

Working Paper Series

Department of Business Studies

No. 13, 2008

Feeding Food Producers with (Regional) Knowledge
for Innovation?

By

René N. Nielsen

Feeding Food Producers with (Regional) Knowledge for Innovation?

René N. Nielsen

Aalborg University
Department of Business Studies
Fibigerstræde 4
DK-9220 Aalborg Ø
E-mail: rnn@business.aau.dk

Abstract:

The objective of this paper is to consider theoretical perspectives in relation to studying the agri-food sector through a regional innovation system approach. Specifically the paper underpins the aim of the feat2015 project to analyse and understand “development potentials in the agricultural and food sector seen from a regional innovation system perspective” by establishing a theoretical grounding. Generally it raises theoretical considerations for all interested in analysing conditions of the agri-food sector in regional settings.

ISBN 9788791646188

Acknowledgements:

The author wishes to acknowledge the Danish Ministry of Food, Agriculture and Fisheries for financial support of the project. The project is carried out by a consortium with the following partners: DTU Management Engineering at the Technical University of Denmark, Department of Business Studies at Aalborg University, GEMBA Innovation and the Research Centre Innovative Fisheries Management at Aalborg University. The author also wishes to thank Jesper L. Christensen, Preben S. Kristensen, Søren Eliassen, Christian R. Østergaard, and Michael S. Dahl for comments made on earlier versions of this paper, and student assistant Thomas Mølgaard for drawing up the figures in the paper.

1. Introduction

The agri-food sector is an important part of the Danish economy (Direktoratet for FødevarerErhverv 2003; Hansen 2005), a sector in which Denmark has a comparative strength, and a sector for which Denmark is internationally well-known (Porter 1990). As in other sectors, the agri-food sector develops and globalisation, increased competition, policy initiatives, and changes in consumer behaviour contribute to transformation pressures and structural changes in the sector (Direktoratet for FødevarerErhverv 2003; Hansen 2005; CIAA 2007), but also to new business potentials in the sector.

Hansen (2005) demonstrates that mergers, acquisitions, and realisations of economies of scale are important ways in which Danish agri-food firms have met and presumably will meet their challenges, but he also states that there may be some limitations in these directions. The Danish Directorate for Food, Fisheries and Agri Business informs that concentration tendencies have been linked with increased specialisation and focus on core competences (Ministry of Food, Agriculture and Fisheries 2003). Acknowledging both of these overall change characteristics, we argue that innovation, in terms of introducing new products and new processes, is also important for firms in the Danish agri-food sector. That is, to secure or even strengthen the comparative strong Danish position within the agri-food sector, Danish firms and other actors related to the sector have to be adaptive and innovative in regard to new technology, processes, products, and ways of organising. Innovation and newness are thus perceived to complement economies of scale and an increased focus on core competences in the agri-food sector (see also Direktoratet for FødevarerErhverv 2003).

Related to the comparative strength of the Danish agri-food sector, the transformation pressure in the sector, and the perceived importance of innovation, it is relevant to consider the spatial dimension of the Danish agri-food sector. The sector is thus important for economic development (including income generation and industrial development) in peripheral, rural districts in Denmark (Direktoratet for FødevarerErhverv 2003). And now, given the transformation pressure, it is important that innovation is supported and underpinned in all types of districts, also in the peripheral, rural ones.

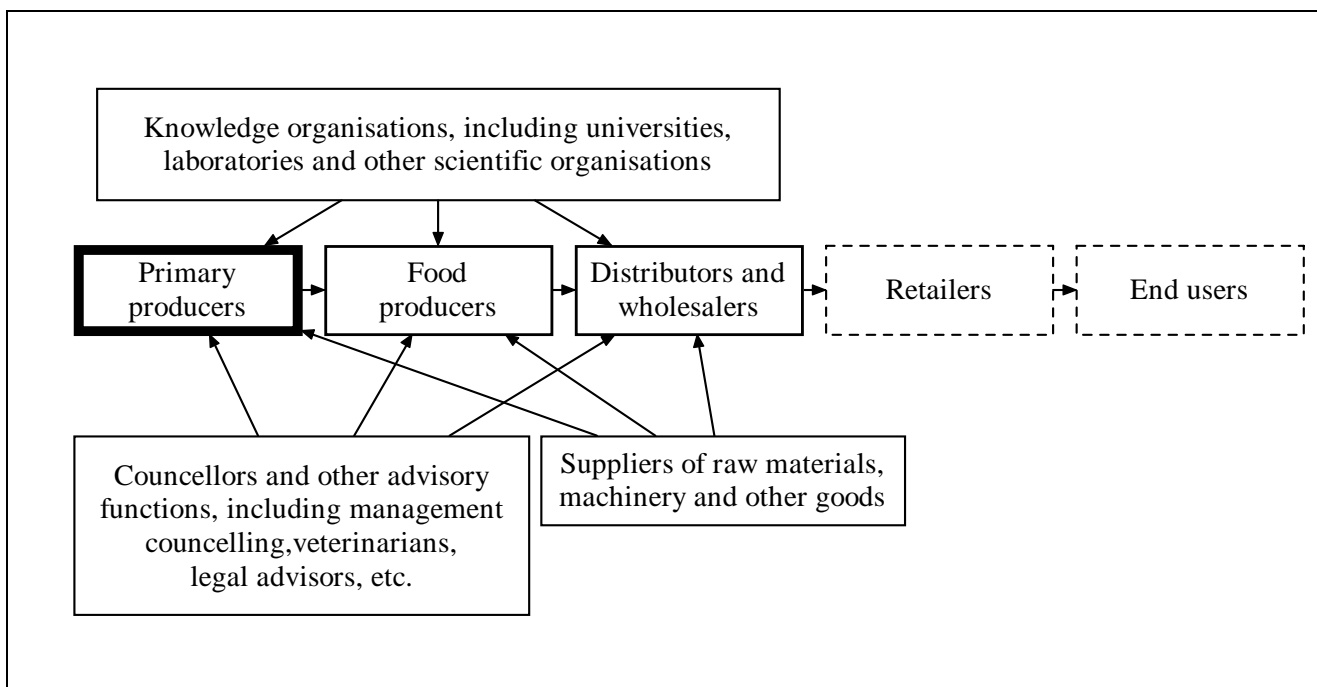
This paper is focused on current *innovation and development processes* in the *agri-food sector* from a *theoretical point of view* and with a *regional perspective*. The paper is structured as follows: First we approach the agri-food sector through a value chain perspective. Second, given that the project aim is to analyse and understand “development potentials in the agricultural and food sector seen from a regional innovation system perspective” we shall supplement this perspective with general, analytical potentials in the regional innovation system literature. Finally, we discuss analytical potentials of the regional innovation system approach vis-à-vis the agricultural and food sector.

