



Development of organic sector. Status quo report Finland

*CoreOrganic Project HealthyGrowth: From niche to
volume with integrity and trust. WP 2*

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Abstract. The present review on the development of the organic sector and on the status of the organic research in Finland has been compiled within the frame of the HealthyGrowth project. The numeric data are based on official statistics. The role of the government and the national goals and strategies were captured by analyzing about 20 relevant national policy documents. Regarding research, the focus was on the completed and on-going projects that deal with either policy, markets and consumers, with specific food items and/or their quality. The information was compiled from the research registers of the Finnish universities and MTT Agrifood Research Finland. The major part of the research deals with primary production. Out of the altogether 140 research projects, only 31 deal with the topics that are relevant in this review.

Organic farming has long, but thin roots in Finland. The official status was established in 1995 with Finland's entry to EU. Today one of the goals of the Finnish food policy is to expand the use of organic food, and the public sector is obligated to act as a path-breaker.

The area of organic cultivation is now about 9% from the total field area. Until past few years organic, sector has remained rather marginal (1%) within the Finnish food markets. Recently there has been a rapid increase. Organic products comprise now about 5% from the food sales, and the expansion is expected to continue.

Important milestones within the organic sector are foundation of the Organic Research Institute in 2013 and launching of the government promotion program for organic sector in the same year. In this program the goals for organic sector are explicitly specified and not treated parallel together with local food.

Keywords: state of art- review, organic sector, development, research, policy goals

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Background

With a land area of 303 892 km² (total area 390 903 km²) and a population of 5 375 276 million (Statistics Finland 2012) Finland is a sparsely populated country; about 80% of Finland's surface area is extremely sparsely populated, with fewer than 5 inhabitants per km².

Agriculture is severely constrained by the northern location (between 60° and 70° northern breadth) of the country, and arable land comprises only about 6% of the total area. Finland extends 1,157 km in a north–south direction. In such a large area, the natural circumstances vary greatly, and the preconditions for agriculture vary in different parts of the country. Reindeer herding areas cover the northernmost third of Finland, and fisheries are located in coastal areas and in the lake-rich parts of the country. Crop cultivation together with the pig and poultry farms is concentrated in south and southwest Finland, whereas cattle farms are mainly located further north. Other factors, such as the size of farms and their location in relation to markets and to the possibilities for off-farm work, contribute to regional differences with regard both to production structure and to the overall importance of agriculture in regional economics.

The share of agriculture from the gross domestic product (GDP) oscillates around 1%; the food sector as a whole comprises about 4% of the GDP. During past decades agricultural production has markedly intensified, e.g. in crop production the yields per hectare have doubled. In 1970 the total yield level was about 3.4 tons per hectare and reached the present level of about 7 tons per hectare in 1990'ies. However, since the mid 1990'ies, the eco-efficiency of the production has also significantly improved, which means that less fertilizers, biocides energy and lime is needed per unit volume of production (Risku-Norja 2011).

Over the decades agriculture has gone through a major structural change. The number of the farms had dropped from nearly 300 000 in 1970 to about 130 000 by the end of the past millennium, and the trend has continued during the 21st century, the number of farms is now about 60 000. At the same time, the average size of the farms has increased from under 10 hectares in 1970 to about 36 hectares in 2012 (MMM annual issues). In 1970 the share of the farmers and agricultural workers from the employed labour force was nearly 18%, today it is about 2.5% (MMM annual issues; Statistics Finland 2012; Statistics Finland 2012). The cultivated land area is now about 2 million hectares, while in 1970 it was 2.6 million hectares (MMM annual issues). Similar development is taking place also within the reindeer, fishery and hunting sectors.

Judged by the production and consumption statistics, Finland is largely self-sufficient in regard of the basic food products (MMM 2009). Major part of the farms is engaged in plant production (66.6%). Fodder for animals comprises about 60% of the total crop production, the share the cereals production is about 28%, that of potato and sugar beet about 4.5% and all other food plants together make up the rest or about 3%. The share of the dairy farms is 17.2%, and that of the beef cattle 6.2%, pig and poultry husbandry rest together 5.7% of the farms (MMM 2009; MMM 2011). The production structure has remained more or less the same over the decades, but the diversity within the miscellaneous group of all other products has increased (Risku-Norja 2011).

Status organic food production & consumption

Development of the organic sector: production

Organic farming in Finland has long, but thin roots sprouting from the idealistic approach of biodynamic cultivation in the beginning of the 19'ies. Professional organic production without the necessarily biodynamic emphases started to gain ground in the 1970'ies with the emergence of the first commercial organic farms (Hanhilahti et al., 2005). The expansion was rapid during the

1990's, especially after the entry of Finland to EU in 1995: in 1990 the organic cultivation comprised 0.3%. The share increased to about 7% percent by the beginning of the new millennium, and then the goal by the year 2010 for organic production was set to 15% share from the cultivated area (MMM 2002). This goal was not reached. Since then the interest slightly declined, and the share remained at the level of about 6%. From 2008 on organic production area has started slowly to grow again and at present its share is about 9% (MMM annual issues) (Fig. 1a).

In 1995 the share of organic farms from all farms was 2.8%. Today the number of organic farms is 4322 comprising 6.3% of all farms (Fig. 1b). Their average size about 46.4 hectares and thus about 15% larger than that of the conventional farms (39 hectares, (EVIRA 2012; Pro Organic 2013).

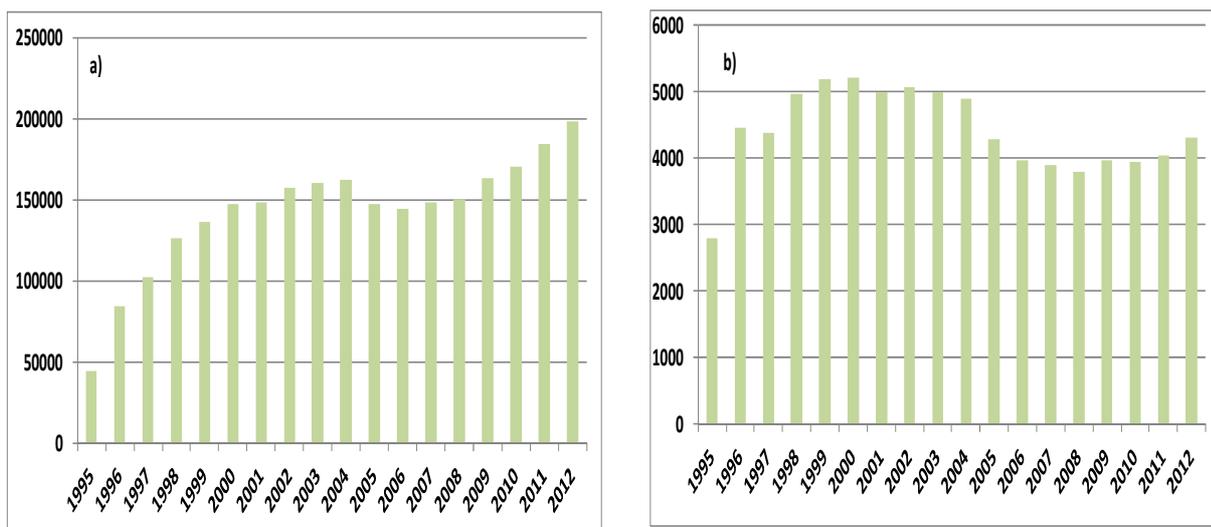


Figure 1. The development of organic agriculture in Finland 1995-2011. Data source: (EVIRA 2012; Pro Organic 2013).

a) Area under organic production, hectares.

b) Number of organic farms.

