring; changes in producer-supplier links, producer-producer links, producer-chain links, producer-consumer links and chain-chain links.

- Ongoing internationalisation processes, both in the retail chain groups and in the industry

We will in turn discuss these points with respect to how they may affect innovation patterns in the industry.

3 HOW CHANGES IN THE INDUSTRY MAY AFFECT INNOVATION PROCESSES

3.1 INTRODUCTION

In this chapter we attempt to interpret trends of change in a broader framework, providing an analysis of innovation in the Norwegian food cluster. These are *increased scientification, international harmonisation and liberalisation, hegemonisation, increased chain group powers, vertical and horisontal restructuring* and *internationalisation.* The processes are sometimes intervowen and mutually dependent.

3.2 CHANGE AND INNOVATION

R&D, competitiveness and innovation

A trend in among food companies have been a growth in R&D expenditures the last decades. Even though some of the increase has clearly propelled by the 'structural change fund' granted in the first half of the 90s, the increase is in line with a similar European trend. Increased scientification, both directly through increased R&D expenditure in companies and indirectly through purchase of equipment and machinery, is marking the food industry.

In Norway, the industry-financed R&D can be interpreted as a demonstration to which degree the existing knowledge and research infrastructure is adapted to the needs of the food industry. In the last years, particularly Matforsk - a central knowledge provider to the food industry (see for example 0) - has gradually increased it's share of industry financed research the last years. Still, industry financed R&D only represent only 186 of about 1.600 food-related researcher man-years - or about 11 percent.

A central question is to which extent the increased R&D level is interesting, not to say determinant, to the industry's further development? The increase in R&D expenditures can be interpreted as a preparation process to increased exposure to international competition, as was the intention behind the 1994 structural fund. According to Michael Porter, R&D can initially be regarded as a higher-order competitive advantage; an advantage achieved through using advanced skills and capabilities (Porter 1990, p 50). Porter argues a cluster's competitive advantages are more difficult to nullify the higher order they are, and the better they are constantly improved or upgraded (ibid. p. 51). The increased R&D level the last years may indicate an attempt of building of such a competitive advantage. This way of thinking has gained terrain among policy-makers, which in 1994 granted the 900 millioner NOK structural fund to prepare the food industry for EU membership.

However, the problematic issue with R&D in the Norwegian food industry is twofold: firstly that newly developed products are easy to copy for other producers. Tastes, colors, wrapping, design or packaging methods are visible and easy reckogniseable factors; as we saw in the case of Majonæsfabrikken. The competitors' new majonese salads are

bought and 'investigated' on quite informal basis; the ingredients are detected through sniffing and tasting, and the manager decides whether to start producing the salad or not. The same goes for indirect R&D, where new process equipment is also easy copiable. In Norway, production machinery is often aqcuired through market relations with wholesailers, and new production technology is easily accessible for most food producers.

Secondly, R&D activities successfully leading to new products are not always guaranteed successful sales, as we saw in the case of TINEs launch of their Ox drink. The treshold of establishing markets for new food products can sometimes be quite high, for reasons of lack of consumer trust, existing traditions etc. In sum, this leads us to conclude that R&D not always represent a higher-order advantage in the food cluster. On the contrary, R&D activities carry many of the same signs of reckognitions Porter uses to describe lower-order competitive advantages; *those factors that are easy to imitate.* (ibid. p. 49).

The very definition of higher order advantages are those factors that are difficult to copy and usually depend on a history of sustained and cumulative investment. In the food industry, there is nothing that fit this definition as much as *branding.* Product or company names that are build up through historical marketing processes represent advantages that are very difficult to copy. The picture becomes more complex if we - in a broader context - understand the food industry R&D investments as mere processes of branding, not so much aimed at product or process development in itself. There are two reasons for interpreting R&D activities as being less vital to product development than branding: Firstly, new products seemingly arise in collaboration with machinery suppliers, as successful introduction of new products very often go hand in hand with implementation of new machinery, as we saw in chapter 2. For food companies, there are no natural division between product innovation and process innovation. One thing is that this result leads us to think in the direction of suppliers of machinery and equipment being rather influential to how and which new food products emerges. However, the direction, amount and blend of knowledge involved from the machinery suppliers and food companies in such developments are discussable. Is it so that the knowledge flow direction is monodirectional, from supplier to purchaser? We think not; it is more likely an interactive process between the two. As we for example have illustrated - in Figure 8 and Figure 9 - that food companies very often establish technological co-operation with suppliers of machinery.