2. Value chains in the agri-food sector

In order to establish a general overview of the sector, our analysis of the agri-food sector starts from a basic value chain perspective. It is not, however, clear and unambiguous where such a sector value chain generally ‘begins’ and ‘ends’. On the one hand it might be argued that the agri-food sector begins with primary production. On the other hand some inputs to and processes in the agri-food sector value chain are based on research and development (e.g. field seeds and feedstuff systems).

In the following we let primary production constitute the beginning of the value chain, and subsequently value is added when input from primary production is processed and distributed to consumers valuing agri-food products. Actors taking an active share in these core processes within the value chain shall be seen as core actors in the agri-food sector, but other actors are also important in the sector. Consultants and counsellors support core actors with sector specific knowledge, knowledge institutions develop and disseminate (partly specialised) new knowledge, educational institutions supply trained employees, and suppliers of raw materials, machinery and other goods also contribute to value creation in the value chain. Figure 1 presents the outlined view of the agri-food sector.

Figure 1: The agri-food sector from a general value chain perspective.



Viewing the agri-food sector through a general value chain perspective is, naturally, no more than a fundamental basis for further analyses. From this basis a multitude of more specific characteristics need to be taken into account depending on specific research interests. Refining the general value chain perspective it is, for example, clear that it

embeds many different value chains. Value chains based on farming differ from those based on fishing, and even within e.g. farming value chains related to pork differ from those within dairy. Besides, value chains generally based on standardisation and large scale production differ from those based on small scale and ecology that again differ from those based on gene manipulation and related scientific developments (see e.g. Manniche 2007). Finally, things turn even more complex when we realise that many of these different value chains are somewhat interdependent and all included in larger systemic contexts.

This paper continues by noting that value chains in the agri-food sector, however defined, are not static phenomena. Related to globalisation, increased competition, policy initiatives, and changes in consumer demand we observe concentration tendencies and development and implementation of new technologies, processes, products, and ways of organising in the sector. But what characterises these dynamics, especially the innovations, within the sector? How are they initiated and implemented? Are they primarily initiated and implemented by individual core actors in the sector, or is it more of a collective process where actors interact, and if so, to what extent are the interactive processes based on structured systemic relationships? And, what about the geography of innovation in the agri-food sector? Is it as dispersed as farming land or fishing waters, or is it geographically bounded, e.g. due to locally bounded 'seeds' of knowledge?

3. Structural changes and innovation in the agri-food sector

As already mentioned, Hansen (2005) demonstrates that mergers, acquisitions, and realisations of economies of scale are important ways in which Danish agri-food firms have met and presumably will meet their challenges in the context of structural changes and transformation pressure. And these concentration tendencies have been linked with increased specialisation and focus on core competences (Direktoratet for Fødevarerhverv 2003). In this section we shall focus on innovations as complementary important developments that are also relevant in dealing with changing context settings and transformation pressures in the agri-food (see also Direktoratet for Fødevarerhverv 2003).

For a start, it shall be clarified that innovation, including technological development, in the agri-food sector is not an unambiguous concept. Measuring R&D expenses as a share of turnover, OECD analyses have shown that the agri-food sector is generally characterised by a low R&D intensity (less than 1% of turnover) and is, thus, classified as a low-technology sector. Such classification should, however, be subject to several qualifications (Smith 2000) and focusing on food-processing, von Tunzelman and Acha (2005) argue that it is generally inappropriate to characterise the food sector as either low-tech or stagnant. On the contrary, at least parts of the food sector is characterised by

advanced knowledge bases and technology, and the sector develops in several dimensions such as new applications of biotechnology, smart materials, and changes in the vertical structure of the industry. Besides, looking ahead, tendencies such as increasingly complex production systems are anticipated to increase the importance of formal R&D for continuously developing knowledge bases in the agri-food sector (Direktoratet for FødevareErhverv 2003).