The volume of organic cereals is 2.2% from the total cereal production, the share of organic production varies species-wise being lowest for barley (0.4%) and highest for rye (7.8%). Organic production has increased especially due to concern regarding self-sufficiency of domestic protein feed for animal husbandry; about 16% of pulses is organically grown (EVIRA 2012). Part of the organic crop production farms, however, uses their production as fodder for own conventional animal husbandry or sells the products as conventional (Pro Organic 2013).

Within the animal husbandry, there are 750 organic farms. The production is strongly focused on beef production, there are also over 100 sheep farms and egg production units, but only 10 organic pork production farms. The share of organic milk has increased from 0.6% in 2000 to 1.8% in 2013 and that of eggs from 2.1% in 2006 to 3.7% in 2012. In 2012, about 2.1% of slaughtered bovine animals were from organic farms.

The area for gathering organic wild berries, mostly lingonberry and blueberry, is largest in the world in Finland, about 7 million hectares¹. Their salable volumes were 2 respective 0.7 million kg in 2011 (Pro Organic 2013), which is about 11% from the sold domestic wild berries.

¹ no chemical fertilizers or pesticides used during previous 3 years

Development of the organic sector: consumption

Small and medium-sized enterprises (SMEs) have a firm role in increasing the market share of Finnish organic food products in domestic retail and in professional kitchens as well as in export (Food Strategy 2010; SRE 2008; VN 2010; VN 2011).

Today there are about 600 enterprises in Finland that manufacture or import organic products (EVIRA 2012) (Fig 2 a). Over 80% of organic sales (€) comes from the grocery stores selling daily consumer goods, but compared to the average of food sales, the share of farmers' markets, special stores and direct sells is clearly higher for organic food items (Pro Organic 2013).

In Finland the consumers are interested in food, its healthiness, tastiness and in environmental and ethic questions associated with food production. Today's Finnish consumer is not guided only by price and nutritional needs, but food choices increasingly reflect life style, identity, personal taste preferences and also values. Healthiness is the most important driver to buy organic products among the Finnish consumers, but ethical and environmental aspects are also brought up (Auersalmi 2005; Kantanen 2002; Lehtonen 2004; Muukka 2008; Sarkkinen et al., 2006). Environmental concerns are important drivers among the younger consumer groups, whereas older people stress health aspects. However, the market share of organic products from food purchases has remained low (of the order 1%) until 2010 (VN 2013). Presumably one of the reasons for the low demand is the good reputation of domestic conventional food, which is perceived as pure, safe and tasty, and often the consumers prioritize domesticity of the products rather than their organic nature (Järvelä and Mäkelä 2005; Kupiainen and Järvinen 2009; Latvala et al., 2011; Piironen and Järvelä 2006; SRE 2008). Nevertheless, since 2010 the market has started to grow rapidly (Fig 2 b), and today the market share of organic products is about 1.6%.

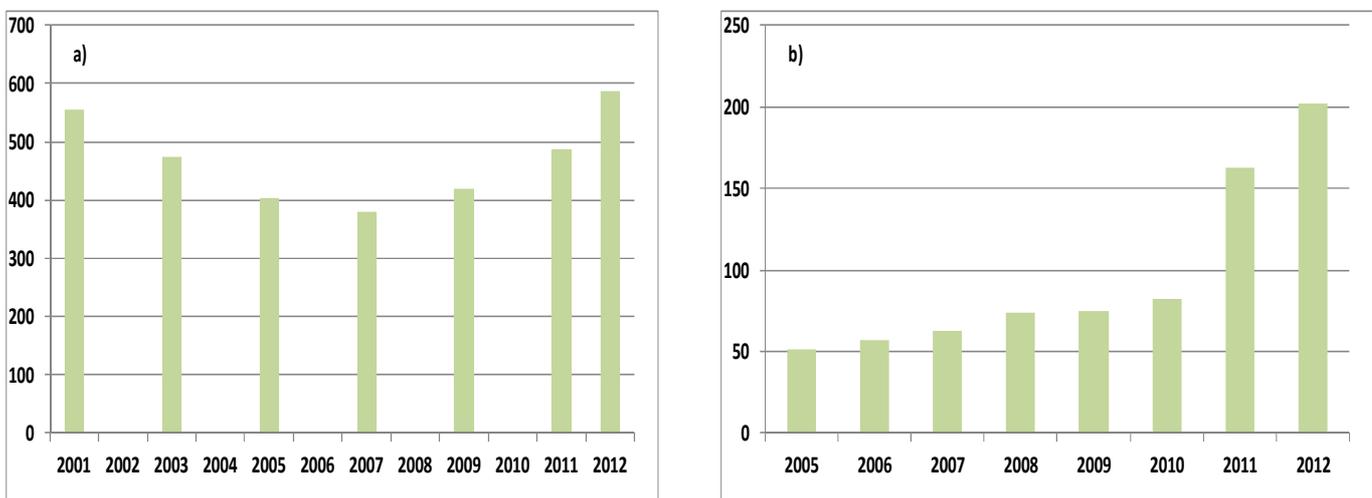


Figure 2. The development of organic markets in Finland during the 2000. Data source: (EVIRA 2012; Pro Organic 2013)

a) Number of organic enterprises.

b) The volume of organic sales, million €.

The largest stores have a choice of about 1500-2000 organic food items, and 60% of them are domestic (Pro Organic 2013). The most bought single product is organic milk. About one third from organic sales comes from each of the three product groups: liquid dairy products, fruit and

vegetables and dry cereal products. The consumers are interested especially in organic meat and would like to have more versatile choice of all products (Pro Organic 2013).

Compared to many other European countries, the statutory public catering plays an exceptionally important role in the Finnish food sector. It provides over half of all meals eaten outside homes, and the great majority, 83%, is at the response of the municipalities and the state; the rest being staff canteens in charge of the private entrepreneurs (HORECA 2008). The share of organic products from the whole sale of the HORECA sector is about 0.5%. The volume of the organic food items served within the public catering sector about is about 5%. The organic food items used on the daily or weekly basis were milk, grain products and tubers. Seasonal use of organic berries, vegetables and tubers appears, however, to be more common. Organic meat and meat products are seldom used in municipal catering; the high price and problems in availability restricts their use (Muukka et al., 2009).

The *Steps to Organic* -training program was launched in 2002. It is a voluntary program aimed at helping professional kitchens to gradually increase the use of organic products as means to support sustainable development within the catering sector. The program is well known among the caterers and the kitchens committed to the program are situated all over the country. However, because nearly 90% of the participating kitchens are in the first and second step, and only 2% have reached the fifth step, the share of organic products from food used in the institutional kitchens is still under 1% (EkoCentria 2012, Pro Organic 2013).

