TPorganics
Technology Platform

Implementation Action Plan

for organic food and farming research

December 2010

Technology Platform «Organics»

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Prepared by
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December 2010

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Collaborators:

National organisations and networks of scientists have been involved in the consultation process for the Implementation Action Plan.

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Dear Reader,

It is my great honor to introduce to you, as vice chair of the committee Committee on Industry, Research and Energy, the TP Organics Implementation Action Plan.

The initiative of TP Organics is of highly interest for the European Parliament and ITRE as organic food and farming is highly innovative and has the potential to contribute significantly to the EU 2020 strategy and its innovation union.

The European Union emphasises the importance of generating innovation in the context of meeting future challenges such as achieving sustainability, stable food security and safety systems, environmental criteria, socio-economic changes in rural communities etc. These challenges require new, innovative solutions for agriculture as well as the efficient transfer of this knowledge to the actors – farmers, advisory services, and policy makers.

In the past, most businesses have focused on continuous improvement of their products and services to maintain a competitive edge. But in today's economy, that's not always enough. As the agriculturalists of the past had to literally break new ground to expand their trade, today's businesses must come up with new ideas, rather than settle for marginally better ideas.

I see innovation as a process of producing creative ideas put into practice as driver of change. I see in this context research in organic food and farming playing a crucial rule for the European development, and therefore I readily welcome the initiative of the organic technology platform, TP Organics.

Innovation in organic agriculture and food production relates not only to technology, economies of scale and specialisation but also diversification, reduced use of external inputs, provision of public goods and services, added value and practises based on agro-ecological knowledge leading to a greater empowerment of rural populations.

The organic sector provides many examples of different types of innovation and this document describes several innovative research ideas and concepts which will strengthen the competitiveness of organic production in the EU and globally and increase its sustainability benefits for the whole of society.

The innovative research at the heart of this Action Plan is appreciated as an important contribution.

The European Commission should strongly support organic research projects and should recognize organic production under relevant cross cutting research themes within current and future EU Research Framework Programmes.

Yours truly,

On PATRIZIA TOIA

Patrizia Toia
Vice Chair of the Committee on Industry, Research and Energy of the European Parliament

Dear Reader,

The agricultural sector today is facing several challenges at economic, territorial, environmental and food security level. Organic food and farming provides certain elements of answer to these challenges, which are useful for the agricultural sector as a whole. Indeed, as Europe considers its priorities for agriculture policy after 2013, it is clear that we have to match greater economic competitiveness with environmental competitiveness, because we cannot afford to address the food supply challenge without fully embracing a sustainable approach to agricultural production.

When looking at the organic sector, a clear policy direction is given in the European Action Plan for organic food and farming, made up of 21 actions, which was agreed with the Council and the Parliament in 2004. In particular, Action No 7 aims at "strengthening research on organic agriculture and production methods". Research and innovation are key to the development of sustainable agriculture.

To that effect, there was a need for the organic sector to identify and establish research priorities involving all the various parts of the chain - from industry to producers, passing through the research community, to consumers and civil society. A wide participatory approach is required, going beyond organic agriculture in the strict sense, and this is fully in line with the Europe 2020 priorities of Smart Growth, Sustainable Growth and Inclusive Growth.

TP 'Organics' is such a platform. It started its activity in 2008 under the guidance of IFOAM-EU, and I welcome this initiative. The first orientation paper "Vision for Organic Food and Farming 2025" was followed in 2009 by the relevant Strategic Research Agenda (SRA), and it is now time to bring those principles to reality. That is the purpose of this Implementation Action Plan, which rightly identifies the key aspects to focus on all together, in particular the "eco-functional intensification" of organic production.

I believe that TP Organics is the appropriate forum to achieve the outcomes that our society desires for organic food and farming, through innovation generation and knowledge transfers.

I wish all success in the concrete implementation of the action plan of TP Organics.

Dacian Cioloş
EU Agriculture Commissioner

Executive Summary

TP Organics brings together stakeholders throughout the organic sector and from the wider public to discuss strategic research priorities that will enhance the sectors' ability to produce high quality foods consistently, reliably and in sufficient quantity, while at the same time also serving the interests of European societies at large. As the only European Technology Platform focusing on agriculture and food systems, TP Organics is an important resource for policymakers looking for insight into how science can advance the sustainability and public benefits of European agriculture. Profound challenges and the need to improve the sustainability of agriculture and to increase food production are widely acknowledged, but different views exist on how to respond. TP Organics can help Europe achieve the goals set out in the EU 2020 strategy for a smart, sustainable and inclusive economy. EU policies emphasise green innovations, scientific cooperation, and increased involvement of SMEs in research and development. TP Organics can support all these areas in the field of agricultural research, by engaging with organic and other farmers and with organic food businesses through its broad range of stakeholders. Research in organic and low external input food production extends the range of options available to policymakers by identifying and developing important solutions which perceive, protect and harness natural ecosystems and the services they provide as well as the multiple functions of agriculture.

The Implementation Action Plan completes TP Organics' trilogy of key documents. **Chapter one** introduces this and the other documents. The Research Vision to 2025 (2008) discussed knowledge gaps in technology and science under three themes, 'Empowerment of rural economies in a regional and global context', 'Securing food and ecosystems by eco-functional intensification', and 'High quality food – a basis for healthy diets and a key to improve the quality of life and health'. Next, following extensive stakeholder consultation, a roadmap of 61 concrete topics how research that could fill these knowledge gaps was presented in the Strategic Research Agenda (2009). The Implementation Action Plan addresses important areas for a successful implementation of the Strategic Research Agenda.

Chapter two explores the strength of Europe's organic sector on the world stage and as a contributor to the continent's own economy and society. In 2008, about one quarter of the world's organic agricultural land was in Europe; sales accounted for more than half of the global organic market and about 210,000 producers and about 34,000 companies produced, processed and sold organic food. The aims and objectives of organic farming reflect a broad range of societal demands on the multiple roles of agriculture and food production of not only producing commodities but also ecosystem services. These are important for Europe's economic success, the resilience of its farms and prosperity in its rural areas. The organic sector is a leading market for quality and authenticity: values at the heart of European food culture.

Innovation is important across the EU economy,

and no less so within the organic sector. The Implementation Action Plan devotes its **third chapter** to considering how innovation can be stimulated through organic food and farming research and, crucially, translated into changes in business and agricultural practice. TP Organics argues for a broad understanding of innovation that includes technology, know-how and social/organisational innovations. Accordingly, innovation can involve different actors throughout the food sector. Examples illustrate that beyond technology, innovations in the organic sector have been made in the areas of agro-ecological know-how, resource protection, resource-use efficiency, business diversification, agricultural resilience, creating added value and distributing wealth. The various restrictions imposed by organic standards have driven change and turned organic farms and food businesses into creative living laboratories for smart and green innovations and the sector will continue to generate new examples. The research topics proposed by TP Organics in the Strategic Research Agenda can drive innovation in areas as wide ranging as production practices for crops, technologies for livestock, food processing, quality management, on-farm renewable energy or insights into the effects of consumption of organic products on disease and wellbeing and life style of citizens. Importantly, many approaches developed within the sector are relevant and useful beyond the specific sector.

The **fourth chapter** of the action plan addresses knowledge management in organic agriculture, focusing on the further development of participatory research methods. Participatory (or trans-disciplinary) models recognise the worth and importance of different forms of knowledge and reduced boundaries between the generators and the users of knowledge, while respecting and benefitting from transparent division of tasks. The emphasis on joint creation and exchange of knowledge makes them valuable as part of a knowledge management toolkit as they have the capacity to enhance the translation of research outcomes into practical changes and lead to real-world progress. The Implementation Action Plan argues for the wider application of participatory methods in publicly-funded research and also proposes some criteria for evaluating participatory research, such as the involvement and satisfaction of stakeholders as well as real improvements in sustainability and delivery of public goods/services.

European agriculture faces specific challenges but at the same time Europe has a unique potential for the development of agro-ecology based solutions that must be supported through well focused research. TP Organics believes that the most effective approaches in agriculture and food research will be systems-based, multi- and trans-disciplinary, and that in the development of research priorities, the interconnections between biodiversity, dietary diversity, functional diversity and health must be taken into account. **Chapter five** of the action plan identifies six themes which could be used to organise research and innovation activities in agriculture under Europe's 8th Framework Programme on Research Cooperation:

- **Eco-functional intensification** – A new area of agricultural research which aims to harness beneficial activities of the ecosystem to increase productivity in agriculture.
- **The economics of high output / low external input farming** – Developing reliable economic and environmental assessments of new recycling, renewable-based and efficiency-boosting technologies for agriculture.
- **Health care schemes for livestock** – Shifting from therapeutics to livestock health care schemes based on good husbandry and disease prevention.
- **Resilience and "sustainagility"** – Dealing with a more rapidly changing environment by focusing on 'adaptive capacity' to help build resilience of farmers, farms and production methods.
- **From farm diversity to food diversity and health and wellbeing of citizens** – Building on existing initiatives to reconnect consumers and producers, use a 'whole food chain' approach to improve sustainable consumption of natural and authentic foods.
- **Creating centres of innovation in farming communities** – A network of centres in Europe applying and developing transdisciplinary and participatory scientific approaches to support innovation among farmers and SMEs and improving research capacities across Europe.