The innovation concept is also ambiguous in other dimensions which states the reason for keeping it open for subdivision and conceptualisation in different dimensions, a few of which shall be dealt with in this paper (see Fagerberg 2005 for a general introduction to the innovation concept). First, there are different types of innovations. Schumpeter distinguished between five different forms of innovation that may be termed: product, process, market, input, and organisational innovations, and in the agri-food sector innovations also come in many different forms such as:

- New types of fodder
- New feeding systems
- New types of logistics
- New types of packaging
- New types of conservation
- New additives
- New consumer products introduced continuously at the market.

Second, innovations may be more or less fundamental. This is often captured in the distinction between radical vs. incremental innovations (see e.g. Freeman and Soete 1997). Both of these ‘degrees’ may, in principle, be used in connection with the different types of innovations introduced above. Third, related to the distinction between radical vs. incremental innovations, some scholars distinguish between innovations that are: (1) new to the world, (2) new in the national context, or (3) new to the firm.

Based upon the above, we propose that innovations in the agri-food sector may be characterised and classified according to the following dimensions:

- Type of innovation
- Radical or incremental
- To whom the innovation is new

These multidimensional characteristics of innovation in the agri-food sector obviously add complexity to theoretical as well as empirical studies. Specifically it challenges operationalisations of empirical data collection in the sector, a challenge which will have to be dealt with in more empirical oriented papers.

Now, with the multidimensional characteristics of innovation in the agri-food sector in mind, and given that innovations are generally important in dynamic settings: how are innovations initiated and implemented? Are they primarily initiated and implemented by individual core actors in the sector, or is it more of a collective process where actors interact, and if so, are the interactive processes based on structured systemic relationships?

4. Systems of innovation

The system of innovation approach is fundamentally based on the view that innovations – product, process, organisational, or market – are usually related to firms, but they are not isolated, firm internal processes. On the contrary, firms' innovative activity is embedded in a systemic context, and innovations impact economic development through new products, new technology, and new organisational forms. Recalling figure 1 from section 2, we saw that actors contributing to the agri-food value chain and its development were located in the systemic context of the core chain. And, combining this illustration with The Danish Directorate for Food, Fisheries and Agri Business perception that the Danish food sector is characterised by an innovation system (Ministry of Food, Agriculture and Fisheries 2003) entitles an unravelling of the system of innovation approach.

An innovation can be conceived as a new combination of knowledge (Lundvall 1992; Edquist 1997; Edquist, Hommen et al. 2001), i.e. in order to innovate an economic agent will need new knowledge, e.g. about market potentials or technological opportunities, and the economic agent will need to combine the new knowledge with existing knowledge in new ways (Nielsen 2007). This is where the system perspective becomes relevant. Some knowledge with innovative potentials will originate within individual firms, e.g. through learning-by-doing, but other pieces of knowledge with innovative potentials will be placed outside individual firms, in the systemic context. Individual firms may, therefore, benefit from knowledge sources in their systemic context (Nelson 1993; Stoneman 1995) by interacting with and learning from other firms, suppliers, customers, universities, knowledge organisations, and other government organisations (Lundvall 1992; Edquist 1997; Sharif 2006).

Interactive learning is central in the innovation system literature. Through interaction individual actors can benefit by learning from other actors, at least if they have the absorptive capacity to do so (see e.g. Cohen and Levinthal 1989; 1990). And, relations of interactive learning may be regulated or institutionalised in innovation systems. Such

systemic relationships can be based on strategic, conscious design and regulation, e.g. firm strategy and policy initiatives at regional or national level. Or, the relationships may be grounded on institutionalised patterns of cooperation that have developed less strategically over time. So, in principle, the system of innovation approach is a broad analytical concept embracing different types of interactive learning and different types of innovations at different aggregation levels. As stated, this paper is aimed to (and thus focused on) consider potential strengths of applying a regional innovation system approach in studying the development potentials in the agricultural and food sector.

5. The geography of innovation and regional innovation systems

Conceiving innovations as new combinations of knowledge and emphasising interactive learning have motivated an increasing amount of studies on the relationship between knowledge, learning, and innovation, many of which have a geographical dimension. Types of knowledge, learning, and their geographies are thus fundamental elements in literatures on geographical clustering and agglomeration of economic activity (Dahl 2003), as well as in the regional innovation system approach (Asheim and Gertler 2005).

Porter (1994; 1998) argues that the capacity to innovate and upgrade is critically important in globalising contexts of dynamic competition, and local aspects such as geographically bounded knowledge, localised learning relationships, and geographic concentrations of supporting organisational and institutional settings underpin this capacity to innovate and upgrade. Consistently other scholars distinguish between codified and tacit knowledge, argue that especially tacit knowledge is geographically bounded, and find this tacit knowledge to be important for localised capabilities, innovation, and dynamic, industrial competitiveness (Maskell and Malmberg 1999; Pavitt 2002; Gertler 2003).

The regional innovation system (RIS) approach is related to and generally consistent with literature on the geographical concentration of innovation (Asheim and Gertler 2005), but it is, nonetheless, possible to distinguish between a regional innovation system and a regional cluster. Generally a cluster perspective and related policies tend to be somewhat more specific in their approach than the regional innovation system approach and related policies, and a regional innovation system may, in principle, contain more than one cluster of economic activity.