The catering sector purchases organic products most often from retail or from the special or organic whole sale. The kitchen professionals appreciate local organic products, and the possibility to buy them directly from the producers facilitates their use. Processing enterprises and normal whole sales are seldom used delivery channels. When large quantities of products are needed, purchasing in retail is out of the question. Therefore, the availability problems are accentuated in large units and organic food is easier to realize in small kitchens than in large ones (Muukka et al., 2009).

Government role in the development of production & consumption

The strategic goals of the Finnish food policy is to develop agriculture and food production as a sector of strong expansion both for domestic markets and for export (Food Strategy 2010; VN 2010; VN 2011) and to improve sustainability of the food sector (Ministry of the Environment 2009; Ministry of the Environment 2012; SRE 2008; VN 2006a; VN 2006b; VN 2009). Organic food is specifically brought up as one of the foci in strivings to improve the domestic strengths of the food sector (Ministry of the Environment 2008; Ministry of the Environment 2012; VN 2010; VN 2011), and together with local, seasonal and vegetarian food it is taken up in a great number of national policy documents as means to promote sustainability strivings (Risku-Norja and Muukka 2013). Encouraged by country brand working group visioning organic production to contribute at least 50% to the Finnish food sector by the year 2030 (Country Brand Delegation 2010) marked growth is expected in the coming years.

The aims of the government policy for organic sector are to diversify and to increase production so as to meet the demand, to develop the organic food chain and to improve the degree of upgrading of organic food. The domesticity is stressed both in supply and in use of organic products (VN 2011). In order to turn organic sector into a strong upsurge, national institute for organic research and development (R&D) was founded in 2013 and a promotion program for organic sector for the years 2012-2020 has been prepared (VN2013). The realisation of the program relies on the measures implemented both by the organic sector itself and by the government. Also the *Steps to Organic* -training program is a typical promotion program with strong policy support. It started as a common initiative of Finfood Luomu, Finnish Food Safety authority EVIRA and Finnish Organic Catering

Centre as a response to the growing demand anticipated in the late 1990'ies (MMM 2002). The program was launched in 2002, and it has been funded from the start by the Ministry of Agriculture and Forestry (EkoCentria 2012).

National goals and strategies for organic production and consumption

The overall goal is to consolidate Finnish organic food products in domestic retail and catering sectors as well as in export. The aims expressed in several of the policy documents have been brought together and concretised in the strategy for developing organic food markets in Finland. The aims for 2007-2015 were outlined in a working group which had representatives from ministries, extension organisations, higher education, food industry and retail as well as from organic food associations. The basis for development is customer orientation, efficient collaboration, learning and innovation and clear profile. R&D of organic sector is encouraged for new innovations and in order to upgrade organic production and to streamline supply and demand (Kottila 2011; Organic strategy work group 2006). Attention is paid especially to organic animal husbandry and to public procurements, in which the use of organic products is to be expanded so as to cover all kitchens within the public sector. Improved efficiency in processing, marketing and export of the Finnish organic food items and of organic niche products is stressed (VN 2013).

The institutional kitchens of the public sector are obliged to act as path-breakers and as good examples in environmentally responsible food purchases and in increasing the use of local and organic food (Ministry of the Environment 2008, 2012, SRE 2008).

The factors hampering the use of organic food (as well as local food) within the public catering sector deal with the strategic decision-making, lack of knowledge on purchasing procedure, lack of education among the municipal procurers and with the underdeveloped purchasing process focusing only on price (VN 2010). In addition, the co-operation along the organic food chain is not satisfactory, and the field is fragmentary (SRE 2008, VN 2010). Practical problems for kitchens are the uneven availability and low degree of processing of the products as well as the impact on the purchasing costs (Ministry of the Environment 2009; VN 2009).

The measures aim at settling the legislative, informative and practical hindrances in use of organic food and at securing decent resources both for food purchasing and for the actors' education (VN 2010). Communication campaigns, certification schemes and clear criteria for sustainable food procurements are offered as means to improve actors' awareness on environmental and health impact of food. The need to clarify procurement law by providing instructions regarding promotion of organic, seasonal and local food is acknowledged. The kitchens need also advice in putting out tender calls with request for traceability, freshness and nutritional quality. Improved purchasing know-how within public catering sector and inclusion of qualitative criteria in competitive tendering as well as legislative procedures are also seen to strengthen the competitive power of the small entrepreneurs and small-scale food processing (Ministry of the Environment 2012).

Other proposed measures deal with the operational pre-conditions, more efficient organisation and mutual co-operation among the SMEs along the whole food chain. In order to secure continuous supply of versatile products and to overcome the logistic problems, the emergence of shared marketing organizations within the organic food sector is to be encouraged (VN 2010). The need for R&D is also pointed out, because a better match between supply and demand necessitates new innovations, developing small scale food processing technology and upgrading organic production (SRE 2008).

The concrete aims by the year 2015 are specified as follows: the share of organic products is 6% from domestic food retail and 10% from food exports, all public institutional kitchens use organic products, and in private catering sectors there is a yearly increase of 15% in use of organic products.

Further, organic food is a natural part of the food sector's communication (Organic Strategy Work Group 2006, Kottila 2011). The concrete aims by the year 2020 are defined in line with promotion program for sustainable consumption and production (Ministry of the Environment 2012): an overall three-fold increase in sales of domestic organic food products both in retail and within public catering sector. This means the share of 20% from cultivated area as well as from food served in schools and in day care centres, and the share of 10% for organic products from the Finnish food export (Ministry of the Environment 2012).

Research related to organic sector

Research institutes

Finnish Institute for Organic Food² was founded in 2013 with the aim to coordinate organic R&D in Finland and to improve connections with international research. It is a network organization focusing on multi- and interdisciplinary research, science communication, adult education and co-operation with entrepreneurs. With one of the key tasks being the strengthening of interaction between research and economic life the institute stresses transdisciplinarity. The main fields of the research are primary production, environmental impacts, nutrition science and social aspects of organic food chains including politics, consumers and markets.

Other main actors involved in organic research are the University of Helsinki and MTT Agrifood Research Finland, but R&D is to some extent carried out also in other universities and in high schools of applied science. In continuation, all R&D most likely will be linked to the activities of the Organic Food Institute.

Out of the research projects only those carried out at the MTT Agrifood Research Finland and at the Helsinki University are considered here, but doctoral theses from all universities are accounted for. In addition to the theses and projects considered here, there is a great number of published review articles. However, these are likely to be outcomes from research projects, most of which are hopefully captured here.

Research

The compilation of the Finnish doctoral dissertations and research projects dealing with the organic sector is based on the results obtained through a simple search of the research registers using organic, food chain, food supply, actor, as search terms. The time span covers by and large the past 15 years, information on older research is sporadic.

On the basis of the title, keywords and abstract the theses and research projects were then sorted into 6 categories, primary production, environment, food systems, meta-research, food items and their quality, and society, the last two categories being the relevant ones in this context.