Secondly, a survey of the Norwegian food companies' strategic preferences - performed in relation to the establising of the structural funds - revealed that mere product development ranges very low, compared to other factors as quality, hygiene and customer relation[65]. In the survey, food companies collectively reported 'strong brand names' as the tenth most important factor of 24, while 'ensuring quality on processed products', 'quality and hygiene in production' and 'relation to customers' were the three most important factors. Developing radically new products was ranked as the 23. most

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[65] ECON/Coopers and Lybrand (1997), *Evaluering av omstillingstiltakene for den landbruksbaserte næringsmiddelindustrien,* Sluttrapport fase 2, ECON, Oslo, p. 25

important strategy, developing existing products was ranked as the 20. This suggests that we have to understand branding in the food industry in a much broader way than just traditional building of product names or trade marks. In this approach, we must also include long-term, strategic developments of factors that customers appreciate, like food quality and hygiene.

The increased R&D is also interesting to interprete in a user-producer perspective, where the grocery chains stands as the users and the food producers are producers. The grocery chains dominate - and make a living out of - markets for food products. It is still mostly the industry that carries the product development expences. This ‘free rider’ system is similar to what we find in German car production, where car manufacturers puts most emphasis on putting devlopment pressure downwards in the system, forcing their suppliers to product innovate in order to maintain contracts.

Corporations, hegemonies and competition

Within evolutionary economic theory there exist two competing 'grand theories' on economic development, innovation and production structures. On the one hand there are those that claim that the economy is in a profound change from mass production to flexibel specialisation (a second industrial divide), characterised by increased vertical disintegration, decentralisation of control and development of new, flexible modes of production and organisation[66]. In line with this argument, it follows that large, vertically integrated companies producing standardised mass products gradually will be outcompeted by small, flexible and specialised companies in informal networks producing differensiated and customer adapted products for a fragmented market. Others are more careful in their conclusions. Leborgne and Lipietz claim that we are in a transition periode that includes both change and continuity, and that mass production will be modified through process and product changes based on new technology. According to L&L, new technology *allows* vertical disintegration, but does not imply a necessary deconstruction of power.

We have shown that a larger share of employment is increasingly found in the largest companies. Employment share within the group of establishments with more than 100 employees increased from 40 to 44 percent. At the same time, the small companies are getting smaller: While the total number of small companies is stable, the number of people working in these establishments has decreased. In 1986, 41 percent worked in establishments with less than 50 employees. Today, the share is 38 percent. These shares represent a decrease of about 3.000 persons in 1.800 small companies, or about two persons in each company. There are in other words no immediate reason to believe that Norwegian food production approaches a more flexible food production structure, at least not if one judge by the size of the companies alone.

However, there are contradictory trends appearing. Traces of increased flexibility appears at least in three forms. Firstly through the high share of R&D financed by small food

[66] See for example Piore and Sabel 1984, Scott and Storper 1989

companies. R&D, which is commonly associated with something that dominantly large companies undertake, is more frequently taking place in small companies. As much as 40 percent of the R&D was financed by companies with less than 50 employees, which is four times higher than national average. Secondly, a countering trend is the gradually implementation of new process, transport and logistics technology, which have implied more efficient supply systems, possibilities for longer transport routes and better stock control - as we for example saw in the case of Ringnes. A third trend is the dissvolving process of already established monopolies in the agrofood sector, like we have seen through the increased competition in the meat sector and through the establishing of Synnøve-Finden and Gårdsmeieriene.

On a more broader level, there is no clear answer to the discussion whether or to which degree company size is related to flexibility or inflexibility. We have seen that barriers-to-innovation reports from companies said that organisational relations were regarded as major obstacles in the food industry. As organisational barriers are more likely found in larger companies, the results indicate that large food companies may be more resistant to change than other large companies in Norway.