Based on this foundation, the regional innovation system approach considers how regional contexts – including regional organisations, institutional setups, R&D, education, trust, culture, cooperation, formal as well as informal, and systemic interaction – can foster and promote regional innovation. Asheim and Gertler (2005: 299) perceive a regional innovation system “as the institutional infrastructure supporting innovation within the production structure of a region”, and this overall conceptual perspective embrace

three different empirical types of regional innovation systems (Asheim 1998; Cooke 1998). As accounted for in Asheim and Gertler (2005: 300-303):

The first type may be denoted as *territorially embedded regional innovation systems*, where firms ... base their innovation activity mainly on localized learning processes stimulated by geographical, social and cultural proximity, without much direct interaction with knowledge organizations. This type is similar to what Cooke (1998) calls “grassroots RIS” ... Another type of RIS is the *regionally networked innovation system*. The firms and organizations are still embedded in a specific region and characterized by localized, interactive learning. However, policy interventions lend these systems a more planned character through the intentional strengthening of the region’s institutional infrastructure – for example through a stronger, more developed role for regionally based R&D institutes, vocational training organizations, and other local organizations involved in firms’ innovation processes. The networked system is commonly regarded as the ideal type of RIS: a regional cluster of firms surrounded by a regional “supporting” institutional infrastructure. Cooke (1998) also calls this type “network RIS” ... The third main type of RIS, the *regionalized national innovation system*, differs from the two preceding types in several ways. First, parts of industry and the institutional infrastructure are more functionally integrated into national or international innovation systems – i.e. innovation activity takes place primarily in cooperation with actors outside the region. Thus, this represents a development model in which exogenous actors and relationships play a larger role. Cooke (1998) describes this type as “dirigiste RIS,” reflecting a narrower definition of an innovation system incorporating mainly the R&D functions of universities, research institutes, and corporations. Second, the collaboration between organizations within this type of RIS conforms more closely to the linear model, as the cooperation primarily involves specific projects to develop more radical innovations based on formal analytical-scientific knowledge. Within such systems, cooperation is most likely to arise between people with the same occupational or educational background (e.g. among engineers).”

Besides, in order to understand specific, empirically observable geographical concentrations of innovation and competitiveness, and in order to foster and promote such concentrations, concrete industrial knowledge bases need to be taken into account. Quite intuitively, understanding and supporting regional concentrated economic activity within electronics and computing industries in Silicon Valley (see e.g. Saxenian 1990; Saxenian 1994) will differ from understanding and supporting concentrations of traditional food production in other regions. Asheim and colleagues have also argued that characteristics of underlying industrial knowledge bases are important in order to understand, and potentially support, regional innovation and competitiveness (Asheim and Coenen 2005; Asheim and Gertler 2005). They primarily distinguish between “synthetic” and “analytical” knowledge bases, where the former category tend to be more practical, know-

how-based, and tacit than the latter which is more formal, science-based, and codified. But, they also recognise that these knowledge bases in their purest form are best understood as opposite end points of a continuum with most industries “occupying an intermediate position along this spectrum”.

Viewing regional innovation systems in light of specific, underlying knowledge bases implies that regions will differ as regard relative strength in knowledge, learning, and innovation based on characteristics such as:

- Degree of trust, collaboration, and interaction among regional firms sharing a common knowledge base.
- Presence and quality of specialised education and training institutions supplying skilled human resources to work with and develop the knowledge base.
- Presence and quality of specialised R&D institutions supplying new knowledge to the knowledge base.
- Strategic regional initiatives to support and develop systemic relationship within established (or potentially emergent) regional strongholds within a given knowledge base.

Especially it has been argued that peripheral regions tend to differ from central, metropolitan regions in terms of institutional settings, knowledge sources, networking, innovation activity, and innovation barriers, and these differences have policy implications (Tödtling and Trippel 2005). For example, for peripheral regions policy initiatives such as “catching up learning”, building up medium level skills, and support of incremental innovation activity might be more important than, likely unrealistic, policy initiatives aiming for radical innovations and contributions to the science-based research front.

Now, given that specific, innovation activities and underlying knowledge bases tend to vary across regional settings as well as across sectors, we shall briefly introduce the sectoral innovation system approach, with a special focus on the food sector, before returning to the application of a regional innovation system perspective on innovation and development in the agri-food sector.

6. Sectoral innovation system and the agri-food sector

It is an established finding in innovation studies that innovation differs greatly across sectors in terms of knowledge bases, influential actors, relationships and interactions among actors, and relevant institutions (Pavitt 1984; Malerba 2005). Some sectors are more R&D-intensive than others; some sectors are dominated by few large firms, while

smaller firms are relatively more important in other sectors; and firm-firm collaborations are more prevalent in some sectors than in other; not to mention that the economic importance of non-firm organisations such as knowledge institutions and governmental organisations differ across sectors.

Given these sectoral differences, the sectoral innovation system approach is “a multidimensional, integrated, and dynamic view of innovation in sectors ... a methodology for the analysis and comparison of sectors [where a] sector is a set of activities that are unified by some linked product groups for a given or emerging demand and which share some common knowledge. Firms in a sector have some commonalities and at the same time are heterogeneous. A sectoral system framework focuses on three main dimensions of sectors: (a) knowledge and technological domain, (b) actors and networks, (c) institutions” (Malerba 2005: 385). Some sectoral innovation systems are internationally dispersed while others are more geographically bounded at the national or regional level, and Malerba (2005: 386 & 400) explicitly states that the sectoral innovation system approach is to be seen as a complement to regional and national innovation system approaches.