There were in total 25 theses; 12 of them focused on primary production and/or on environmental aspect; these have not been further considered. The rest have emphasis on societal aspects and address actors of the organic chain or take a food system approach.

The research registers of the University of Helsinki and MTT Agrifood Research Finland gave altogether 140 projects that are linked to organic research, starting from 1987. The great majority of the projects (88) deals with primary production, 13 projects focus strictly on the environment, 8 projects have a food system approach from comprehensive sustainability perspective, and three

² <http://www.helsinki.fi/ruralia/luomuinstituutti/english.htm>

projects have been initiated to coordinate organic R&D within the newly founded Organic Research Institute. These 109 projects are not considered any further here. Out of the remaining 31 project 24 (inclusive HealthyGrowth) are oriented specifically to some aspect of policy, markets and consumers, and 7 projects focus on specific food items and/or their quality. These are listed together with the doctoral theses in Appendix 1.

The research topics of the two categories - food items and their quality, and society - that are dealt with in this report can be roughly classified as follows: change and learning processes, communication, actors' interaction and networking, supply chain and public catering. The references dealing with the Finnish organic research relevant in this context are presented separately in Appendix 2.

Change and learning processes

1) Within the frame of the LoFo project (LoFo 2003-2006), the learning challenges of the food chain actors were studied through qualitative analysis of selected food chains and their networks. The focus of the study was on local food. Both large and small as well as organic and conventional food chains were analyzed. The methods used in the study were interviews and actor meetings. The results showed that even the small local chains have wide, national and even international linkages. The locally existing interests and other perspectives to local/organic food are not necessarily contradictory, but there are learning challenges, which deal with the communication between the different perspectives to local food (Seppänen et al. 2006).

2) Learning challenges in organic vegetable farming in adapting to the internal and external changes were studied in a doctoral thesis (Seppänen 2004). Adaption was approached from the activity theory point of view, in which contradictions are seen as as fruitful resources for learning and development. The study focussed on two central contradictions: short-term and intensive use of resources as against their ecological and sustained use, and independence and self-sufficiency as against societal integration.

The methods used in the exploratory qualitative longitudinal field study were ethnographic field work and systematic qualitative analyses of crop rotation planning sessions and organic inspections. The methods for analysing the results were created in the study. Also the elaboration of the theoretical framework proceeded along with the research findings. The study is thus based on the grounded theory approach, and the activity theory applied to a new field of organic farming is one of the outcomes of the study. Other outcomes are the methods and tools for analyzing the learning challenges. These are visual learning diagrams, 'strategies for increasing product volume' and 'three orientations towards farm workers'. 'Speech across the years' and joint negotiation between the farmer and the inspector were elaborated for communication as tools for talk- based learning.

3) The topic of the Roslakkka's doctoral thesis was adoption of organic production as an innovation in the region of North Carelia, eastern Finland (Roslakkka, 2005). Theories on innovation diffusion were used to study the causal relations among the social phenomena and their temporal order within the regional actor networks. The aim of the research was to find causal relations between the farmers' background variables, social influences (neighbor relations, contacts with change agents, media), farm characteristics (size and geographic location) and neighborhood effect regarding adoption of organic farming.

The material for the research was obtained from the farm register data basis of the Information Centre of the Ministry of Agriculture and Forestry, and the register data were complemented with telephone interviews of nearly 400 organic and conventional farmers. The research methods were

statistical analysis, cross-tabulation and logistic regression analysis among the variables and the change in the number of organic farms in the region during 1995-1999.

During the study period the number of organic farms in the region increased from 42 (3%) to 299 (7.8%); today it is 313 (11.8%). The influence of the external social sources, especially the impact of the media, proved to be important for the early adopters. The spatial closeness to other organic farmers, was important in adoption of organic farming, and the importance was accentuated among the late adopters. The motivation in adoption organic farming changed during the research period from that of the early adapters emphasizing non-materialistic reasons and life-style towards that of the late adopters stressing more the economic reasons. The overall conclusion was that despite the erosion of the local communities and development of the communication technology, people still socialize with those who are in their near neighborhood, and these relations provide a channel for exchange of information, discussion and social impact.

Communication

1) Three projects deal with communication. One focused on increasing knowledge about organic food production for the food chain actors within the whole chain (LuoMeNek 2010-2012). To achieve this, an Internet portal was developed as the tool to communicate the information to all target groups, the emphasis was specifically on the consumers' needs. The outcomes of the project were popular articles, national organic fair and the functioning web portal, <http://luomu.fi/>. The project was a national level development project with well defined practical aims addressing the acute need identified within the organic field and with no further research on the subject.

2) In the ongoing project "Vitality of the rural enterprises in the Kainuu county" 2011-2015 the focus is on improving communication and networking among regional food chain actors, both organic and conventional within the Kainuu county, eastern Finland. The project aims at up-dating and developing the web portal <http://www.tukinetti.net/> as a mutual link among farmers, researchers, advisers of the extension organizations and public authorities and using also the potentials of the social media. The portal has a specific entry for organic actors. The overall goal is to strengthen the regional co-operation among rural enterprises and other rural actors. The focus of the project is rural viability, and the web portal is developed in view of the rural entrepreneurs' needs. The work is carried out as a participatory process among the regional rural actors, and it has a number of practical aims dealing with transfer of research knowledge and rural policy to the local level, with strengthening the relationship between rural entrepreneurs and other actors.

3) The other ongoing project is an inter-European Leonardo research-oriented study with the focus on knowledge transfer between science and practice in the European countries (LOVet II 2012-2014); the web page of the project is <http://www.lov-project.net/>³. The theoretical frame is within the science communication and the aim is to identify the main gaps in knowledge and the main problems in communicating science to its practical implementation in the area of organic farming in Europe. This is done by mapping and evaluating the existing networks in the old EU countries with established organic sector and by creating new networks and evaluating their functioning in science communication in the younger EU member states with emergent organic farming. Based on these the best practices of science communication are elaborated and attention is paid specifically in view of the needs of the local action groups.

The method is a questionnaire which was in the first phase targeted to organic farmers and, in the second phase will be targeted to the researchers in the participating countries. The elaboration of the

³ The project started in 2010 and the first phase LOVet 2010-2011 focused on the knowledge transfer between research and organic farmers.

best practices takes place in workshops, net meetings expert interviews and in the five international project meetings. The results will be available to all interested stakeholders, the beneficiaries being especially those involved in developing science communication.

Actors' interaction and networking

1) Because of the requirement of crop rotation, specialization in organic production presents problems, and this often constrains volume of the production. Co-operation among the farms is a means to improve the potentials for specialization. Drivers and bottle necks for co-operation were investigated by means of a literature study, which was complemented with a field study of five existing rings of co-operating organic farms (Lätti et al. 2005). The effectiveness of co-operation was assessed with the help of nutrient balances and cost accounting. The aim was to create co-operation models between different lines of production in order to optimize production of the cooperative rings in terms of environmental, economic and functional perspectives compared to that of farms operating alone.