However, there are no necessary one-to-one relation between larger size and reduced inflexibility. We have seen in the case of the Norwegian food industry that large companies perform more R&D (as large companies often do), they may have more organised transport systems, the large agro-cooperatives have formal integration to suppliers of machinery and they have in general better financial base and interpretive capability to purchase and utilise market surveillance information. In line with this argument, Nooteboom (1999) claims - in line with Rothwell's 'dynamic complimentarity' concept - that there are no ideal organisational system for innovation, but that different types of corporate structures are better adapted to some parts of the innovation process than others. For example, large, vertically integrated companies should theoretically be better adapted to those innovations being costly; like in those cases where marketing, R&D and trademarks are important features of the innovation process. Small companies are typically more adapted to situations of rapid product change and flexibly developing or serving small niche markets. We have shown that there are in general three types of food companies in the Norwegian cluster: the large and vertically integrated agrofood companies, the corporations with varying vertical integration and some horisontal integration, and thridly the independent, family-owned companies with few vertical nor horisontal linkages. In this respect, the above referred-to statistics suggest that Norway has been in a duopole situation, with large companies representing the dynamics of marketing and branding, while the small companies represent the role of non-mass, niche markets, with rapid development and commercialisation of new products. Several indicators suggest that the Norwegian food industry is moving towards the Leborgne and Lipietz model, where large companies still dominate the market, and that new technology only modifies this paradigme. We have for example seen that a larger share of employment over time is found in the largest companies, that large companies have (theoretically) better economic potential to exploit new market information and new, flexible technology, i.e. logistics, as in the case of Ringnes. We have seen that development of new products are closely related to implementation of new process technology, which tend to make product innovation more expensive. And we have seen

that companies often report that products meet market failure, which indicates that developing new products is not always vital to the performance of the industry - with negative implications for those small companies where product development are central.

Does this mean that policy should appreciate development of larger entities? There are basically two interrelated main arguments for stimulating growth - or maintaining the existence - of small companies. The first one is the Piore and Sabel argument of small companies being more flexible and structurally better adapted to new technology, an argument we have shown is only to some degree true in the light of the decicive food dynamic factors. The second, related argument is that small companies may be important to create variety and thereby enlarging the platform for further selection[67]. The gradually increasing dominance of large companies in Norwegian food production can therefore illustrate a trend where variation and selection powers are subordinate to increased corporate hegemony. This can again on the one hand be interpreted as a process of less domestic competition than before, and implicitly a smaller selection platform.

However, on the background of increased international competition, this may seem as a plausible preparation development, not at least when we know that large entities are often better adapted to the specificities of innovation in the food industry; branding, trade-marks, development of transport systems etc. On the other hand, to which degree the increased hegemonisation affects product variety for the consumer is a vexatious task to determin. In terms of product variety, we know that product development in general are less important for food companies than other companies, which points in the direction of saying that product variety may not always be of vital interest to consumers.

For most large companies, new products are also related to high market insecurity, and they are expensive to develop, as they demand new process technology and high marketing costs. Innovation for food companies is often, as we have underlined before, aimed at maintaining or increasing sales of existing products instead of developing new products. Increased exposure of internationally produced food products may therefor be the most likely way to create product variety for consumers.

Increased chain group powers and innovation

Vertical and horizontal integration among the Norwegian retails stores has led chain groups to control larger parts of the production system than before. For many food producers, the increased chain dominance is of course real and experienced as threatening: Competition from cheaper private labels products, combined with a professionalisation of the grocery stores through common marketing, common wholesale and common acquisition of products and inventories - are issues that make life for the largest food producers more demanding than before. These new challenges take several forms:

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[67] Smith (1991) in J. S. Metcalfe (1994)

Threat from private labels: The mere threat from private labels are not overwhelming, so far. According to a survey by ACNielsen[68], only about 7 percent (in 1997) of total turnover in the chains stem from private label products. Although the share has risen from less than five percent in 1995, this is much less than what we find in larger, international chains like Tesco (UK), where the share of private label products are as high as 65 percent[69]. In addition, production of private labels products is still mainly performed domestically, by relatively small or medium-sized companies (like in beverages). Private labels is represent therefor no threat to the food economy itself, it is more a balancing of powers towards Orkla (and partly Coca Cola Company) as the hegemonic supplier of beverages in Norway.

Threat from low-price chains with few products: The low-price chains' market share has grown, and represent today very important nodes for food products turnover. The main critique towards these chains has been that they homogenise and standardise the product array, making the selection of products less varied. There are little empirical evidence supporting this perspective. The reason why is that the grocery chains are still diversified. There exist several chains with larger product selections, like Jens Evensen, Mega, Spar etc. It is possible for small companies to gain access in these stores. Majonæsfabrikken, for example, with only 14 employees, distribute their quality majonese to more independent chain stores, like ICA and Jens Evensen. In addition, the grocery chains also are in demand for new products, as a natural part of the competition between them. Several interviewees have reported that the chains are less conservative than often claimed. Particularly NorgesGruppen - the largest group of the four - is denoted as being in demand for new products.