Table of Contents

1. Introduction

With its Implementation Action Plan, the Technology Platform for organic food and farming research, TP Organics, completes its trilogy of key documents. Since its establishment in 2007, TP Organics has published a Research Vision 2025 (2008)[1] and a Strategic Research Agenda, with concrete research priorities (2009)[2] . The Implementation Action Plan adds to these by addressing how to approach, carry out and follow up the research proposed for the best possible effect. It also takes the first steps towards outlining how organic sector research can contribute to Europe's progress during the period of the EC's 8th Framework Programme.

TP Organics integrates the views of a broad range of stakeholders: the organic movement, business, science and civil society. Its inclusiveness is one of its great strengths, since its representativeness lends weight to its words. Through its diverse stakeholders, TP Organics has access to multiple perspectives and a large pool of expertise, which it has brought together in a comprehensive analysis of research and development priorities that can leverage organic food and farming's potential to help Europe address contemporary challenges.

Thus, TP Organics can contribute to the Europe 2020 Strategy for a smart, sustainable and inclusive economy.[3] The Europe 2020 Strategy channels 3 percent of the EU's GDP into Research and Development, with innovation being a major theme. The strategic importance of innovation for the EU is highlighted by the Innovation Union, one of the seven flagship initiatives of the Europe 2020 Strategy.[4] TP Organics is fully aware of the power of well-managed innovation, and supports the EC's attempts to make participation in EU research and innovation programmes easier; this will provide a strong stimulus for the participation of more organic businesses, particularly SMEs.

Organic food and farming generates many different types of innovation. These include not only technological solutions but also innovations in the areas of business diversification, agro-ecological know-how, resource protection, resource-use efficiency, agricultural resilience, generating value-added and distributing wealth. Organic sector innovation can support empowerment of rural populations as well the health and well-being of consumers. The smaller scale of organic systems relative to conventional food systems is a driver of innovation and progress, making organic systems into highly creative living laboratories for smart and green innovations. The organic sector has already generated a multitude of useful new practices for sustainable agriculture, and it will generate more. Organic production still has great potential for further development. If its performance is considered relative to investment, the sector is already disproportionately successful: it has been estimated that organic production receives less than one percent of the research funding and/or support invested in food production, but has achieved significant growth in the market and shares of more than 5 percent of retails sales in some countries.

There are many uncertainties and anxieties around food security into the future, and the EU is preparing to equip itself for challenging times. It

is clear that the sustainability of food production needs to improve. TP Organics argues that investment in organic and low external input farming methods can return high dividends and answer to contemporary needs. The organic sector searches for production methods that strike a balance between sustaining the natural resource base in the long term and generating sufficient quantities of outputs in the immediate term. Organic and low external input systems can identify solutions for the wider agriculture and food sector which recognise and make use of multi-functionality and which take account of the complexity of agricultural systems and their diverse social and ecological contexts. Organic standards are designed around social and environmental criteria, not just economic criteria. A properly implemented organic production system generates benefits which are diffuse and long term, and this is a strong argument for the justifiability of investing public funds in particular into organic sector research.

Organic food and farming is a steadily growing sector of quality food products in the EU and around the world, even in times of financial crisis. Quality is a watchword in European agriculture, frequently emphasised by EU institutions as a selling point in the global market, and close to the hearts of European consumers. The legal proposal on quality schemes of the Commission says that "*consumers increasingly look for authentic products produced using specific and traditional methods. In meeting this demand, the diversity and quality of European Union agricultural production should be an important strength and source of competitive advantage for Union farmers.*"[5] Organic food is one spearhead and lead market for high quality and high value foods, and thus harmonises perfectly with the values and orientation of the EU's agricultural strategy.

The EU has a leading position in global organic food and farming research and in the global organic market. Investing in organic research will strengthen this position, deliver benefits across the EU's agricultural sector in terms of green innovation, and contribute to the broader goals of agriculture strategy.

TP Organics believes that its trilogy of key documents contributes to the building of a well-coordinated and targeted programme of research and innovation that can reinforce the Europe 2020 Strategy and drive EU food and agriculture towards a sustainable bio-based economy by 2020.[6]

It should be emphasized that TP Organics is the only Technology Platform that deals with agriculture and food production as a science of complex multi-functional ecological and socio-economic systems. As will become clear in this document, its work is relevant not only to organic agriculture but also to other low input and sustainable food and farming systems. It therefore represents an important resource for policymakers.

Further, TP Organics merges the interests of organic stakeholders and businesses - comprising an active core of about 100 SMEs, farmer and advisory services - with civil society. One of the core values of TP Organics is to involve stakeholders along

the whole food supply chain from farm to fork, including consumers, in determining the needs of research in the organic sector. From the very beginning, TP Organics has been fully open to especially to farmers and SMEs, and civil society organisations, which are often neglected by other European Technology Platforms, and in research in general.

Currently, TP Organics' members include 20 EU umbrella organisations in the fields of sustainable agriculture research and environment and consumer protection, plus about 20 companies and SMEs. There is close collaboration with national technology platforms for organic research in Hungary, Italy, and the Czech Republic, as well as a new national platform in Spain which is still under development. Further, TP Organics is an observer in the ERA–NET CORE Organic II. The TP secretariat manages the coordination of TP Organics and is hosted by the IFOAM EU Group in Brussels.

1.1 How to read the Implementation Action Plan document

This action plan aims to identify what is required to enable and derive maximum benefit from the implementation of the TP Organic Strategic Research Agenda and the 61 research priorities identified therein.

It begins with a short overview of the development of the European Organic Agriculture sector in the global context. The next chapter focuses on generating innovation through organic farming research and through implementing the Strategic Research Agenda of TP Organics.

The next chapter discusses research methods and knowledge transfer, and illustrates the important contribution of participatory and systems-based approaches to the generation and dissemination of knowledge. The action plan goes on to present what TP Organics believes should be key themes of research under the next EC Framework Programme: eco-functional intensification; the economics of high output/low external input farming, health care schemes for livestock, a focus on resilience and 'sustainagility', from farm diversity to diversity of natural foods and creating innovation centres in farming communities.

The Implementation Action Plan concludes with a chapter on co-operation activities and proposals for the future of TP Organics.

The Implementation Action Plan is written so that it can be read as single document. However, it builds on the two strategy documents previously published by TP Organics which are summarised in the following section.

1.2 TP Organics Research Vision 2025

The first step for TP Organics was to develop a vision to guide innovative organic food and farming research, setting out how organic food and farming can contribute to addressing EU and global challenges. The platform set about building up an extensive and broad-

Figure 1: Vision for an Organic Food and farming research agenda to 2025.

reaching participatory process of workshop discussions and public consultations. It worked closely with NGOs, civil society, public institutions, science and enterprise to develop the Vision for Organic Food and Farming Research Agenda to 2025, published in December 2008.

The Vision illustrates the potential of the organic sector as a generator of strategies to meet global challenges like climate change, biodiversity loss, natural resource depletion, food insecurity, and socio-economic difficulties in rural areas. It identifies three priority themes for strategic for food and farming research embedded in the principles of health, ecology, fairness and care *(see Figure 2)*.

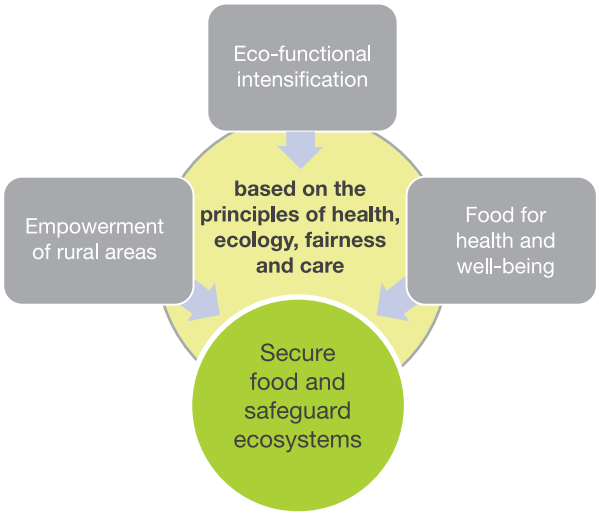

Figure 2: Vision for 2025: Strategic Research Priorities for food and farming research

The three strategic themes provide a framework for the definition of key challenges and the associated research goals that can support ongoing development of the organic sector and other low external input systems to secure food supplies and safeguard ecosystems.

1.3 Strategic Research Agenda

As the next step, TP Organics worked out the research activities needed to mobilise the organic sector towards the goals identified in the research vision. These activities, comprising not only research and development but also knowledge transfer, are presented in the Strategic Research Agenda in the form of concrete project proposals.

TP Organics established three expert groups in line with the three priority themes identified in the Vision. The Strategic Research Agenda was developed in a one-year process of intensive consultation on various levels, with stakeholder and public participation in consultations and discussions facilitated by the platform. Consultations involved researchers, advisors, members of inspection and certification bodies, and different beneficiaries of the research such as farmers, advisors, processors, market actors and members of civil society organisations throughout Europe and overseas.

More than 110 experts from 34 countries were involved in formulating or reviewing the research goals and topic descriptions. All together, over 300 stakeholders contributed to the development of the document through public online or direct consultations, workshops and the stakeholder forum *(see Figure 3)*.

The Strategic Research Agenda was developed in three steps:

1. key challenges were identified for each of the three themes outlined in the Vision;
2. Research goals were identified based on the feedback from stakeholder consultations and expert advice;
3. Research goals were formulated as project descriptions.

For each of the key challenges, two to six research goals were identified. Additionally, three major cross-cutting issues were considered separately from the themes outlined in the Vision:

- Climate change
- Biodiversity loss
- Water scarcity

During the course of discussion and exploration, it became clear that there was an additional need for one more cross-cutting theme of knowledge management and communication.