Five different forms of co-operation were identified: co-operation in 1) machinery use and contracting, 2) input integration, 3) crop rotation, 4) shared buildings for production, and 5) marketing. The benefits from co-operation were lower production costs and better profitability, specialization of professional skills, more free time, better or wider crop rotation, more efficient use of green manure as fodder and animal manure as fertilizer. Increases in road transport and machine weights, the need for social skills, and problems in machinery maintenance were identified as drawbacks.

2) Mononen (2008) studied in her PhD thesis the transformation of the organic networks in two regions in Finland. The aim of the research was to clarify the meanings attached to organic production in 20th and 21st centuries, to identify the development of the organic networks and to describe their change over time through the farmers' story lines. The study represented the broad field of the agri-food research in social sciences with specific emphasis on alternative agro-food geography. The research material consisted of literature and documents on organic and agri-food research in social sciences in the 20th and 21st centuries as well as organic farmers' interviews carried out in the Kainuu region and in the district of South-West Finland at the end of 1990's. The actor network approach was used in the analysis of the material.

In the interviews four different types of actor networks were identified: the network of the pioneers, the marketing network, the economic network of the remote areas and the network of the belittlers. The actors in each of these have different motives, aims, attitudes strategies regarding organic production.

For the outsiders, organic networks appear as uniform, but the research showed their great variation, heterogeneity and inconsistency in regard of the actors' interests and expectations. The organic networks has expanded, institutionalized and globalised, they are local only in terms of the social relations of the human actors. The meanings attached to organic are under constant change, and health, environment and money have had different emphasis over time. Regarding the motivation the boundaries between the identified network types seem waver.

Supply chains

1) Sarkkinen et al. (2006) studied the food chain actors' attitudes towards and their concepts on organic production and organic food. The aim of the study was to improve the functioning of the organic demand-supply chain and the relationships among the food chain actors. This was done by

examining, how the organic food supply-demand chains function. Specific attention was paid to the different actors and to their co-operation along the chain. An optimal interaction for all actors in the chain could in a long run guarantee the best result for each individual actor. A shared view of the function of the chain was also expected to lead to deeper co-operation between the actors to interest in developing common processes between actors. The approach was that of the supply chain management.

The study examined the actors' attitudes and concepts regarding the organic food and transfer of information within the organic chains. A survey was carried out in 2003 and was targeted to 1186 consumers and to 333 other food chain actors representing agricultural growers and producers, stores, producers and catering services. Statistical methods - factor, cluster and discriminant analyses - were applied in scrutinizing the survey responses.

Six different groups were identified among the food chain actors: the positives, the commitments, the doubters, the opponents, the unsatisfied and the negatives. These groups were described, as well as the influence on the attitude of being part of an organic chain. Among the consumer the identified groups were the positives, the commitments, the doubters, the neutrals, and the negatives.

The conclusions regarding the functioning of the organic chain was that focus should be on the transparency and traceability of the chain, rather than the product itself. This is easier when both the number of the actors involved in a specific chain and the distance in terms of time and space is limited. The relationships among the actors in creating value play an important role. The main beneficiaries of the research results are the SME:s who often can make own organic products available for the customers only through the effective existing distribution channels. The smoothly functioning organic chain improves the SME.s' possibilities within the mainstream retail.

2) Kottila carried out a number of case studies in examining the same organic chains, but approaching the problem in each study from a different, complementary perspective. Collaboration and trust among the organic food chain actors were studied by focusing on communication and trust between the actors (Kottila and Rönni 2008). Collaboration was found in dyadic relations, but not at the level of the whole food chain. Trust is the prerequisite for collaboration, and the basis for trust is competence. Thus, the quality of communication in creation trust is more important than the high frequency of communication alone. The implication for the small organic suppliers is to enhance their overall competence in developing the relationships with mainstream retailers, and to consider the influence of their action within the whole organic food chain, not only on the actors adjacent in the chain.

Coherency is seen as an important factor in increasing the actors' commitment to the organic system. It, thus, paves the way for collaborative value production and, in line with the principles of ecological modernization, it enhances the environmental and economic benefits of food production. Coherency among the actors' interests was studied by considering the stakeholders' values, needs and goals regarding organic production (Kottila in press).

Kottila and Rönni studied also inter-organizational communication within the organic food chain as means to increase the competitive advantage both for the whole supply chain and for its individual members (Kottila and Rönni 2010). The focus was on the core processes of marketing in view of efficient consumer response, i.e. efficient replenishment, assortment, promotion and product introduction. The approach was that of the supply chain management. The same approach was used also in identifying knowledge needs and in examining how knowledge is shared within in the organic supply chains (Kottila 2009).

Kottila compiled her findings on collaboration, trust, communication, knowledge sharing and coherence among the food chain actors in the PhD thesis (Kottila 2010) and integrated the findings into a conceptual framework of interaction among actors in organic food chains. The framework

combines the approaches of food system research, supply chain management and ecological modernization.

The conclusion was that regardless of the coherent values emphasizing responsibility, the organic chains were loosely integrated and were therefore not properly operating systems. The focus was on product flow, and attention was not paid to the other aspects of value creation, e.g. to communication with consumers or to the role of a leading actor in enhancing the market for organic products. The options for environmental and economic benefits of food production that organic food could provide are therefore not fully used.

With 'the three-layer framework', developed in the thesis different layers of interaction can be distinguished. The interrelation between the layers becomes visible by gradually expanding the chain orientation. This framework is useful in enabling further research and understanding the practical implications of the performance of organic food chains.

2) The project on regional food chains (Häme Organic Food Chain 2012-2013) deals with organic potato and meat. The justification is in the lack of organic raw materials which has been pointed out as one of the factors constraining the growth of the Finnish organic sector. With the expected growth of the organic sector in near future the problem may aggravate and result in import of such organic items that could be also of domestic produce. The purpose of the project is to identify the strategically most important development needs and aims in view of improving the ecological sustainability and regional economy in the target area of the Häme province. The whole chain from field to table is considered, and the overall goal is to improve the availability of organic food items and raw materials to meet the expected growth in their demand. This is done by boosting production of organic potato, improving both the availability and quality of organic feed and the eco-efficiency of organic production

3) Another one-year development project focuses on marketing of organic vegetables from the producers' point of view (Mattila 2013). The study addresses the problems related to the profitability, logistics and marketing of organic potato, carrot, onion and broccoli. The problems in sales, delivery and logistics are identified by interviewing 12 organic vegetable farmers and a number of representatives of professional kitchens. In addition, profitability calculations are carried out for the chosen farms. The potential functioning and cost-efficient marketing channels are identified and described in order to make it easier for the producers to find suitable marketing channels. An European benchmarking is carried out by clarifying the existing communication and marketing mechanisms for organic vegetables in the countries with established organic sector. The information is obtained through interviews. The results from the European and national investigations are used to prepare recommendations for the marketing procedures for the Finnish organic vegetable producers. The results together with the existing (scanty) data on the profitability of organic vegetable farming are compiled, and the other outcome will be the profitability calculation data basis for the producers.