A third threat is of course that *the chains* found a counterbalance to the existing domination of co-operatives - like Norsk Kjøtt and Tine - and the corporations - particularly Orkla, but also Rieber & Søn. This counterforce manifests in several ways. One way it manifests is that end consumers have indirectly more power towards the food producers, as they have more organised negotiators on price than before. Another way is that chains may to some extent challenge the traditional supply monopoly from the existing grand organisations. Orkla has for example developed a dominant position in production of beverages. Some of Orkla's remaining competitors (small, familiy-owned breweries like Lerum, Telemark Mineralvannfabrikk and Grans) have strengthened their position (and possibly survived) in the market by being suppliers of private label beverages to the chain groups. However, none of the chains are offering private label mineral water only. The balance stands on whether Orkla can make the chains dependent upon their own national products through branding or quality. The same applies for Norsk Kjøtt, who has countered increased competition on meat processing through a major effort to build up and maintain their brand-name Gilde.

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[68] ACNIelsen is a market monitoring company. The survey is cited in Dulsrud in Stræte and Dulsrud (op.cit.)

[69] Dulsrud in Stræte and Dulsrud (op.cit.) p. 118

Table 9: Vertical and horizontal relations between different actors in the Norwegian food cluster

	Suppliers of raw material	***Industry***	***Knowledge and research***	***Chains***	***Consumers***
Suppliers of raw material	• Most milk farmers horizontally integrated through their common relationship to TINE. Similarly with meat producers and Norsk Kjøtt, and manufacturers of fruits and vegetables • Local fishermen own jointly the fish sales organisations • Landbrukets Forsøksringer, a joint research knowledge diffusion programme on soil and plant research • *Omsetningsrådet, incl.* joint information offices for respectively meat and fruit and vegetables				
Industry	• Most grain farmers participates owners in Felleskjøpet, a joint organisation for grain processing • Strong links between domestic suppliers of raw material and the co-operatives. Vary still by co-operative. Links strongest in dairy, increasingly weak in meat production. • Links between suppliers and large corporations vary in strength • Few stable links between suppliers and small companies • *Omsetningsrådet*	• Almost no linkages at all between the agrobased part of the cluster and the fish based part. • Traditionally strong horizontal relations within the agrobased subcluster. However, some agrofood co-operatives encounter increased competition from independent suppliers, particularly meat • Signs of 'extra-horizontal' integration [between the different agro-based co-operatives], like common distribution (LFD), Fjordland (co-operation in production of prepared meals) and Landteknikk (machinery supplier) • *Omsetningsrådet*			
Knowledge and research	• Strong segmentation between fish and agrofood. • Share of sales from agrobased products to agrobased R&D through means distributed from *Omsetningsrådet* • Traditionally strong relation between agrofood co-operative suppliers and the Ås complex (Jordforsk, Planteforsk, Matforsk).	• Low industry-research interaction: 80 percent of food-related R&D is governmentally financed. • Increasing use of R&D in the industry • Emerging market-orientation among some research environments. • Low degree of formal integration between suppliers of machinery and the food industry - mostly based on market relations. Exception is Landteknikk AS, jointly owned by Norske Meierier and Norsk Kjøtt. • Market research important knowledge suppliers to the industry • Establishment of Norwegian Biotechnology Advisory Board in 1998	• Traditionally little communication between different research institutions, particularly between those working within respectively fish and agrofood. • 'Extra-horizontal' co-operation between food related research environments established; SINTEF, Norconserv, Matforsk and Havforskningsinstituttet		
Chains	• Some vertical integration to suppliers of fruit and vegetables, through stable alliances with fruit wholesalers • increasingly stable relations to meat producers outside Norsk Kjøtt • NKL owns their own mill	• Chains are increasingly vertically integrated, but mainly with distribution/wholesale. • Chains have deliberately sought to establish links with alternatives to Norsk Kjøtt /Gilde • Links to regional suppliers prevail, particularly among the non-low-price chains • Stable relations between some chains and producers of private labels and meat . • NorgesGruppen is the most vertically integrated chain, with ownership in mills and conserves factory	• Little to no direct linkages between chains and food knowledge suppliers. • Links are mostly indirect, through for example fruit and vegetables suppliers that are vertically integrated with chains, with meat producers supplying chains etc.	• Traditionally little integration nor impact • Increased chain group domination. Four chain groups now control almost whole grocery market, joined in common marketing and often common acquisition organisations	
Consumers	• Development of Godt Norsk, a branding programme for domestically produced raw materials • Development of DEBIO, a control organisation for ecological products	• Ongoing processes of branding, establishing and maintaining consumer trust • Integration with customers through pre-manufacturing testing, market surveillance and trend analysis	• Non-expert conferance on gene modified food in 1996	• Marketing and chain branding • Creating stable relations through membership cards	• Consumer organisation weak • Forbrukerrådet (public investigation on consumer security, also non-food)