Clarifying the sectoral innovation approach, Malerba states that sectors may be broadly or narrowly defined, depending on the aim of a given analysis.¹ And given this paper’s focus on the agri-food sector such question of definition and delimitation is clearly relevant to consider. To illustrate, Manniche (2007) distinguishes three different “ideal types” of food production-consumption models that in combination can be said to broadly define the agri-food sector: (1) “Industrial food in which the distinctive conventions of quality and competitive factors are price and efficiency” (cf. e.g. raw materials from industrial agriculture, exploitation of advanced breeding techniques, chemical fertilisers and pesticides, transport-intensive, high-energy processing based on Fordist production technologies and organisation principles, modern retail systems). (2) “Alternative food in which domestic, green and inspiration qualities are crucial” (cf. e.g. organic food, local, high-quality, specialty, slow food, fair-trade, premium priced food). (3) “Functional food emphasising health and nutritional effects” (cf. e.g. food enriched with active ingredients not normally contained in them, nutrition, science, genomic and microbiological knowledge, bio- and nanotechnologies). Each of these “ideal type” models will, in principle, be characterised by different knowledge and technology bases, as well as different relevant actors, relations, networks and institutions.

Another way of clarifying the agri-food sector is through the concept of ‘distributed knowledge bases’. Focusing on the food processing industry Smith (2000) argues that the agri-food sector is characterised by different key activities and technologies, and these

¹ A broad definition of a sectoral innovation system holds the potential to “capture all the interdependencies and linkages in the transformation of sectors”, but it may be complicated if different products have different innovation systems. A narrow definition “identifies more clearly specific relationships”, but it does not capture the broader interdependencies and relationships.

activities, technologies, and their development are underpinned by different developing knowledge bases distributed among different knowledge suppliers. Some of the knowledge bases are science-based and stem from science-based organisations such as research institutes, and Smith actually states that: “Despite the fact that this [the food processing industry] is an industry with relatively low levels of internal R&D, it might well be claimed that this is one of the most knowledge-intensive sectors of the entire economy ... [and] ‘low tech’ industries are knowledge intensive, and are frequently part of ‘high tech’ systems.”

The main point to be taken from this section is: (1) that sectoral knowledge and technology are important (distributed) elements to be understood in system of innovation approaches, (2) that a sector is an ambiguous concept that needs to be defined and delimited more closely, and (3) that the sectoral system of innovation approach is complementary to regional and national system approaches – actors, relations, networks, and institutions are relevant to study both from a sectoral and a geographical perspective. This leads us to consider and discuss analytical potentials of the regional innovation system approach vis-à-vis innovations in and development potentials of the agri-food sector.

7. Discussion: regional innovation systems in the food sector?

In this paper we have, so far, dealt with the agri-food sector, regional innovation systems, and sectoral innovation systems in a somewhat decoupled way. Now, we shall discuss and conclude on the potentials of integrating these elements in a combined analytical approach. In doing so, we shall acknowledge a few scholars that have studied the agri-food sector from a regional innovation system approach, but we shall also argue that much work needs to be done in order to clarify the general, conceptual-analytical framework as well as in order to enhance our more specific knowledge on these matters.

First, we have noted that process, product, organisational, and market innovations are usually related to firms, but they are not necessarily isolated, firm internal processes. Some economically useful knowledge with innovative potentials will originate within individual firms, e.g. through learning-by-doing, but other pieces of knowledge with innovative potentials may come from the external context of the firm, feeding into the innovation process. Studying the agri-food sector from a system of innovation approach, we shall take interest in how important the systemic context is for innovation in the agri-food sector and in how structured potential systemic relationships are.

Second, given that sector-specific knowledge and technology are highly important in order to understand innovation and development processes in the sector, and given that a sector is an ambiguous concept, we shall urge consideration of these matters. What is meant, for example, when we say the agri-food sector? Is it a broadly defined sector