The Strategic Research Agenda was finalised and published in December 2009. It provides a guide to the research activities that with sufficient funding could significantly contribute to achieving greater sustainability of food and farming. Many of the projects proposed are relevant not only to organic agriculture but also to other low external input and sustainable food and farming systems.

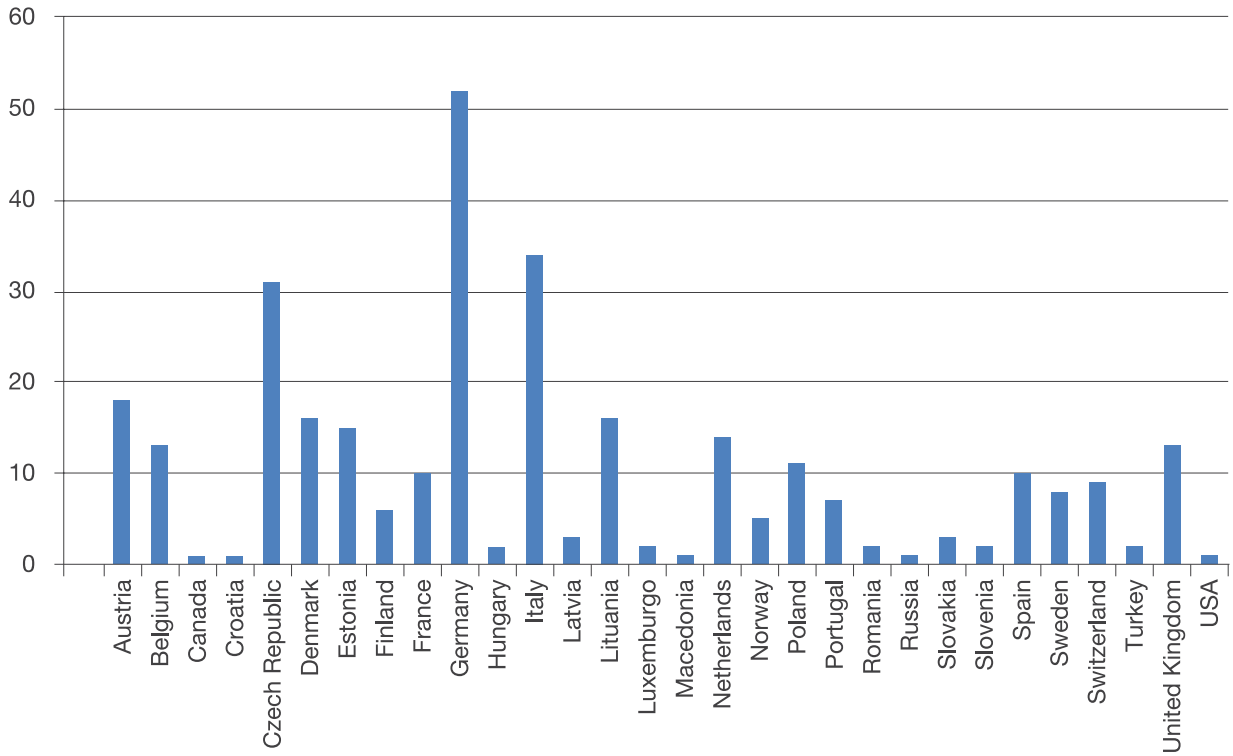

Figure 3. Responses to consultations for the SRA of TP Organics

2. European Organic Agriculture in the Global Context

In organic agriculture, Europe is a very strong player on the world stage. In 2008, about one quarter of the world's organic agricultural land (35.2 million hectares in total) was in Europe. The global organic market has doubled in value since 2003 and was estimated to be worth US$ 50 billion in 2008. The European market for organic food accounts for more than half of the global organic market and is thus even larger than the North American market.[7] In total there are about 210,000 organic agricultural producers in the EU and about 34,500 companies that process or retail organic food.

The organic sector is made up of many different people and types of organisations: Farmers, NGOs, civil society groups, and ultimately, millions of consumers who choose to consume organic food. Each of these plays a role in the ongoing development of organic food and farming in Europe. The competitiveness of the European organic sector depends greatly on innovation, novel appropriate technologies and scientific evidence in support of its benefits and qualities. Thriving and innovative organic food and farming research will be one of the most important tools for driving progress in these areas and making the most of opportunities.

Organic food and farming is regulated at the European level and organic certification is a European quality scheme that is seen as a benchmark for food quality certification schemes worldwide. A new organic regulation came into force on the 1st of January 2009, repealing the previous regulation and presenting a complete set of objectives, principles and basic rules for organic production. Since July 2010 it is compulsory to show the newly designed EU logo on organic products, and the import of organic products is also controlled. The EU regulatory framework continues to develop as production and processing standards are written for new products in response to new demands (aquaculture and wine products, for example). The comprehensive set of regulations for organic food in the EU provides considerable protection for both consumers and producers and sets the framework for payments under national rural development programs and organic action plans.

An increasing proportion of consumers is buying organic food. Consumers display positive attitudes to organic food, which they associate with perceived health benefits, environmental protection and better taste compared to other food[8]. A subset of consumers is specifically interested the values of organic agriculture, and appear willing to pay for characteristics such as local provenance, fair returns for farmers and high animal welfare.[9] However, EU organic production competes in the market place with both conventional food products and global organic food production.

Organic agriculture continues to develop dynamically in Europe. In most countries the organic area is on the increase and the market continues to grow. The economic crisis slowed market growth rate in most countries in 2009, but despite this the organic area continued its expansion even more rapidly than in previous years. This positive development is the result of a combination of consumer

demand and the introduction of several policy measures such as support for organic farming under the Rural Development Programme, legal protection and EU and national organic action plans as well as support for research and development.

2.1 Growth in land area continues

Since the beginning of the 1990s, organic farming has rapidly developed in almost all European countries. In 2009 in Europe, more than nine million hectares were managed organically, constituting an increase of almost one million hectares or 11 percent compared with the previous year *(see Figure 4)*. 4.7 percent of the agricultural area in the European Union (and 1.9 percent of the agricultural land in Europe) are managed organically. Higher growth rates continue in Spain and in the new European member states (for example Poland and the Czech Republic). Spain remains the country with the largest area of organically managed land in 2009 (1.3 million hectares), followed by Italy (1.1 million hectares), and Germany (0.95 million hectares.

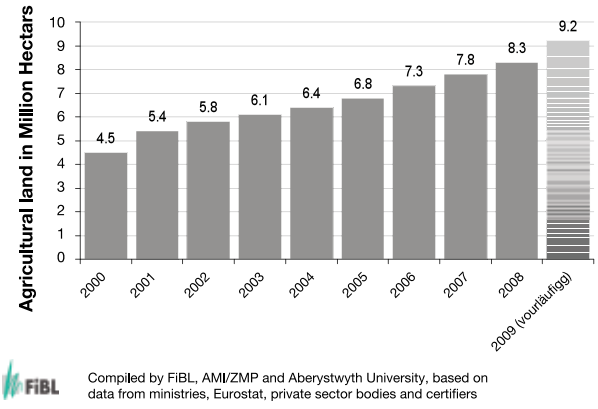

Figure 4. Organically managed land area (including forest and aquaculture, excluding wild collection) in Europe 1985-2008[11]

The percentage of organically managed land varies considerably between countries in Europe. Five countries had more than 10 percent of their agricultural land managed organically in 2009: Liechtenstein (26.9 percent), Austria (18.5 percent in 2009 and 19.5 in 2010), Sweden (12.6 percent), Switzerland (11.1 percent, 2008) and Estonia (10.5 percent). This compares with countries with as little as 1 percent. A similar difference can also be observed across regions within countries.

Europe now has almost 260,000 organic agricultural producers (of which almost 210,000 are in the EU). The country with the highest number of organic producers is Italy (more than 43,000 producers). In 2007 there were around 33,800 certified processors in the EU, it is estimated that this number increased further in 2008. The vast majority of processors are located in the EU-15, but data were not available for all new member states. This reflects the longer history of development of the organic sector in the EU-15 countries that also have a tradition of on-farm processing (for example, cheese making). In many EU-12 member states the development of the processing sector lags behind the development of organic agricultural production (EC-AGRI, 2010).[10]

2.2 The European market for organic food and drink

In 2009, the turnover of organic food and drink through all market outlets (general retail sales,

specialised shops, farm shops, farmers' markets, online) is estimated to have reached €17.8 billion (*see Figure 5*). The largest market for organic food is in Germany (€5.8 billion), followed by France (€3.0 billion), the UK (€2.1 billion) and Italy (€1.5 billion).

Denmark (7.2 percent of total food market), Austria (6 percent), and Switzerland (5.2 percent) have well established markets for organic foods, with shares of more than five percent of the total national food market. While organic land has expanded rapidly in many new EU member states as well as in candidate and potential EU candidate countries, consumption levels have remained very low in the latter (less than one percent).