= horizontal relations

= vertical relations

Restructuring of vertical and horizontal alignments

Hauknes (1998) has pointed out that the food cluster represent an activity with high degree of intra-relatedness; it is the Norwegian cluster where most trade of intermediate goods take place *within* the cluster, compared to the other five clusters. These internal transactions are performed in a profoundly intervowen web of horisontal and vertical relations. Some of these relations are also changing. We have described these linkages - and how they are slightly changing - throughout the paper. Table 9 is an attempt to sum up the network of vertical and horisontal in the Norwegian food cluster. The grey boxes represent horisontal linkages - those linkages between companies or units performing the same operations or activities. The white boxes represent vertical linkages - linkages between units with different roles along the production line.

Internationalisation, globalisation and ownership

International food trade is an activity with deep and historically interdependent relation to sea and land transport technology and to logistics. Food trade is not only based on deep historical roots, international trade *started* with food trade. Hobsbawn writes for example that *International trade…developed primarily as an exchange of raw materials and foodstuffs*[70].

Access to foodstuff was among the driving forces behind colonialism. The Economist writes: *Soon after dawn on May 21st 1498, Vasco da Gama and his crew arrived at Calicut after the first direct sea voyage from Europe to Asia. If history's modern age has a beginning, this is it. Europe's ignorance of, and isolation from, the cosmopolitan intellectual and commercial life of Asia were ended forever. With ships, weaponry and a willingness to use them both, the countries of Europe were about to colonise the rest of the world. To support this expansion, its merchant classes would invent new forms of commercial credit and the first great corporations, vital parts of capitalism's operating system, and spread their trading networks across the seven seas. And what did the men shout as they came ashore? "For Christ and spices!"*[71]

International trade with food and food stuffs has never gained full momentum, for three interdependent reasons. On the one side, trade with food products has dominantly been limited by the interests of western economies through national and supranational regulation aimed at protecting their domestic food producers, like we have seen in the case of Norway - where regulations protecting the interests of domestic farmers combined with a profound fear of inferior food quality from foreign producers have muted the flow of food across borders. Secondly, limits to logistics, trade networks and transport technology and transport costs have limited the possibility of full international trade with food, because food stuff is heavy and/or it often need to be kept cool all the way. Thirdly, new technology replacing traditional inputs from raw materials - like in the case of artificial sweetening for sugar, gene modified soy beans for regular beans or

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[70] Hobsbawn (1979) cited in Dicken (1986)

[71] Economist 19.12.1998, from http://www.economist.co.uk/485VV9aT/editorial/freeforall/19981219/xm0008.html

greenhouse grown vegetables to maintain production in colder areas - are also factors that to some degree influence the amount and direction of international food trade.

Since internationalisation processes meets their limits in technology and regulation, globalisation processes has in many areas grown up as an complimentary process. While internationalisation commonly is associated with quantitative cross-borders trade, Østerud suggests that globalisation involve increased strengthening of (qualitative) networks across country borders[72]. Such networks are most commonly associated with multinational companies controlling companies in several countries[73]. Foreign ownership in the food industry is rare. Most large agrofood companies are for example owned by domestic farmers or dairies, and rather few of the remaining large food corporations located in Norway have foreign ownership. With exception of Nestlé and Freia Kraft Marabou, near to all large companies are owned by domestic owners. And in those cases there are foreign owners, the share is low.

Norwegian food production is therefor seemingly low integrated in the global network of corporate ownership in the food industry. However, many of the Norwegian companies are controlling activities abroad, particularly in the nordic countries and increasingly in eastern Europe. This mostly applies for Orkla, Rieber and some of the retail chains. Orkla is already well established in Norway and Sweden, and has as explicit objective to improve the position in Finland and Denmark. Orkla has a sales apparatus in all the Nordic countries. Orkla also intends to further develop the Nordic region as its domestic market and gradually expand into selected markets in Central and Eastern Europe, in countries like Poland, the Czech Republic, Hungary, Ukraine, Austria, Estonia, Lithuania, and Latvia. Rieber & Søn had a sale outside Norway in 1998 that exceeded 60 percent for the first time. The whole Rieber Group had in 1998 a total of 7737 employees, whereof 4911 were employed abroad. Similarly, TINE also have tight relations to the US american market, where they produce Jarlsberg.