The profitability of organic suckler cow production was studied using the real option method regarding the investments in the farm (Järvenpää and Nykänen 2005). The results suggest that the profitability of the Finnish suckler cow farms can be improved by increasing the unit size, utilizing effectively the low-price pasture fodder and by rationalizing feeding and handling systems which decreases the labour costs because of the need for labour input.

4) The FoodGIS project addresses the logistical problems in matching the demand and supply; this problem is accentuated in the sparsely populated Finland (FoodGIS 2012-2014). The study is carried out in the North Ostrabothina county. Using the GIS-based method (geographical information system) the site data – the map coordinates - on the regional population's residence and working places, and on the local and organic food producers and consumers are combined with the real time data on the road network. The map coordinate site data are complemented with

qualitative information obtained through questionnaires directed to the regional actors. The outcome will be a model for supply-demand accessibility that can be used in regional rural planning and in the enterprises' logistics planning.

5) An on-going PhD study explores the reasons for the underdeveloped organic food sector in Finland (ORGIDENT 2012-2013). The study focuses on the superior quality of organic food, the superiority being supported by research evidence. After identification the specific quality factors, their recognition and opinions among the food chain actors is investigated. The divergent opinions of the food chain actors are reflected against the actors' different positions within the food chain, and methods knowledge transfer are developed in order to remove the obstacles in recognition the superior quality factors.

The institutional kitchens

The public catering sector is specifically addressed in several studies. In these the focus is not only on organic sector, but KEKEPAMPO and KeHa (see below) take an overall sustainability perspective and therefore deal also with local food.

1) The iPOPY project (iPOPY) investigated perceptions and learning about sustainability and organic food as Education for Sustainability (EfS) and Food Education for Sustainability (FEfS). The study investigates the use of organic food in municipal food service and specific attention paid to the school food. Both the cooperative potential for change towards sustainability among the actors such as public procurement, headmasters and teachers, catering organizations and their personnel, pupils/ students as well as their parents, and the impact of implementation of organic school meals on supporting healthier eating behavior were studied. The research was carried out in a series of studies in the Nordic countries in 2007-2010 and the results have been published in a number of publications. (Mikkola et al. 2009, Mikkola et al. 2009, Roos and Mikkola 2010) deal with food education and (Mikkola 2009a, Mikkola 2009b, Risku-Norja and Mikkola 2009, Post and Mikkola 2012) deal with the caterers' concepts and their professional identity in relation to organic products. The research methods were case-studies, in depth interviews, focus group interviews and theme interviews.

2) The aim of the KEKEPAMPO-project was to analyse the role of public food procurement in improving citizens' sustainability skills, to promote Finnish food culture for sustainability, and to support sustainable entrepreneurship and regional economy (KEKEPAMPO 2009-2011). It was an umbrella for several studies:

In the SEED-project (SEED 2008-2011) the concept of food education was developed to be incorporated it into the schools' curricula. PubCat focused on the municipal caterers' views and on the bottlenecks and drivers regarding sustainable food provisioning. These were captured through a survey targeted to the caterers. The questionnaire comprised several types of questions ranging from the numerical data to open questions aimed at capturing the caterers' experiences, expectations and views. Beneficiaries of these subprojects are the education sector and the public actors responsible for decision-making. The focus of the KeKekupo was the role of public food procurements as a part of municipal strategy and rural development, the beneficiaries being the politicians and administrative authorities responsible for the guidance of entrepreneurs.

3) The on-going project (KeHa 2013) deals with developing purchasing know-how among the public caterers. The project is carried out in nine municipalities, in each of which one specific basic food item is chosen; the chosen food item is from the actors' point of view of key importance. The focus of project is local food, but several municipalities have chosen an organic product of local origin. The potential bottle necks of sustainability inclusive environmental impacts within the whole production chain and social impacts within the community are clarified, and new action models are

sought to improve the situation. Training, guidance and communication are given to the actors. Methodologically the project represents actor-oriented participatory research and development (PAOR&D).

4) Still another ongoing research addresses the practical needs of the institutional kitchens by focusing on the quality of organic potato (SLUPE 2013-2015). The institutional kitchens have specific needs regarding the uniformity of good quality potatoes. The kitchens require ready peeled potatoes, but both the warm and cold storage of such potatoes as well as their taste present problems. These are addressed by testing the various potato varieties, by developing the recipes and by focusing on the caterers' professional skills.

5) The *Steps to Organic* -training program represents a hands-on approach to promote the use of organic products within the municipal catering services. It is a voluntary program aimed at helping professional kitchens to increase their use of organic products as means to support sustainable development within the catering sector. Increased demand of organic products is hoped to improve also their supply (EkoCentria 2012).

The program comprises five steps allowing the kitchens to develop own operations according to the availability of organic products and to the customers' expectations. In the first step the kitchen regularly uses at least one organic product and/or item of raw material. In the second step at least two, in the third step at least four, and in the fourth step at least eight important food items as organic products are in regular use in the kitchen. In the steps one to four other organic products are used where practicable. In the fifth step, the kitchens use a substantial variety of organic products from all raw material groups. Conventional products are used only when no organic alternative is available.

In order to improve the match of the program with the needs of the kitchens, the program was revised in 2010. The revision was planned in a participatory process together with the caterers. The revised program was more closely integrated with the sustainability principles, the number of the steps was increased from the original three to the present five, and an on-line access was provided; this offers the kitchens the opportunity of progressing at their own speed and beginning the program at any one of the five steps (EkoCentria 2013).

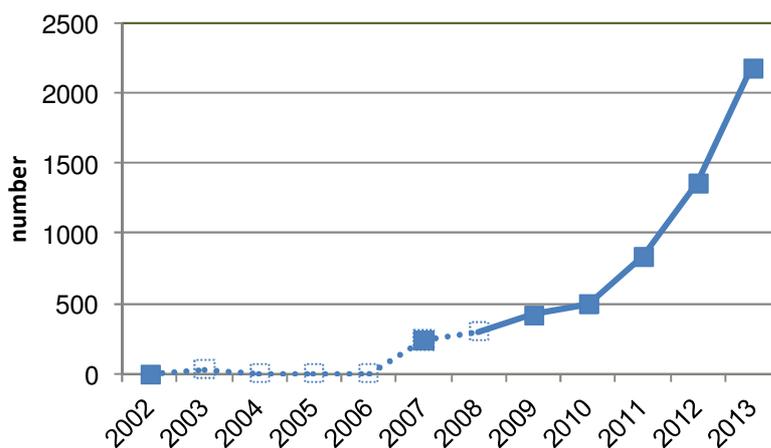


Figure 3. The development of the number of *Steps to Organic* -kitchens in Finland after the launch of the program in 2002. Empty symbols: no data available. Data source: Pro Organic 2013.