Europe: Development of the Market for organic food 2005-2009

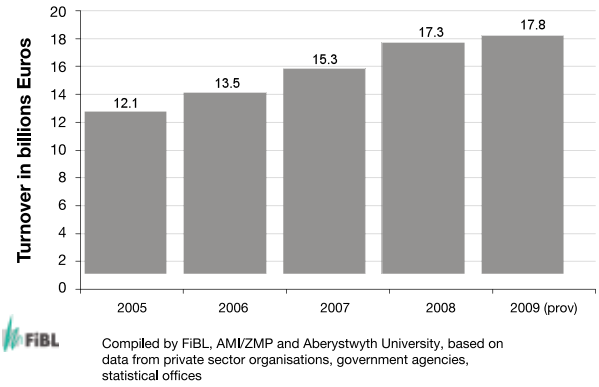

Figure 5: Development European organic food market 2005-2009[12]

With the economic crisis, market growth in 2009 has slowed down in some countries; in the UK there was even a decrease of 12.9 percent, and in Germany the market stagnated. On the other hand, an increase of half a billion Euros (or +17 percent) was noted for France. For 2010, many companies have reported growth. It is expected that the overall growth rate will be higher than in 2009.

3. Generating Innovation – Implementing the Strategic Research Agenda of TP Organics

In several of its strategies, the European Union emphasizes the importance of generating innovation to meet future challenges. Following the Lisbon Strategy[13] and the renewed EU Sustainable Development Strategy of 2009[14] , the European Commission president José Manuel Barroso launched his 'Europe 2020 Strategy for a smart, sustainable and inclusive economy'. This paper was supported and amended by the Council and the European Parliament. It aims to achieve a more competitive, efficient and greener economy based on knowledge and innovations and fostering high employment and social and territorial cohesion. The Europe 2020 strategy calls for an innovative and resource-efficient Europe. It highlights the building of a bio-economy (an economy based on renewable resources and ecological sensitivity in product and service provision, with highly developed green technologies) by 2020 as one of the deliverables under the flagship initiative of the Innovation Union.[15] To measure progress in meeting the Europe 2020 goals, one (among a total of five) headline target is the investment of 3 percent of the EU's GDP (public and private combined) in R&D and innovation.

According to Research, Innovation and Science Commissioner Máire Geoghegan-Quinn, the European bio-economy is worth nearly two trillion Euros, and provides around 22 million jobs in Europe across sectors as diverse as agriculture, forestry, fisheries, food, chemicals, and biofuels[16] Meeting the grand environmental, food and social challenges requires new, innovative solutions in agriculture, as well as the efficient communication of these solutions between farmers, advisory services, researchers and policy makers.

The Innovation Union was set up by the EU to stimulate innovation and to guide it towards achievement of the Europe 2020 goals. At its heart is the idea of 'generating innovation', which has become an important theme in contemporary EU politics. It is worth dedicating a few paragraphs to the exploration of this idea, for clarification.

3.1 A broad understanding of defining innovation

In simple terms, innovations are "the successful exploitation of new ideas".[17] This implies not only having the idea, but developing it and translating it into real-world progress in the form of products and services that can create growth and jobs. The Innovation Union will facilitate this process by making research and innovation finance more accessible. Meanwhile, the EU-funded INSIGHT project[18] defines an innovation as a problem-solving activity in response to internal or external pressure. According to this understanding, innovations can emerge even where no research has yet been conducted.

The most common understanding of an innovation is probably as a new technological development; for example, research may discover new drugs or new substances which can then be developed into a range of products. A focus on technological innovations is also widespread in the context of the bio-economy, where important innovations have included the substitution of biological raw materials into the manufacture of chemicals and chemical building blocks, or meth-

ods for the recycling of biological waste. However, there has been encouragement from several fronts for reconsidering this understanding.

The EC has acknowledged the importance of research and innovations in promoting eco-friendly production methods and addressing resource efficiency and climate change mitigation. According to the EU innovation policy, eco-innovation is 'any innovation that benefits the environment - embracing technological innovation, process innovation and business innovation.'[19]

The Business Panel on future EU innovation policy highlighted social innovation (see below) in its 2009 report and advocated a 'broad concept of innovation[20]'. The European Bureau of Policy Advisors recognises the need of the European Union to innovate on many fronts:

- not just in manufacturing but also in services;
- not just in the private sector, but also in the public and non-profit sectors;
- not just in big organisations, but in smaller entrepreneurial ones as well;
- not only through new technology, but also through new forms of organisation to tackle social issues.[21]

Social innovations are widely referred to in the context of health and education and feature prominently in Innovation Union documents. Social innovations aim for empowerment of groups facing common problems, and address dysfunctional markets by deploying non-monetary resources and rules of partnership and collaboration. This sort of activity has clear relevance to rural areas and rural development policies.

3.2 Innovation in food and agriculture

Agriculture is an industry in which a wider and systems-based approach to generating innovation has been overlooked until now. Several factors may be called upon to explain this, including institutional barriers and the 'distance' between research and practitioners.

In many countries, farmers have not been recognised or supported as a possible source of innovations[22, 23] although they are, in a sense, applied scientists playing a part in important creative processes. Farmers have developed high-yielding crop cultivars from wild races, domesticated livestock, invented all manner of farm equipment and constructed useful classification system since the beginning of agriculture about 10,000 years ago[24].

A purely technological understanding of innovative action in agriculture focussing on the production and use of commodities as raw materials for food and other industries is likely to miss the innovative potential on farms and in food supply chains. Both can make an important contribution to the goal of multi-functional rural development and sustainability. It is therefore helpful to have a broad understanding of innovation in the agriculture and food sector.

Innovations making agriculture and food production more sustainable can relate to production

practices and raw materials, techniques and codes of practice for careful processing and can also relate to marketing, and organisation and management of supply chains. They involve a plurality of actors including farmers, food processors (both small and large), supermarkets and other wholesale and retail outlets, public and private regulatory bodies that set and monitor adherence to specific standards, and also consumers.

Ultimately, it is consumer attitudes and behaviour that determine the success or failure of product innovation in the marketplace.[25] Innovations can build trust by improving methods for safeguarding claims about quality and authenticity of produce, or by addressing health concerns, or by building better understanding of the link between environmentally sound agriculture and health effects of its outputs.

There are several aspects of agriculture which require innovation, going forward from 2011. Innovation is needed to increase productivity whilst maximising the efficiency of resource use and minimising the impact on the environment, both at the farm level and throughout supply chains and distribution systems. Innovations must also help the food sector to meeting consumer demand for high quality and health value and to improve information on provenance. Strengthening the resilience of farming systems against more erratic climate behaviour and improving the contribution of agriculture and food businesses to rural development are also areas that will require fresh thinking.

The EU is already positioning itself to assess the current state of innovation in European agriculture and encourage its development into the future. The EU-funded INSIGHT project[12] looked at the innovation processes in agriculture and rural development and identified examples of innovation in direct marketing, renewable energy and new rural services. Maive Rute, Director of Food, Agriculture and Biotechnology research at the EC, has proposed that the emphasis of innovation in agriculture be placed on the development of biological knowledge that will make farming more sustainable and provide a safer, better quality and more secure food supply.[26] In its third foresight expert round, the Standing Committee on Agricultural Research (SCAR) has initiated a review of the links between the generation of knowledge by research and its translation into practical innovations. Today, farmers can benefit from knowledge generated by a variety of traditional and novel sources, but modern communication media will be increasingly important in helping them do so.

3.3 Innovation in the organic sector

Organic farming employs an integrated, holistic approach which has the following objectives at its core (see Article 3, Regulation EC 834/2007):

- to produce products of high quality that nurture consumer health
- to respect high animal welfare standards
- to establish sustainable management systems for agriculture that sustain and enhance the health of soil, water, plants and

animals and the balance between them
- to contribute to high levels of biodiversity, and
- to make responsible use of natural resources.

Operating within the constraints imposed by these objectives, the organic sector has generated a wide range of innovations and developed new ideas that have been put into practice on farms and in companies throughout the EU. Many organic farms and food businesses have become creative living laboratories for smart and green innovations. The organic sector has already generated a multitude of useful new practices for sustainable agriculture useful both within and outside the organic sector, and it will generate more. For example, organic systems can only use a very limited range and quantity of inputs compared to conventional food systems; less than ten percent of the pesticide types allowed in conventional and integrated farming can be used in organic production (those used are of natural origin such as Neem and Quassia), and as a result, organic science has developed a rich knowledgebase of natural methods of pest control which will be useful to many agriculturalists. In the words of the IAASTD report:

> *Organic farming with its stringent rules on external input use has to be even more innovative to solve production problems, sometimes opening up new avenues.*[27]

The practices developed by organic farmers and scientists will become increasingly relevant as rising prices and stricter chemical regimes prompt more farmers to look for ways of reducing their input use.

The 'Push-Pull technology' approach is one example of a low external input agro-ecological innovation that has achieved international recognition in 2010.[28] Push-Pull is a system of integrated management of pests, weeds and soil. The system was developed for the control of stemborers, striga weed and soil fertility in maize production. Under the system, maize is intercropped with a repellent plant, such as desmodium, and surrounded by a trap crop to attract insects, such as Napier grass. Gravid stemborer females are deterred from the maize crop by host masking effects of the intercrop (push), while being simultaneously attracted trap crop around the border (pull). Push-Pull was developed through collaboration by scientists at the International Centre of Insect Physiology and Ecology (ICIPE) in Kenya and Rothamsted Research in the United Kingdom along with other national partners. The technology is appropriate and economical for resource-poor smallholder farmers as it is based on locally available plants, not expensive external inputs, and fits well with traditional mixed cropping systems in Africa. To date it has been adopted by over 35,000 smallholder farmers in East Africa and has led to substantial increases in maize yields achieved with minimal inputs.

In organic processing, the prohibition of certain techniques and additives also imposes pres-

sure to innovate. For example, SIPAL[29] Partners has developed a unique range of varied and innovative organic cereal and dried fruit concentrates as healthier ingredients for sweetening and other technical functionalities, which will be useful in the agri-food industry beyond organics.