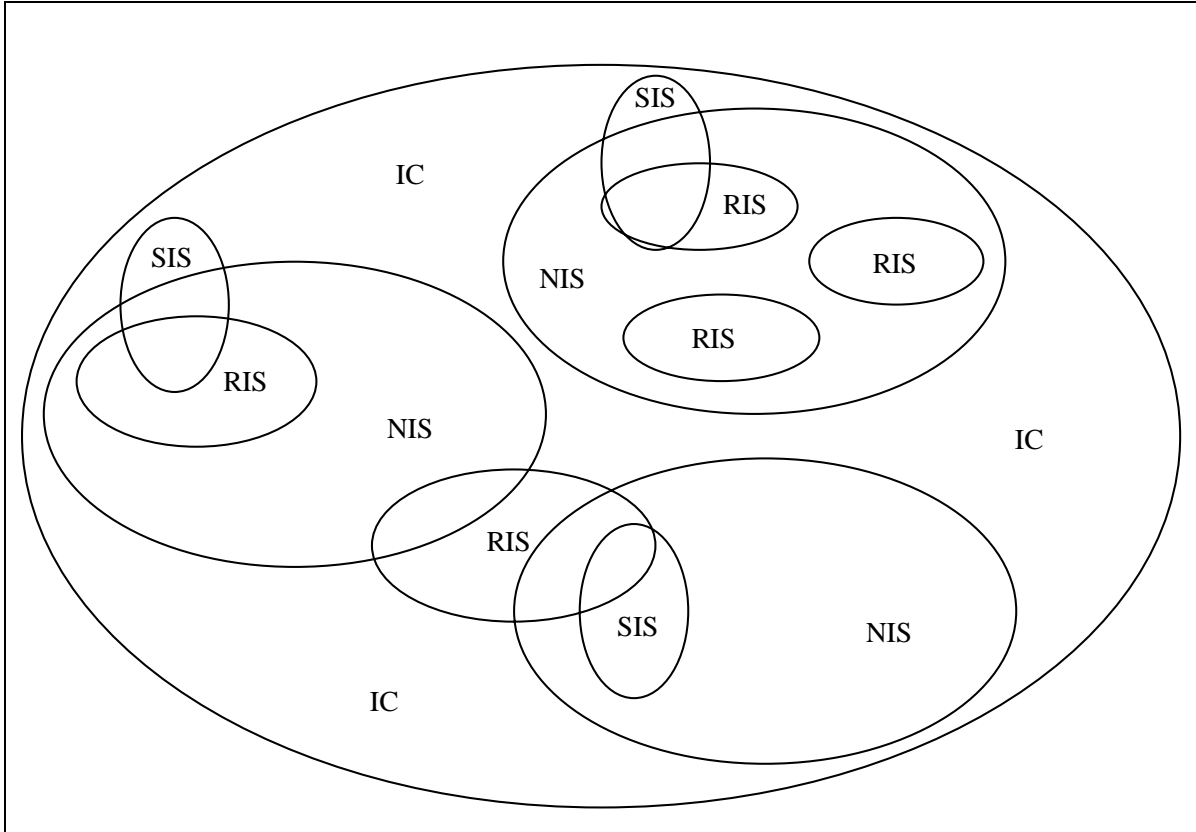
perspective? Is it encompassing the whole value chain? Or, is it a more strictly delimited focus we have in mind? There are no a priori answers to such questions – the point is that when studying the agri-food sector from a system of innovation approach, we need to consider these questions in relation to more specific research questions.

Third, given that some economically useful knowledge with innovative potentials in the agri-food sector (however defined) come from the external, systemic context of the firm, feeding into the innovation process, it is relevant to study the geography of this knowledge sourcing and/or knowledge supply. Actors, relations, networks, and institutions that are important for innovation and development in the agri-food sector may in general be local or less-local, specifically they may be regionally-based, nation-based, or even internationally-based. When studying the agri-food sector from a system of innovation approach we need to consider this, and it will be relevant to study the importance of these different geographical system-levels.

Even if the research focus is primarily regional, it will still be important to remember the other geographical system-levels, and if the focus is on improving the functioning of regional innovation systems within the agri-food sector, this system-level could be seen as a mediating system coordinating regional actors, relations, and institutions and linking this system to higher-level systems. Besides, if the research focus is primarily regional, it is also important to consider that regions differ in characteristics and dynamics. Especially peripheral regions seem to be challenged in today's transformation pressures and structural changes, so from a policy perspective special attention may need to be given to such regions.

Figure 2 below illustrates conceived conceptual-analytical relationships between an international context (IC), national innovation systems (NIS), regional innovation systems (RIS), and sectoral innovation systems (SIS). The large, exterior circle represents the international context that encompasses a multitude of national, regional, and sectoral innovation systems. The figure also illustrates that national innovation systems can hold more than one regional innovation system, and that a regional innovation system is fully or partly encompassed in a national innovation system. Finally, the figure illustrates that a sectoral innovation system – e.g. an agri-food sectoral innovation system – may concurrently be embedded in regional and national innovation systems, as well as it may transcend both of them.

Figure 2: Conceptual-analytical relationship between different innovation system approaches



Having stated some of the most important implications stemming from the conceptual-analytical focus in this paper, we shall now present some studies that have combined a regional innovation system approach with a research interest in the agri-food sector.

Asheim and Coenen (2005) argue that “the analysis of the importance of different types of regional innovation systems must take place within a context of the actual knowledge base of various industries in the economy, as the innovation processes of firms are strongly shaped by their specific knowledge base”. Regarding knowledge bases, they broadly distinguish between: analytical and synthetic knowledge bases, where the former is generally more science-based and codifiable than the latter, which is more know-how-based and tacit. Asheim and Coenen substantiate their argumentation by a comparative study of five Nordic case-studies, two of which are from the food industry. The point to be referred to here is that a more traditional food cluster in Norway is primarily based on synthetic knowledge, whereas an “embryonic” functional food cluster in Sweden is more heavily based on analytical, science-based knowledge. This rather fundamental difference is crucial in order to understand the two clusters and, relatedly, it needs to enter into

potential considerations on how to support each cluster through different types of regional innovation policy and regional innovation systems.

Aradóttir et al. (2005) state that “there is a need for increasing our knowledge of innovation systems in the periphery and to pay increased attention to the design and implementation of innovation policy and innovation facilitation practice in the rural context.” Applying a case study approach, partly focusing on agri-food production, they find that innovations are perceived to be important in periphery regions and, indeed, innovations are taking place in these regions (especially small-scale and incremental innovations). Regarding system settings underpinning innovative activity they emphasise extending the knowledge and competence base in peripheral regions, as well as facilitating the entrepreneurial culture in these regions.