However, in a global comparison, Norwegian food producers are quite small. According to Fortune 500, ConAgra, Sara Lee, RJR Nabisco Holdings, Archer Daniels Midland, IBP and H.J. Heinz are the five world's largest food producers. SaraLee alone has 140.000 employees, or almost three times the whole Norwegian food industry. ConAgra is a world leader in trademarks with more than 80.000 employees). The risk of increased international competition seems relevant. As the food industry is so highly intervowen, increased competition leading to reduced activities in the Norwegian industry will infleuence more than the industry alone.

However, successful introduction from foreign brands and producers are dependent upon many factors, for instance the fact that Norway represents a small market with long food traditions related to domestic established brands. The situation today is that the number of foreign employees working in Norwegian companies 'outcompete' those domestic employees working in foreign owned companies. Using this indicator, it looks like the

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[72] Ø. Østerud (1999), *Globalisering*

[73] Asheim. A list over the largest food manufacturers is given in the Appendix

Norwegian food industry seems more expansive and globalised in its form than foreigners are to Norway.

A more vital threat to the food industry may be how the chain structure develops. Several food producers report that the development of large domestic chains has made their life more difficult. However, we may only have seen the beginning of the story. As with the food industry, the grocery chains are also increasingly becoming global actors, with an aggressive strategy. A good example is Wal-Mart, the world largest grocery chain, with almost *one million* employees[74]. Wal-Mart has just entered the British market, and there are no immediate reason to belive that the tour should stop here. Whether foreign chains will enter the Norwegain market is again a question of market size and barriers to entry. If the Norwegian market is regarded to small for international grocery chains, a theoretically possible development may be that some of the vertically integrated agrofood producers enter the chains as owners, completing the dominance line from soil to shelves.

Still, a possibility of foreign chains buying into the Norwegian chains lies of course in the fact that three of the four Norwegian grocery chains are familiy owned. An indication of times to come may be Ahold's takeover bid for ICA/Hakon-gruppen. To what extent will events like these influence Norwegian food suppliers. There is of course a possibility that foreign chains will bring with them already established industry-relations. It is reasonable to believe that successful branding - i.e. to which degree Norwegian producers have made their customers more apt to buy exactly *their* products - will be very influential to which direction such competition will take.

3.3 SUMMARY AND POLICY CONCLUSIONS

By using the food industry as starting point, we have described the food cluster as large, compared to the size of the Norwegian ecconomy, and a profitable activity compared to other industries in Norway. The industry has in many respect lived it's own life, sheltered from the surrounding world. Historically, the industry has been protected from international competition through tight relations to policy-makers. Today, the food cluster is the cluster with fewer extra-cluster relations than any other cluster (Hauknes 1999), and marked by tight vertical relations between different units in the production line.

We have seen that the food industry is innovative, but not in the conventional meaning of the concept: In terms of product and process innovation - a particularly interrelated action in the food industry - the rate is comparatively low. However, we have suggested that innovation defined as an action aimed at increasing profitability, we must include more intangible factors like developments in transport systems and sustained branding (including cumulative building of trademarks, product testing and commercials, avoiding negative rumors etc.). Also, horisontal and vertical alignments can be interpreted important innovation efforts, as they resulted in corporate powers. First among agrofood producers towards policy-makers, later among retail chains toward the industry. As

[74] A list of the world largest grocery chains are presented in the Appendix.

manufacturing of food has been a strategic issue for Norwegian politics the last centuries, corporative power may in itself be regarded as an innovation.

Innovation policy towards the food industry is a complex task, as the food industry dynamics vary quite a lot from dynamics in other industries. The food industry build competitiveness on seemingly other and less easy copied factors, as cumulative branding efforts and building of consumer trust. R&D activities, in the understanding of applied research aimed at developing new products, seem rather unimportant, compared to other industries. However, the indirect R&D fee through *Omsetningsrådet* is a rather important basic research backbone to the food cluster.

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Interviewed persons/companies/location/date

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