Innovations in the organic sector are not limited to production and processing methods, but extend to marketing. The IAASTD report points out that "Organic farming has the additional opportunity of deriving benefits from close links between producers and consumers" (Global Report, p. 384). For example, the Danish organic company Aarstiderne[30] has developed an internet-based concept to deliver a wide range of organic produce from its own farms direct to the consumer's doorstep. Again, this is a tool which is readily transferrable to other food and farming systems.

In summary, innovations in the organic sector can relate to a wide range of areas, such as production practises for crops and livestock, processing technologies, quality manage¬ment, marketing, farm diversification (including tourism, care farming and renewable energy, for example) and scientific insight for consumer wellbeing.

3.4 Innovative research projects in the organic sector in Europe

In the following section, examples are presented to illustrate the achievements of organic sector research and discuss their wider role. They include past and ongoing research projects at both European and national levels. An important feature common to many projects is collaboration between researchers and stakeholders in the development and/or implementation of innovations.
The examples have been grouped by the types of innovation they represent.

Technology innovations are generated mainly through lab-based science and technology, and then transferred to users such as farmers, advisory services, and policy makers. Technological innovations are actively supported by the Knowledge-Based Bio-Economy area in the EC's 7th Framework Programme, and by technology platforms. Modern farm technologies (especially information and communication technologies like robots, cameras, differential GPS and sensors) can be highly relevant to organic farming systems if employed appropriately Technological innovations have benefitted the organic sector by enhancing products, production processes, inputs and farm machinery, contributing not only to agricultural production but to food processing and retail too.

Know-how innovations involve the development and prototyping of management practices. In contrast to knowledge relating directly to a new technology and is use, Know-how Innovations generate knowledge around methods and practices. This category recognises that know-how is important to the farmer's ability to respond effectively to new challenges. For example, breeding programmes and methods for the relatively small and by its nature very diverse organic sector are fundamentally different from those used in the wider agricultural sector. Typically, breeding approaches developed for the or-

ganic sector involve breeding in small populations at the farm or regional level and working with lines and breeds that are adapted for local conditions and can be selected to meet local market requirements. The constant integration and application of knowledge (or know-how) is an essential aspect of improving the multi-functionality and sustainability of agriculture (*see Chapter 4*). Know-how innovations are particularly important in relation to resource use efficiency, flexibility, adaptability and problem prevention in food and farming systems and improving public goods or public service delivery.

Technological and Know-how Innovations are intimately linked; a technological innovation necessarily requires fresh thinking about management processes:

> *Innovations in research and development (R&D) take place in diverse and complex human and natural landscapes that thrive within specific political, economic and institutional contexts. An innovation…. is neither a research product nor a technology, but rather an application of knowledge to achieve desired social, ecological or economic outcomes. This knowledge might be acquired through learning, research or experience, and may come from a variety of sources and actors, but until applied it cannot be considered an innovation.*[31]

Organisational and Social Innovations are grouped together because of the considerable overlap between them. Organisational Innovations are changes in management approach, which in the organic sector could involve anything from ploughing to promotional campaigns. Social Innovations are to do with behaviours of groups in wider society and the relationships between companies and the public. The Bureau of European Policy Advisers (BEPA) described successful Social Innovations as "experimental (testing out a range of alternatives and assessing which ones work), collaborative (making use of the full potential of network technologies to boost productivity in the social fields and to speed up learning), and able to engage citizens as co-creators"[32] . Both of these types of innovation affect collaboration within and between various levels in the food chain as well as the relationship between the food chain and wider society and with the consumer. They can facilitate the development of markets and supply chains and are important in helping organisations to overcome constraints which may obstruct the uptake of other potentially helpful innovations.

3.5 Examples of research projects supporting Technological Innovations in organic food and farming

Europe's organic sector offers many examples of Technological Innovations. One important area of work at the farm level is the development of varieties or populations of crop and livestock which deliver high value to the consumer and are suited to organic systems. A ten-year-long UK project (now extended to several EU countries as part of an FP 7 project) has been researching the use of Composite

Cross Populations for wheat farming which deploy genetic diversity in cultivated wheat to increase the crop's resilience to climate fluctuations and its adaptability to different agricultural environments.

Another important field is pest and disease control. A Swedish project is using a multiple-tool approach to control aphids in spring-sown, involving cereal varieties with multi-gene resistance combined with enhanced activity of aphid natural enemies[33]. Technological Innovations have also contributed innovative materials for fertilisation and soil improvement.

Many machine-related Technological Innovations have been stimulated by developments in renewable energy generation. A completely new biogas reactor has been designed that uses feedstock with high dry matter content rather than liquid mixtures of slurry. The technology is considered very well-suited to organic farms that are more likely to have solid manure systems.

Organic food processing has also benefitted from innovations in technologies and ingredients, such as that described in the SIPAL example.

Finally, there have been important Technological Innovations made in methods of food quality assessment and authentication and in the environmentally friendly re-use or disposal of agricultural and other waste products. A good example is the PROTECTOR project on recycling and upgrading of bone meal for crop nutrition[34].

Title	**Adaptive Composite Cross Populations of Winter wheat**
Aims	This project represents a key step in using composite cross populations of wheat as a means of harnessing the many practical advantages of within-crop diversity to maintain a high level of crop performance under increasingly variable environments. The populations were derived from two-way intercrosses among 20 important parent varieties, the progeny of which have been exposed to natural selection under organic and non-organic farming conditions since 2004. Evaluation of the population dynamics uses genetic marker technology. In the current project the populations have been tested on a wide range of farms to extend the range of environmental exposure and to determine the level of local adaptation that might occur. The grain produced is also being tested for end use in milling and baking under both industrial and artisanal approaches. The concept and the material have recently (2010) been moved forward into the EC 7th Framework Programme (SOLIBAM: Strategies for Organic and Low external Input Breeding and Management) to evaluate the approach for widely contrasting environments and a greater range of cereal and other crops. The populations are part of the training Leonardo da Vinci training project (Leo-Columelle).
Funding sources	The current project is financed under the UK LINK Programme that requires participation of industry and research partners. It uses a participatory approach for on-farm testing. Further funding comes from the EC 7th Framework Programme (SOLIBAM) and EU Leonardo da Vinci.
Innovative elements	The composite cross approach (or 'Evolutionary Breeding') was first proposed in California as an experimental breeding method. A number of projects has carried this forward as a practical and efficient crop production method. A wheat research project led by the Organic Research Centre has initiated a study on the response of genetically diverse wheat populations to varied environmental conditions. Using molecular markers, researchers at partnering institute John Innes Centre look into changes that might occur in the genetic profile of the wheat populations over several generations. The method reverses the principle of monoculture and uses diversity to increase resilience. The wide diversity within the crop ensures that many potential mechanisms are available for restricting the spread and negative effects of pathogens, pests and weeds, and for providing physiological buffers against fluctuations in the environment. The effectiveness of these measures has been proved in the field. Populations have performed well relative to parent varieties and showed a higher degree of reliability across a range of different environmental conditions.
Further information	www.efrc.com/manage/authincludes/article_uploads/Research/Plant%20breeding/WBL%20web.pdf
Project website	www.efrc.com/?go=Research and development&page=Plant breeding
Contact person	Prof Martin Wolfe, Organic Research Centre: Martin.w@organicresearchcentre.com Dr Thomas Doering, Organic Research Centre: Thomas.d@organicresearchcentre.com
Time	2001 to 2014

Title	Dry anaerobic digestion of organic residues on-farm
Aims	To provide facts and figures for decision makers in Finland to support the development of the most economically and environmentally promising on-farm biogas technology.
Funding sources	The biogas plant design was funded by municipality Järna and the Biodynamic Research Institute Foundation (SBFI) of Järna, Sweden. The feasibility study was funded by Finnish Ministry of Agriculture and Forestry (MMM) and Agrifood Research Finland (MTT).
Innovative elements	This project describes a completely new biogas reactor design that uses feedstock with high dry matter content rather than liquid mixtures of slurry and crop residues. The dry fermentation biogas prototype plant offers the possibility to produce both energy from solid manure, straw, and oat husks and a high-nutrient new compost product made from the solid digestate. The prototype-stage research has shown that there is potential to adapt the processing stage to generate organic fertilisers specifically suited to needs, but also that there are constraints concerning the structure of the feedstock. The technology is considered very well suited to organic farms. Proposals for further research and development have been made.
Further information	Schäfer, W, Lehto, M, Teye, F (2006), Dry anaerobic digestion of organic residues on-farm - a feasibility study. Agrifood Research Reports 77. **www.orgprints.org/6590/**
Project website	**https://portal.mtt.fi/portal/page/portal/mtt_en/mtt/research/projectdatabase/Projectdetail?p_kielikoodi=GB&p_hanke_seqno=172047&p_kysely_seqno=34115,** **www.mtt.fi/eng**
Contact person	Winfried Schäfer, Agrifood Research Finland: **Winfried.Schafer@mtt.fi**
Time	2004 – 2006

Title	**"Image forming methods": Complementary methods for food quality assessment**
Aims	To develop image forming methods for organic food quality determination, and standardise the image formation and evaluation processes. These techniques should eventually be able to differentiate food samples from several farming practices and processing techniques, allowing for the authentication of organic products by several complementary methods.
Funding sources	German Ministry, foundations, European SMEs
Innovative elements	Image-based technologies are a new approach in food quality determination and have potential for organic food authentication. The work uses computerized image analysis combined with crystallization or chromatographic methods. Methods can be used for several product classes (e.g. grain, vegetables, fruits, milk) and product types (e.g. fresh, processed).
Further information	Szulc et al. (2010). Discrimination between organically and conventionally grown winter wheat farm pair samples using the copper chloride crystallisation method in combination with computerised image analysis. **doi:10.1016/j.compag.2010.08.001**
Project website	**www.uni-kassel.de/agrar/nue/?c=163**
Contact person	Dr Johannes Kahl, University of Kassel: **kahl@uni-kassel.de**
Time	2002 to 2010

3.6 Examples of research projects supporting Know-how Innovations in organic food and farming

There are many examples of research projects aimed at developing organic or low external input production practises for specific farm types or enterprises. Many are carried out with the involvement of farmers and address specific challenges they raise. Recognising that one of the main challenges faced by farmers is to reconcile a number of competing demands, interdisciplinary teams are often called for.