Gellynck et al. (2007) refer to literature on positive contributions of the regional context to the dynamics of innovation, and establish a framework depicting “regional networks as an external resource of the firm, acting as an instrument to innovate”. Acknowledging that firm internal resources and external resources at other geographical levels (e.g. national or international) may impact the innovation process, it is hypothesised that regional networking will positively affect innovative performance. Based on survey data, factor analysis, cluster analysis, and discriminant analysis, Gellynck et al. (2007) find that Belgian food firms in the region of Meetjesland which are characterised by: (1) an orientation toward the international market, and (2) participation in regional networks, demonstrate a stronger innovation competence.² This finding leads the authors to the policy implication that “[p]olicy support to regional networks is an instrument to increase innovation and thus improve the economic performance of the region”, even though they leave it for further research to clarify whether the positive relationship found between regional networking and firm innovation performance is “induced by qualities of the region or regional networks, or is the success of networking due to the presence of particular firms and sectors?”, i.e. to sort out the direction of causality.

Eliassen and Raakjær (2008) establish that the Danish region Nordjylland is characterised by a relative specialisation in the food sector, but they are in doubt whether there is a ‘food cluster’ in the region, or whether such cluster is currently being established through policy initiatives. Therefore they study how food firms in the region source knowledge for product and process innovation, internal or external? And, if external whether the search is regional bounded or not? Based on case interviews, Eliassen and Raakjær find that it is mostly smaller firms that participate in policy initiatives to share knowledge in networks of regional food firms, whereas larger firms show less interest in such initiatives. This finding may, however, be partly explained by current policy-driven

² “Data are gathered at three levels of the agri-business complex: (1) food processing firms, (2) trade firms (wholesale trade), and (3) main suppliers (excluding farmers). A sample of 81 firms, which is 50% of the total population”.

network initiatives being aimed at smaller food firms. Besides, given that the policy-driven regional development strategy is in progress it is too early to conclude finally on the ‘food cluster’ initiatives. Anyhow, Eliassen and Raakjær do find that both smaller and larger firms search important external knowledge out of the region, also internationally which indicates that a regional cluster, if existing or under establishment, does not supply all external knowledge of importance to food firms in the region.

Christensen (2007) recognises that the food and drink industry is important in many national and regional economies, that this industry is as innovative as other manufacturing industries, and that knowledge inputs to the innovation process may generally come from R&D and formal knowledge organisations or from know-how related to primary production. Christensen states that geographical proximity to either of the latter two types of knowledge will tend to support interaction and knowledge transfers to the benefit of innovative activity, and he designs a test to indicate whether it is more important for food producers to be located near formal knowledge organisations or near primary producers. The Danish region of North Jutland is selected as a suitable test case as it has many primary producers while few formal knowledge organisations within the food sector, and based on empirical findings that North Jutland food producers are relatively less innovative than other Danish food producers, as well as they apparently experience obstacles to innovation, Christensen states that he has found indications that geographical proximity to the formal knowledge structure within the food industry may be “indispensable”.

Existing studies mentioned in this section reveal that scholars have started to direct attention to the intersection of the agri-food sector, peripheral regions, regional innovation systems, and sectoral innovation systems. It is, however, obvious that this intersection of four ambiguous perspectives causes complexity and triggers many unresolved questions, not yet dealt with in current research. Bottom line this means many research openings, but also many research challenges, not all of which we shall attempt to clarify in this paper. In fact, we shall end this paper by outlining merely one research opening, a research opening that will be addressed in, and constitute a major part of the feat2015-project.

When it comes to innovation in the agri-food sector most research focuses on the part of the value chain from food processing onwards. Research is lacking regarding the primary sector. How much innovation is taking place in this part of the value chain? If any, where do the primary producers get their ideas and knowledge from? Are ideas, motivation, and learning primarily firm internal driven, or are they brought in from the outside, external context? These are questions that we have studied in Christensen et al. (2008)

References

- Aradóttir, E., H. Tanvig, et al. (2005). Innovation Systems and the Periphery: 1-438.
- Asheim, B. T. (1998). Territoriality and Economics: On the Substantial Contribution of Economic Geography. Economic Geography in Transition, The Swedish Geographical Yearbook, vol. 74. O. Jonsson and L.-O. Olander. Lund: 98-109.
- Asheim, B. T. and L. Coenen (2005). "Knowledge bases and regional innovation systems: Comparing Nordic Clusters." Research Policy **34**: 1173-1190.
- Asheim, B. T. and M. S. Gertler (2005). The Geography of Innovation: Regional Innovation Systems. The Oxford Handbook of Innovation. J. Fagerberg, D. C. Mowery and R. R. Nelson. Oxford, Oxford University Press: 291-317.
- Christensen, J. L. (2007). Knowledge-sourcing for product innovation in the food and drink industry. Title YY. E. XX. City ZZ, Publisher VV.
- Christensen, J. L., M. S. Dahl, et al. (2008). Innovation in agriculture, forestry and fishery: Knowledge sourcing and innovative capabilities. DRUID 25th Celebration Conference 2008, Copenhagen, CBS.
- CIAA (2007). CIAA benchmarking report 2007 update: The competitiveness of the EU food and drink industry. Brussels, CIAA: 28.
- Cohen, W. M. and D. A. Levinthal (1989). "Innovation and Learning: The Two Faces of R&D." The Economic Journal **99**(397): 569-596.
- Cohen, W. M. and D. A. Levinthal (1990). "Absorptive Capacity: A New Perspective on Learning and Innovation." Administrative Science Quarterly **35**(1, Special Issue: Technology, Organizations, and Innovation): 128-152.
- Cooke, P. (1998). Introduction: Origins of the Concept. Regional Innovation Systems. H.-J. Braczyk, P. Cooke and M. Heidenreich. London, UCL Press: 2-25.
- Dahl, M. S. (2003). Knowledge diffusion and regional clusters: lessons from the Danish ICT industry. Department of Business Studies. Aalborg, Aalborg University: 248.
- Edquist, C., Ed. (1997). Systems of Innovation - Technologies, Institutions and Organizations. Science, Technology and the International Political Economy. London, Pinter.
- Edquist, C. (1997). Systems of Innovation Approaches - Their Emergence and Characteristics. Systems of Innovation - Technologies, Institutions and Organizations. C. Edquist. London, Pinter: 1-35.
- Edquist, C., L. Hommen, et al. (2001). Innovation and Employment. Cheltenham, Edward Elgar.