39 professional kitchens joined the steps to organic program in January 2003, and the expansion of the number of the *Steps to Organic* –kitchens is shown in Fig. 3. (EkoCentria 2012). After the revision the number of kitchens joining to the program has increased rapidly, and is at present 2063, out of which 1620 are municipal kitchens (EkoCentria 2012). With the number of professional kitchens amounting to 22 642 including 9162 municipal kitchens in total, 9% of the all professional kitchens and nearly 18% of municipal kitchens participate the *Steps to Organic* – program. About half of them are kitchens in schools and in day care centers, about 20% are in hospitals and nursing homes, and another 20 % staff restaurant kitchens, the rest being in the private sector.

Summary of the research

The research related to organic field in Finland has been very much focused on the primary production, the production methods, yields and environmental impacts, whereas little attention has been paid to the societal, policy aspects and to the supply chain as an entity. In the research with the comprehensive food system approach the environmental and/or societal and/or economic emphases overlap, but in these studies the supply chain point of view is largely missing.

Several bottle necks regarding the development of the organic supply chain have been pointed out in the national goals and strategies dealing with organic production and consumption. The bottle necks deal with both the legislative and informative as well as with the various practical hindrances. Since the organic sector is still rather marginal in Finland, it appears that either the research design or communication of the research results to the relevant actors so as to open the bottle necks has not been very successful. However, there are signs that the situation is already changing suggesting that over the past few years the knowledge transfer between science, policy and food chain actors has improved. Important contributing factors have been the Country Brand Report (Country Brand Delegation Finland 2010), the promotion program targeting specifically the organic field (VN2013) and the foundation of the Organic Research Institute.

The studies focusing on the consumer attitudes and on the R&D aiming at promoting organic food within the public catering sector are in line with the national strategies. Several studies focus on local rather than strictly on organic food. These emphasize geographic proximity of production and consumption, but the registered PDO and PGR labels have not been specifically the issue. Profitability of organic production has been addressed, but only on the level of specific actors, not on the level of the whole supply chain. Other important topics are formation, development and characteristics of the organic value chains and networks, and the prerequisites for their functioning. The research on these topics is modest, but in recent years the interest has been growing. The emerging research also attempts to address the supply chain as a whole instead of focusing only on a specific actor group or on specific products. The pioneering work using the supply chain management approach and developing the new approach to the interaction among actors in organic food chains was Kottila's PhD thesis (Kottila 2010).

So far, in the research carried out in Finland the international perspective is almost totally lacking. In two on-going studies, the European experience is used to develop the approaches suitable for the Finnish circumstances, but exploring the organic food chains that cross the state borders has not been among the research topics.

In future, the research will be coordinated by newly founded Finnish Institute for Organic Food, and the situation regarding the supply chain-oriented research is likely to improve further. The institute stresses the need of science communication, adult education and co-operation with entrepreneurs in research. The transdisciplinary approach involving both the researchers and the practical actors, enables designing the research so as to better respond to the needs of the organic sector and to the expectations of the society.

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Appendix 1: Research dealing with organic food chains

Red font: research has been cited in this report

APPENDIX 1 a) The doctoral theses

	TITLE	AUTHOR	YEAR	RESEARCH AREA	UNIVERSITY	WEBSITE
1	Formation of consumers' perception on quality, value and purchasing willingness of environmentally friendly food items: empirical application of experienced quality and value [in Finnish]	Tiilikainen Aimo	1998	Consumer research	University of Helsinki, Department of Economic science	
2	Consumer and organic option. A study on the acceptance and rejection of the widely-impacting consequences of consumption with regard of the daily consumer goods [in Finnish]	Kantanen Teuvo	2002	Consumer research	University of Vaasa, Business Economics	http://old-www.uwasa.fi/materiaali/pdf/isbn_951-683-952-5.pdf
3	From organic farming to modern organic farming: from teaching to learning: evaluating development of the agricultural production and education in northern Finland from organic perspective [in Finnish]	Kivelä Markku	2004	Agricultural education	University of Lapland, Faculty of Pedagogics	http://www.doria.fi/bitstream/handle/10024/66705/Markku_Kivel%C3%A4_v%C3%A4it%C3%B6skirja.pdf?sequence=1
4	<i>Learning challenges in organic vegetable farming: an activity theoretical study of on-farm practices</i>	Seppänen Laura	2004	Participatory action research	University of Helsinki, Faculty of Agriculture and Forestry	https://helda.helsinki.fi/handle/10138/20699
5	<i>Organic production and adoption of innovation: contributing social, spatial and economic factors in North Carelia [in Finnish]</i>	Roslakka Juha	2005	Action research	University of Eastern Finland, Faculty of Social Sciences	
6	Dimensions of novelty: social representations of new foods	Huotilainen Anna	2005	Consumer research	University of Helsinki, Dpt of Social Psychology, Dpt of Food Technology	https://helda.helsinki.fi/handle/10138/23503
7	<i>Networks of organic production: study on transformation in the Finnish organic production networks [in Finnish]</i>	Mononen Tuija	2008	Actor networks	University of Eastern Finland, Faculty of Social Sciences	http://epublications.uef.fi/pub/urn_isbn_978-952-219-083-3/urn_isbn_978-952-219-083-3.pdf
8	<i>Understanding the organic chain: the framework of the interaction between actors in organic chains in relation to the ecological modernisation of food production</i>	Kottila Marja-Riitta	2010	Actor networks	University of Helsinki, Faculty of Agriculture and Forestry	https://helda.helsinki.fi/handle/10138/20755
9	Rural development from the participatory action research perspective – an ecological vision 2011 [in Finnish]	Susiluoma Heikki	2011	Rural development	University of Vaasa, Chydenius Institute	http://ethesis.helsinki.fi/julkaisut/mat/maant/vk/susiluoma/maaseudu.pdf
10	From environmental concerns towards sustainable food provisioning. Material flow and food consumption scenario studies on sustainability of agri-food systems	Risku-Norja Helmi	2011	Food system research	University of Helsinki, Faculty of Agriculture and Forestry	https://helda.helsinki.fi/handle/10138/24303
11	Social dynamics for sustainable food systems - Actors' orientations towards sustainability in primary production and public consumption	Mikkola Minna	2011	Food system research	University of Helsinki, Faculty of Agriculture and Forestry	https://helda.helsinki.fi/handle/10138/25946
12	Feasibility of use of organic products and nutritional importance for children at day-care centres [in Finnish]	Muukka Eija	2008	Nutrition and health	University of Kuopio, Faculty of Medicine	http://epublications.uef.fi/pub/urn_isbn_978-951-27-1054-6/urn_isbn_978-951-27-1054-6.pdf
13	Dietary modulation of β -catenin signalling in an experimental model of colon cancer	Misikangas Marjo	2007	Nutrition and health	University of Helsinki, Applied Chemistry and Microbiology	https://helda.helsinki.fi/handle/10138/20788