Know-how Innovations for crop production focus on preventive systems for pest and disease control and on design-based nutrient management, as opposed to Technological Innovations which focus more on input-based solutions. At the core of these approaches is a better understanding of the interactions between the host, pests and potential beneficials. A project underway in Switzerland is using this principle to improve the efficacy of biological control of a major maize pest (Western corn rootworm, Diabrotica virgifera virgifera) with environmentally friendly nematodes. The researchers have found that a natural root signal may explain why some maize varieties seem to enhance the effectiveness with which nematodes can locate the plant root and attack the rootworm[35].

In another example, the INTERCROP project (*see p.31*) researched interactions at multiple levels between cereals and legumes in intercropped systems. The project indicated that cereal-legume intercropping could be a powerful tool in agriculture: intercropping enhanced grain yields relative to sole cropping, improved nutrient use (of nitrogen and phosphorous) and increased the stability of grain legume yields (with implications for Europe's ability to supply more home-grown protein).

Organic animal husbandry projects develop management strategies that achieve high animal welfare, low environmental impact and good product quality in a resource-efficient way. The ANIPLAN project showed that through planning alone the herd conditions on farms can be improved and antibiotic use reduced. The ECOVIT project demonstrated that adjusting the content, harvest and storage of green fodder crops can significantly impact their nutrient content, and careful management can eliminate the need for vitamin and mineral supplements for dairy cows. Additionally, work with alternative forages is aiming to improve parasite control in small ruminants.

Know-how Innovation projects are not limited to farm based production and are equally relevant for other supply chain actors and consumers. There are innovative and informative research projects being performed on health effects from the consumption of organic food products. Effects associated with organic foods are being found in the immune system in children (fewer allergies) as well as in animals (more alert immune reactions). The Farmer Consumer Partnership Project found that organic consumers are willing to pay additional premiums for certain attributes, representing an opportunity for market differentiation of organic foods.[36]

In several projects, Technology and Know-how innovations are combined.

Title	INTERCROP
Aims	• Identify technical and socio-economic benefits and obstacles for the more extensive and flexible application of intercropping on arable land in the EU. • Increase knowledge of the multifunctional role of intercropping: production level and stability, resource use, environmental impacts, and product quality of intercrops. • Develop a simulation model for grain legume and cereal intercrops that can be used in design and strategic planning • Design and test new methods of intercropping • Carry out on-farm demonstration activities
Funding sources	EC 6th Framework Programme QLK5-CT-2002-02352
Innovative elements	This project represents a unique multidisciplinary and integrated European approach. It evaluates the potential of intercropping and defines intercropping strategies for sustainable plant production in organic farming systems under different regional conditions in Europe. In comparisons with monocultures, intercropping cereals and grain legumes has been shown to enhance the efficiency of plant use of growth resources such as light, water and nutrients. Intercropping is associated with greater and more stable grain production. In particular, intercropping results in improved use of soil nitrogen. Combination of grain legumes with cereals reduces agronomic risk and weed problems associated with grain legume cultivation, and significantly increases the protein concentration in the associated cereal. INTERCROP employed a unique multidisciplinary and integrated European approach to evaluate the potential of cereal and grain legume intercropping and to develop new strategies for sustainable arable crop production. The project was particularly concerned with increasing Europe's capacity for local protein production for feed and food and other ecosystem services in organic farming systems under different regional conditions. The results showed that intercropping enhances grain yields relative to sole cropping, improves the use of soil and atmospheric nitrogen and phosphorous resources, increases the stability of grain legume production across years, enables enhanced protein production from grain legumes without increasing weed problems, and provides a new tool to improve the protein quality of cereals for bread making and feed under low-nitrogen regimes. The project prompted several new research and development projects in France, Denmark and the UK on reintegration of intercropping into modern organic and non-organic agriculture.
Further information	Gooding, M.J. et al. (2007). Intercropping with pulses to concentrate nitrogen and sulphur in wheat. Journal of Agricultural Science 145:469-479.
Project website	Hauggaard-Nielsen, H. Et al. (2009). Pea-barley intercropping for efficient symbiotic N2-fixation, soil N acquisition and other nutrients in European organic cropping systems. Field Crops Research 113:64-71. **www.intercrop.dk/Publications.htm** **www.intercrop.dk**
Contact person	Prof. Erik Steen Jensen, Swedish University of Agricultural Sciences: **erik.steen.jensen@ltj.slu.se**
Time	2003 to 2006

Title	**ANIPLAN: Planning for better animal health and welfare**
Aims	To investigate active and well planned animal health and welfare promotion and disease prevention as a means of minimising medicine use in organic dairy herds This objective is met through the following intermediate stages: • Develop animal health and welfare planning principles for organic dairy farms under diverse conditions based on an evaluation of current experiences. • Apply a system of animal health and welfare assessment based on the WelfareQuality© parameters in different types of organic dairy herds across Europe, and develop a similar system for calves. • Develop guidelines for communication about animal health and welfare promotion in different settings, e.g. animal health services or farmer groups like Danish Stable School system and the Dutch Network Programme.
Funding sources	CORE Organic (ERA net) Funding partnership
Innovative elements	Health planning principles were developed in an action research approach with focus on the planning process in seven European countries with widely different farming systems. Equal consideration was given to animal welfare assessment tools and the creative dialogue between farmers and advisors. With use of both quantitative and qualitative research methods, the team identified key requirements for successful communication as well as appropriate ways of providing data to support decisions. On an overall level, the herd conditions improved and a significant lowering of antibiotic use was demonstrated after just one year of the project.
Further information	**www.orgprints.org/view/projects/ANIPLAN.html** Vaarst, M et al. (2010). Farmer groups for animal health and welfare planning in European organic dairy herds. Proceedings of the 9th European IFSA Symposium, Vienna, Austria, 4- 7 July 2010. **www.orgprints.org/17867**
Project website	**www.aniplan.coreportal.org**
Contact person	Mette Vaarst, University of Aarhus: **Mette.Vaarst@agrsci.dk**
Time	2007 to 2010

Title	**Increased integrity in organic dairy production through natural sources of vitamins and minerals (ECOVIT)**
Aims	To develop strategies to increase self-sufficiency with vitamins and minerals on organic dairy farms. The hypothesis is that the feeding ration can, with appropriate management, fulfil vitamin requirements and on some soil types also micro-mineral requirements throughout the year, without the need for any supplements.
Funding sources	The project is funded by the Danish Ministry of Food, Agriculture and Fisheries as part of the organic research program DARCOFIII.
Innovative elements	The project offers innovative solutions for the supply of minerals and vitamins for dairy cows in organic production systems. There is a very limited availability of organic vitamin and mineral supplements, and the potential to produce fodder crops with a sufficient content of vitamins and minerals on farm has not been explored until now. The project has demonstrated that it is possible for feed rations to provide enough vitamins and minerals to satisfy the requirements of dairy cows according to standard nutritional recommendations in the USA and Denmark. This was achieved through an innovative strategy addressing composition, harvest and storage of green fodder crops on farm. A novel design for intensive pasture introduced new and productive grassland species like caraway, plantain and chicory into a mixture with more traditional species like ryegrass, lucerne and clovers. The regime developed by ECOVIT is nutritionally equivalent or superior to a traditional strategy relying on standard supplementation with vitamins and minerals with regard to feed intake, milk production, reproduction and animal status
Further information	www.orgprints.org/view/projects/DA3-ECOVIT.html
Project website	www.icrofs.org/Pages/Research/darcofIII_ecovit.html
Contact person	Jakob Sehested, Research Centre Foulum: Jakob.Sehested@agrsci.dk
Time	2006 to 2011

Title	KOALA 1 and 2: Children's health and lifestyle influences
Aims	To study and differentiate the effects of a range of lifestyle factors, one of which is a diet based on organic food, on the development of allergies and obesity in children. The study will test the hypothesis that consumption of organic dairy products by children is correlated with reduced incidence of allergies and obesity. An analysis of mothers' milk composition will test whether there is a relationship between a woman's consumption of organic dairy products and the presence in her own milk of healthy fatty acids.
Funding sources	KOALA 1- foundations; KOALA 2 - Dutch government
Innovative elements	The study is the first to comprehensively address consumer expectations about health aspects of organic food. It is unusual in using such a large prospective cohort.
Further information	Kummeling et al. (2008). Consumption of organic foods and risk of atopic disease during the first 2 years of life in the Netherlands. Br J Nutr. 99:598-605.
Project website	www.louisbolk.org
Contact person	Lucy Van de Vijver, Louis Bolk Institute: L.vandeVijver@louisbolk.nl
Time	KOALA 1, 2000-2005; KOALA 2, 2008-2011

3.7 Examples of research projects supporting Organisational and Social Innovations in organic food and farming

A number of projects from the organic and related sectors fit the definition of Organisational and Social Innovations written by the Bureau of European Policy Advisors[7]

One example is a Swiss region-specific breeding programme for cows using specific breeding criteria and on-farm assessment tools.