Eliassen, S. and J. Raakjær (2008). Innovation i nordjyske fødevarer virksomheder. Hvad skal Nordjylland leve af? J. L. Christensen, T. Nielsen and L. T. Linde. Aalborg.

Fagerberg, J. (2005). Innovation: A Guide to the Literature. The Oxford Handbook of Innovation. J. Fagerberg, D. C. Mowery and R. R. Nelson. Oxford, Oxford University Press: 1-26.

Freeman, C. and L. Soete (1997). The Economics of Industrial Innovation. London, Continuum.

Gellynck, X., B. Vermeire, et al. (2007). "Innovation in food firms: contribution of regional networks within the international business context." Entrepreneurship & Regional Development **19**(3): 209-226.

Gertler, M. S. (2003). "Tacit knowledge and the economic geography of context, or the undefinable tacitness of being (there)." Journal of Economic Geography **3**: 75-99.

Hansen, H. O. (2005). Vækst i fødevarerindustrien. København, Handelshøjskolens Forlag.

Lundvall, B.-Å. (1992). Introduction. National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning. B.-Å. Lundvall. London, Pinter: 1-19.

Lundvall, B.-Å., Ed. (1992). National Systems of Innovation - Towards a Theory of Innovation and Interactive Learning. London, Pinter Publishers.

Malerba, F. (2005). Sectoral Systems: How and Why Innovation Differs across Sectors. The Oxford Handbook of Innovation. J. Fagerberg, D. C. Mowery and R. R. Nelson. Oxford, Oxford University Press: 380-406.

Manniche, J. (2007). Knowledge dynamics and geographies in the food and drinks sector. Regional Studies Association International Conference: Regions in focus?, Lisbon, Portugal.

Maskell, P. and A. Malmberg (1999). "Localised learning and industrial competitiveness." Cambridge Journal of Economics **23**: 167-185.

Ministeriet_Fødevarer, L. o. F. (2003). Vækstmuligheder gennem innovation for fødevarer sektoren i Danmark. København, Ministeriet for Fødevarer, Landbrug og Fiskeri, Direktoratet for FødevarerErhverv: 96.

Nelson, R. R. (1993). A Retrospective. National Innovation Systems: A Comparative Study. R. R. Nelson. Oxford, Oxford University Press.

Nielsen, R. N. (2007). Human resources in innovation systems: With focus on introduction of highly educated labour in small Danish firms. Department of Business Studies. Aalborg, Aalborg University: 198.

- Pavitt, K. (1984). "Sectoral patterns of technical change: Towards a taxonomy and a theory." Research Policy **13**(6): 343-373.
- Pavitt, K. (2002). Knowledge about knowledge since Nelson & Winter: a mixed record. SPRU Electronic Working Paper Series. University of Sussex, Falmer, Brighton: 1-21.
- Porter, M. E. (1990). The Competitive Advantage of Nations. London, The Macmillan Press Ltd.
- Porter, M. E. (1994). "The Role of Location in Competition." Journal of the Economics of Business **1**(1): 35-39.
- Porter, M. E. (1998). "Clusters and the new economics of competition." Harvard Business Review **Nov-Dec 1998**: 77-90.
- Saxenian, A. (1990). "Regional Networks and the Resurgence of Silicon Valley." California Management Review **33**(1): 89-111.
- Saxenian, A. (1994). Regional Advantage: Culture and Competition in Silicon Valley and Route 128. Cambridge, MA, Harvard University Press.
- Sharif, N. (2006). "Emergence and development of the National Innovation Systems concept." Research Policy **35**(5): 745-766.
- Smith, K. (2000). What is the 'knowledge economy'? Knowledge-intensive industries and distributed knowledge bases. DRUID Summer Conference, Copenhagen.
- Stoneman, P., Ed. (1995). Handbook of the Economics of Innovation and Technological Change. Blackwell Handbooks in Economics. Oxford, Blackwell Publishers Ltd.
- Tödtling, F. and M. Tripl (2005). "One size fits all? Towards a differentiated regional innovation policy approach." Research Policy **34**: 1203-1219.
- von Tunzelmann, N. and V. Acha (2005). Innovation in "low-tech" industries. The Oxford Handbook of Innovation. J. Fagerberg, D. C. Mowery and R. R. Nelson. Oxford, Oxford University Press: 407-432.