APPENDIX 1b) Research projects dealing with organic food chains

	PROJECT NAME	RESPONSIBLE RESEARCHER	RESEARCH TOPIC	FOCUS	INSTITUTE	DURATION
1	Market research on organic products	Väisänen, Jaana	Markets	Demand & supply	MTT	1995-1996
2	<i>Organic marketing initiatives and rural development</i>	<i>Forsman-Hugg, Sari</i>	<i>Marketing</i>	<i>Benchmarking based on the experiences from 19 European countries'</i>	<i>MTT</i>	<i>2001-2001</i>
3	Chances of organic production in the province Lapland	Pallari, Maarit	Development of organic sector in Lapland	SWOT analysis, focus also on organic gathering	MTT	2003-2003
4	Consumers, decision makers and local or organic food. Possibilities for the SMEs	Forsman-Hugg, Sari	SME-sector, local and organic food	Attitudes of the consumers and decision-makers	MTT	2003-2006
5	Environmentally friendly agricultural production and the demand for organic products	Huhtala, Anni	Marketing	Demand for environmental quality	MTT	2003-2006
6	<i>Actors' interaction within the organic supply-demand chain ; Marja-Riitta, Juha Helenius</i>	<i>Juha Helenius/Aakkula, Jyrki</i>	<i>Actor networks</i>	<i>Organic supply-demand chain</i>	<i>MTT</i>	<i>2004-2006</i>
7	<i>Innovative Public Organic food Procurement for Youth (iPOPY)</i>	<i>Mikkola, Minna</i>	<i>Public catering sector</i>	<i>Food education for sustainability; Role of public catering and use of organic food in educational contexts: Creating centres</i>	<i>HY</i>	<i>2007-2010</i>
8	<i>PubCat - The role of public catering in promoting sustainability and Finnish food culture</i>	<i>Risku-Norja, Helmi</i>	<i>Public catering sector</i>	<i>Sustainability and Finnish food culture</i>	<i>MTT</i>	<i>2008-2011</i>
9	<i>SEED Sustainable Food Education for Self-Efficacy Development. How to encourage future citizens to act for a sustainable society</i>	<i>Risku-Norja, Helmi</i>	<i>Food education for sustainability</i>	<i>whole school -approach: integration of school lunch into educational goals</i>	<i>MTT</i>	<i>2009-2011</i>
10	<i>Creating a platform for communication between science and practice in organic food system LOVEt</i>	<i>Siiskonen, P. & Mynttinen, R.</i>	<i>Science to praxis</i>	<i>Communication</i>	<i>HY</i>	<i>2010-2011</i>
11	<i>LuoMeNek - Organic information for the food chain to support sales</i>	<i>Hytönen, A., Siiskonen, P.</i>	<i>Marketing</i>	<i>Sales promotion</i>	<i>HY</i>	<i>2010-2012</i>

	PROJECT NAME	RESPONSIBLE RESEARCHER	RESEARCH TOPIC	FOCUS	INSTITUTE	DURATION
12	Communicating environmental friendliness and locality of food in the tourism context	Logren, Johanna	Communication about local food	Internationalization of local food enterprises via targeting food products to particular focus group	hanke	2010-2013
13	WELLBEING- Policy approach for promotion of healthy diet, sustainable food choices and physical activity among various socio-economic groupings in Finland	Kurppa, Sirpa	Policy integration	Food choices and physical activity from the sustainability perspective	MTT	2011-2013
14	<i>Vitality of the rural enterprises in the Kainuu county</i>	<i>Keränen, Katja</i>	<i>Rural development</i>	<i>Communication and networking of regional food chain actors; not only organic actors</i>	<i>MTT</i>	<i>2011-2015</i>
15	<i>Developing organic production in Häme county</i>	<i>Virtanen, Yrjö</i>	<i>Regional organic food chain</i>	<i>Availability of organic potato and meat</i>	<i>MTT</i>	<i>2012-2013</i>
16	<i>ORGIDENT Superior quality factors of organic food and recognition of them in Finnish food system</i>	<i>Nuutila, Jaakko</i>	<i>Food quality</i>	<i>Verification of the superior quality factors and their recognition among the organic supply chain actors</i>	<i>MTT</i>	<i>2012-2013</i>
17	<i>Elaboration of the best practice models of the knowledge transfer from science to practice in the organic farming sector (LOVEt II)</i>	<i>Hytönen, A.</i>	<i>Science communication</i>	<i>Best practices of knowledge transfer</i>	<i>HY</i>	<i>2012-2014</i>
18	KEHA Sustainable procurement - promoting procurement skills in public catering services 2012-2014	Kurppa, Sirpa	Public catering sector	Know-how in competitive bidding of food purchases	MTT	2012-2014
19	WEALTHFOODSYSTEM Integration of Food and Wealth Systems for Sustainability	Irz, Xavier	Sustainability of food consumption	Environmental and human wellbeing	MTT	2012-2015
20	<i>LÄHIKONSTI - The growth strategies environments for local food</i>	<i>Rikkonen, Pasi</i>	<i>Local food; supply of and access</i>	<i>Actors' cooperation within regional supply chains for local and organic food</i>	<i>MTT</i>	<i>2012-2015</i>
21	Interactive and responsible food chain - solving challenges in the interplay between producers and consumers	Latvala, Terhi	Food chain	Responsible consumer choices via interaction between producers and consumers	MTT	2013-15
22	<i>Profitable production, functioning sale and delivery channels and marketing for organic vegetables</i>	<i>Mattila, Tiina</i>	<i>Food chain and marketing</i>	<i>Bottle necks in sales of organic vegetables</i>	<i>MTT</i>	<i>2013-2013</i>
23	<i>FoodGIS the access to local and organic food in the North Ostrabothnia province</i>	<i>Muilu, Toivo</i>	<i>Food chain and marketing: logistics</i>	<i>Problems in meeting demand and supply of organic products</i>	<i>MTT</i>	<i>2012-2014</i>
24	Healthy growth: From niche to volume with integrity and trust	Risku-Norja, Helmi	Food chain and marketing	Value chains of organic food	MTT	2013-2016

APPENDIX 1 c) Research dealing with organic food items

	PROJECT NAME	RESPONSIBLE RESEARCHER	RESEARCH TOPIC	FOCUS	INSTITUTE	DURATION
1	Developing the quality of organic food items	Väisänen, Jaana	Nutritional quality of organic potato and carrot	Impact of cultivation methods	MTT	1994-2001
2	The role of production mode of food for developing allergies	Pihlava, Juha-Matti	Nutrition and health	Allerogogenesis	MTT	2001-2003
3	Selenium in organic food items	Eurola, Merja	Nutrition and health	Potential selenium deficiency in organic products	MTT	2001-2003
4	New technologies for quality affirmation and productification of milk (inclusive special milks)	Tupasela, Tuomo	Milk quality	Implementation of new technologies	MTT	2010-2012
5	Fast methods for authentication of organic plant based foods (AuthenticFood)	Särkkä-Tirkkonen, M. & Tikkanen-Kaukanen, C.	Analytical methods	Identification of organic plant based food products	HY	2011-2014
6	<i>SLUPE- Improving the quality of organic potato - towards increased consumption</i>	<i>Nuutila, Jaakko</i>	<i>Organic potato for institutional kitchens needs</i>	<i>availability recipes</i>	<i>MTT</i>	<i>2013-2015</i>
7	Organic products - more healthy, safe and tasty than conventional?	Mattila, Pirjo	Quality of organic vs conventional products	Health, safety and taste aspects	MTT	2013-2018

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