The IPOPY project studied young people, whose growing bodies have a special need for healthy and high quality food, and showed that serving organic food in school meals in combination with innovative pedagogic practices such as farm visits or school gardening can change young people's attitude to food.

The SUS-CHAIN project analysed the role of new supply chain models and their impact on rural development, establishing three critical factors for success: governance, marketing and embedding in the specific region. The project generated specific recommendations for supply chain actors as well as policy makers.

Title	Organic Animal Breeding in Swiss Canton Grison
Aims	To promote organic dairy cow breeding specifically suited to the environment and farm characteristics in a sub-region of the Swiss canton Grison.
Funding sources	Funded by the regional (cantonal) government, foundations and farmers organisations.
Innovative elements	The project has developed a new on-farm assessment system for a site-specific breeding strategy for dairy cow herds (not individual animals) in a collaboration between researchers and advisors. It showed that for almost half of the organic farms studied, the breeds were not adapted to the site or the specific feeding potential of the farm. This led to the farmers adopting not only the breeding goals but in some cases also the type of breeds recommended by the project. Half of the farms were quite successful in realising site-specific herd breeding goals; here the research focus was on the optimisation of fodder through appropriate harvesting, storage and use of different forages (the use of concentrates in organic farms in Switzerland is limited to 10% of the total fodder). Results were disseminated through workshops, direct advice and a leaflet titled Optimized site-specific cattle breeding strategies in *mountain* areas.
Further information	Förderung der standortgerechten Bio-Milchviehzucht. CH Braunvieh, 5 June 2010, P 9. **www.bioaktuell.ch/de/tierhaltung/rindvieh/zucht.html** (in German)
Project website	**www.fibl.org/de/schweiz/forschung/tierhaltung/forschungsschwerpunkte-tierhaltung.html#c8138** (in German)
Contact person	Anet Spengler Neff, Research Institute of Organic Agriculture (FiBL), Switzerland: **anet.spengler@fibl.org**
Time	2008-2010

Title	iPOPY: innovative Public Organic food Procurement for Youth
Aims	To increase the consumption of organic food among children and youth in public catering, especially school meals. Specific objectives were: • To identify and verify experiences of public organic food procurement for young people in all participating countries (Denmark, Finland, Italy, Norway and partly Germany), and to make organic foods accessible for public procurement. • To analyse and suggest strategies for policies that may increase the consumption of organic products in public catering for the youth market. • To identify various best management practices in relevant supply chains. • To reveal and assess the constraints on public organic food procurement and to identify innovative approaches such as development of sustainable relationships between supply chain actors.
Funding sources	CORE Organic I funding partnership (ERA-NET)
Innovative elements	This project integrated the study of enterprise management, commercial relationships in the supply chain, policy frameworks and pedagogy to spearhead the development of markets for organic food in public catering. It achieved important successes in demonstrating how children can be reconnected with their food sources and stimulated to take an interest in food and nutrition, promoting their health during the important years of childhood growth and development. Moreover, the project contributed to improvements in the health value of food provided in school catering. School meal systems are hotly debated in Europe and are managed quite differently from country to country. The iPOPY project used this situation to promote the transfer of experiences and best practices, finding that Italy in particular can offer a useful example to other countries since it has achieved Europe's highest share of organic food in school meals.
Further information	www.agrsci.dk/ipopy www.orgprints.org/view/projects/iPOPY.html
Project website	www.agrsci.dk/ipopy
Contact person	Anne-Kristin Løes, Bioforsk Organic Food and Farming: anne-kristin.loes@bioforsk.no
Time	2008-2010

Title	**SUS-CHAIN - Marketing sustainable agriculture: an analysis of the potential role of new food supply chains in sustainable rural development**
Aims	This project assessed the potential role of food supply chains (FSCs) in enhancing sustainable food production and rural development. It identified critical points in FSCs which constrain the dissemination of sustainable agricultural production and recommended actions that are likely to enhance the prospects of sustainable food markets.
Funding sources	EC 6th Framework QLK5-CT-2002-01349
Innovative elements	The project developed a clear analytical framework based on the development path of 14 supply chains in Europe. To do this, it employed a multi-disciplinary team which worked in close collaboration with many stakeholders including governments and NGOs. The reconstruction of the 14 supply chains illustrated that the process of increasing sustainability is rooted in strategic choices of the supply chain actors regarding governance, marketing and regional embedding. Governance relates to the structural and process-related aspects of a food network. Marketing refers to the business management of an enterprise or alliance. Regional embedding involves the degree to which a food network employs local resources as well as how societal norms and values factor into the food product and chain. These three dimensions are inextricably linked and lead to different trajectories of development. The analytical framework was used to develop recommendations that are relevant both to supply chain actors and to policymakers. The 14 examples included several organic supply chain initiatives.
Further information	Knickel, K., Schaer, B. and Strauch, C. (2006). Sustainable Food Supply Chains in Europe. Joint Organic Congress, Odense, Denmark, May 30-31, 2006. **www.orgprints.org/7547**
Project website	**www.sus-chain.org**
Contact person	Han Wiskerke, Rural Sociology Group, Wageningen University: **Han.Wiskerke@wur.nl**
Time	2003-2005

3.8 Generating innovation through implementing the Strategic Research Agenda

In the following sections we present a summary of the research topics that were listed in the Strategic Research Agenda (SRA) of TP Organics. Topics are presented under four headings that were used in the SRA:

- Cross cutting issues that are relevant across the three thematic areas
- Empowerment of rural economies (Theme 1)
- Eco-functional intensification (Theme 2)
- Food for health and wellbeing (Theme 3)

Within each topic, topics are presented in order of priority.

Among the topics are some which have been considered by the EC in the 2011 call for the 7th Framework Programme as well as topics that that have been submitted by TP Organics as High Priority Topics for the 2012 call by the European Commission in September 2010.[37]

The topics proposed by TP Organics in the SRA cover demonstration activities in addition to research and development work. They also refer to the innovation typologies discussed above (Technological, Know-how and Organisational and Social), with the aim that the type of innovation pursued within projects could be used to identify complementary relationships between them.

Feedback has been solicited from stakeholders on their feelings about the relative priority of project topics. Many of those rated most important involve Know-how Innovations, of which there is an enormous range. For example, the project on organic management of habitats for biodiversity (*see p. 42*) will focus on know-how about the links between the farming system, landscape and biodiversity and ecological support functions in several European regions and for different annual and/or perennial cropping systems. This helps to assess and improve the multifunctional sustainability of organic agriculture and make better use of ecological support functions (ecosystem services). Other Know-how projects will try to improve our understanding of the contribution that organic and agro-ecological methods can make to global food security and rural development in specific regions of sub-Saharan Africa and South Asia (*see p. 45*). Development of more resilient cropping and livestock systems that support natural resistance to pest and disease pressures and make better use of available resources is another topic of some Know-how projects, as is urban and peri-urban organic food production. Further, studies of the impact of organic diets on human health, wellbeing and lifestyle choices generate know-how and information for supply chain actors and consumers. Several projects combine Technology and Know-how elements.

Technology projects include some exciting examples of cutting-edge technology being exploited to enhance environmental and ecological sensitivity in agricultural production, and can be used to challenge the frequent misconception of organics as a more 'old-fashioned' approach to farming. Technology projects will address the development

of both new inputs and new devices for agro-ecological methods. Critical subjects are the reduction of greenhouse gas emissions from organic and low external input livestock, the development of alternatives to the use of critical inputs in organic farming systems and protein feeds for aquaculture. Another concern is to create methods of assessing the quality and authenticity of foods derived from organic food processing, and to develop functional ingredients to replace harmful additives. The organic sector also shares with non-organic agriculture a strong interest in automation, for example the use of robots to carry out weeding and outdoor feeding, and in intelligent design, for example for information and communication technologies and sensors for animal health in outdoor systems.

Organisational and Social innovation projects relate to the development and evaluation of short supply chains and local food systems, the implementation of values through certification, supporting the development of policy instruments for multi-functional and organic farming systems and the evaluation of new technologies.

Many projects are designed to involve a range of participants in addition to researchers, such as industry partners and SMEs, control/certification bodies, civil society organisations and governments.

The tables show in the case of each research topic which stakeholder groups would experience the most benefit. It can be expected that benefits will be felt not only by producers, but also by industry partners, consumers, policy makers, civil society and, of course, in many cases also the environment through reduced environmental impact or animals through improvements in animal health and welfare.

In terms of funding, Europe has a long history of funding organic sector research both through the EC Framework Programmes and at the member state level. Several member states have funded research programmes in the last two decades. Europe has therefore a reasonably well-developed infrastructure for organic farming research, consisting of specialist research institutes in the public and private sectors and institutes or departments at universities and governmental research centres. However, capacity is not evenly distributed, being weaker in new member states and particularly in the Central and Eastern Europe countries where the organic sector has been slower to develop. Also, the skills and methods required to study multi-functional agricultural systems in multi-disciplinary teams are not part of formal research training at many universities. Carrying out collaborative research across borders requires an understanding of differences in soils, climate and socio-economic and cultural contexts. TP Organics believes that capacity does currently exist to implement the projects proposed in the SRA, but this capacity needs to be maintained and extended. Capacity will erode if there is not sufficient funding for this type of research, with its strong systems and agro-ecological focus and its active involvement of end-users in participatory approaches.

3.9 Summary of research goals presented in the TP Organics Strategic Research Agenda

Legend

Activity type
Different types of project activity might be needed depending on the envisaged outcomes.

Research projects:
Projects ranging from frontier/basic research to applied, precompetitive research. The primary aim of any research project is to generate scientific and technical knowledge which can be further used for the development of new products and/or for improving the sustainability of existing production. These projects will benefit from collaboration efforts and networks.

Demonstration / Pilot projects:
Projects with the aim of demonstrating industrial and economic feasibility, and the sustainability of a concept.

Studies:
These projects include surveys, feasibility studies, LCAs or eco-efficiency analyses, and will generate data to inform evidence-based decisions by stakeholders and decision-makers.

Network / Coordination:
Projects which will improve coordination between stakeholders in a field, interdisciplinary cooperation, exchange of information and coordination between European and member states institutions.

Training:
Projects supporting mobility of researchers, academic exchanges, course development and curricular programmes in member states.

Innovation type
(*see section 3.4 p.24 for a discussion of the categories*)

Technology: These innovations are generated mainly through lab-based science and technology enhancing products, processes, inputs and farm machinery, and food processing.

Know-how: These innovations generate know-how for the development and prototyping of management practices.

Social /organisational: This category is used for innovations answering social and societal needs and changes to organisation management.

Time-scale: Immediacy of need and time horizon of project activities.

Budget: Required resources for the total duration of project activities.

< 500,00 €

500,000 - 1,000,000€

Legend

1,000,000 - 3,000,000€

3,000,000 - 5,000,000€

5,000,000 - 10,000,000€

>10,000,000€

Participation [description]
All projects are assumed to have the participation of academic institutions, but participants may also include industry and control bodies of civil society organisations.

Beneficiaries [description]
Beneficiaries may include producers, policy makers, consumers, civil society, animals and the environment.

Funding Source

European Union (EU) funding
Every financing period, the European Union reserves part of its budget to fund projects and initiatives that promote its policy priorities throughout the European Union and further afield. The main types of financing opportunities are GRANTS (awarded to co-finance specific projects or objectives, usually through a call for proposals) and PUBLIC CONTRACTS (awarded through call for tender). The three main EC funding instruments are: the 7th Framework Programme; the Competitiveness and Innovation Framework Programme; and Structural Funds.

Private of industry funding
For projects that might be of interest to private or industry sponsors.

Transnational funding
For projects where transnational funding schemes are the principal means to support collaborations and the co-ordination of research activities carried out at national or regional levels. The schemes are financed as part of specific programmes integrating and strengthening the European Research Area. They are represented by ERA-Nets and Joint Programming Initiatives (*more details on page 79*)

National funding
Over 76% of the EU budget is managed by National and Regional Authorities. This includes structural funds and agricultural subsidies. Moreover National Authorities also provide funding for strategic projects in the framework of national priorities.

Research goals addressing cross cutting issues

Project Idea	Activity type	Innovative activity	Time-scale	Budget	Participation	Beneficiaries	Funding Source
Improvement of soil management for enhanced carbon sequestration and minimisation of carbon footprint		Technology	Long term		Academia Producers	Producers Environment Society	Private or industry

The aim of the project is to examine the potential for enhanced carbon sequestration of good soil fertility management and cultivation techniques such as conservation tillage and crop rotations, including innovative green manuring systems. Special attention will be given to the effects of improving soil quality, soil biodiversity and crop rooting on the adaptive capacities of soils in organic farming systems. For more details consult TP Organics Strategic Research Agenda, page 24. ***Included in FP 7 call: KBBE.2011.1.2-01***

Management of habitats for biodiversity and ecological functions in agro-ecosystems at organic farm and landscape levels		Knowledge	Short term		Academia Producers	Producers Environment Society	National

The project aims to improve the management of functional biodiversity at levels of organization beyond the field. Research will focus on the linkages between farming systems, landscape factors, biodiversity and ecological functions in several European regions and in different annual and/or perennial cropping systems. For more details consult TP Organics Strategic Research Agenda, page 30. ***Proposed as high priority topic for 2012 (reformulated)****.*

Reduction of greenhouse gas emissions from organic and low external input livestock systems		Knowledge Technology	Short term		Academia Industry	Producers Environment Society	Private or Industry

The project will review existing research to develop a systems approach to assessing the impact of different organic and low external input production systems. For more details consult TP Organics Strategic Research Agenda, page 27.
Proposed as high priority topic for 2012*.*

European knowledge sharing and transfer platform for organic and low external input farming		Knowledge	Short term		Academia	Producers	EU

The main aim of the project is to build a European platform for sharing, transfer and exchange of scientific and technological knowledge in organic and low external input agriculture between research and all other actors, especially practical farming. For more details consult TP Organics Strategic Research Agenda, page 39. ***Proposed as high priority topic for 2012****.*

Assessing sustainable water management in organic farming systems		Knowledge	Short term		Producers	Producers Environment Society	EU

The project aims to establish, validate and implement a transparent assessment system for sustainable water management. For more details to consult TP Organics Strategic Research Agenda, page 35. ***Proposed as high priority topic for 2012****.*

Project Idea	Activity type	Innovative activity	Time-scale	Budget	Participation	Beneficiaries	Funding Source
Technology for generating environmental and socio-economic impact knowledge to support evidence-based decision-making in the organic food chain		Knowledge	Short term		Academia Market Actors	Consumers	Private or industry

The main objective is to enable decision making concerning organic food to be based on sound knowledge of environmental and socio-economic impacts. The project will develop a conceptual and practical framework for knowledge capture, collation, integration, dissemination and exchange, including integration of data concerning agricultural and alimentary processes from a variety of sources. It will set up systems that can handle large quantities of dynamically evolving data and present it in easily usable forms for various end-users including consumers. For more details consult TP Organics Strategic Research Agenda, page 41.

Organic farming in nature conservation areas		Knowledge Technology	Short term		Academia Producers	Producers	National

The project will identify the contribution of organic farming in the maintenance and improvement of nature conservation areas. For more details consult TP Organics Strategic Research Agenda, page 31.

Improving water use efficiency and reducing emissions of nutrients in organic greenhouse and horticultural production		Technology Knowledge	Short term		Academia Industry	Producers Environment Society	National

The project will develop and demonstrate the use of advanced equipment and strategies for irrigation management in combination with inputs and strategies for organic fertilisation and soil management, with the aim of decreasing water use (both per hectare of land and per kilogram of product) and the emission of nitrogen and phosphorus to surface and groundwater. For more details consult TP Organics Strategic Research Agenda, page 36.

Communication tools for ethical values of organic food in the supply chain		Knowledge	Short term		Academia Market Actors	Consumers Producers	Private or industry

The project will develop and test strategies for communicating the holistic concept of organic agriculture in simple and easily understandable ways. For more details consult TP Organics Strategic Research Agenda, page 40.

Organic farming for climate change mitigation and sustainable mixed food agro-energy supply		Societal	Long term		Academia Producers	Producers	EU National

In the production context, the project will focus on crop rotations and land use strategies from the farm to the landscape level, evaluating methods for minimizing climate footprint. In the food system context, the project will focus on defining climate friendly and organic diets. For more details consult TP Organics Strategic Research Agenda, page 25.

Research goals addressing cross cutting issues (continued)

Project Idea	Activity type	Innovative activity	Time-scale	Budget	Participa-tion	Beneficiaries	Funding Source
Towards zero fossil energy organic greenhouse horticulture		Technology Knowledge	Long term		Academia Producers	Producers Environments Society	EU National
The research project will develop a technically and economically feasible system of organic greenhouse production without CO2 emissions. For more details consult TP Organics Strategic Research Agenda, page 28.							
Reducing water consumption in organic farming systems		Technology Knowledge	Long term		Academia Producers	Producers Environment Society	EU National
The project aims to develop water-saving cultivation systems under organic farming conditions in different European regions. The project will include innovative irrigation techniques with decreased water needs and innovative machinery for water-conserving soil and crop management. For more details consult TP Organics Strategic Research Agenda, page 33.							
Evaluating the potential impact of organic farming to preserve water quality in Europe and developing countries		Knowledge	Long term		Academia Producers	Policymakers	EU National
The project will assess the potential of organic farming systems to: 1) minimize risk of water pollution; 2) contribute to safeguarding water quality. The project will help provide a scientific basis for the design of agri-environmental schemes targeting water quality in rural development plans. For more details consult TP Organics Strategic Research Agenda, page 34.							

Research goals related to Theme 1: Empowerment of rural areas

Project Idea	Activity type	Innovative activity	Time-scale	Budget	Participa-tion	Beneficiaries	Funding Source
Data network for better European organic market information		Knowledge	Short term		Academia Governments NGOs	Policymakers Producers Organic sector	EU
This project aims to increase the transparency of the European market for organic food through better availability of market intelligence by improving the collection, quality and publication of market data. For more details consult TP Organics Strategic Research Agenda, page 51. ***Included in FP 7 call KBBE.2011.1.4-05***							
Contribution of organic farming and agro-ecological methods to food security and rural development		Knowledge	Short term		Academia Producers NGOs	Producers in developing countries Consumers Civil society	EU Private
The research will investigate under which conditions dissemination of agro-ecological methods improves food security in all its dimensions. A trans-disciplinary project will integrate agronomic, biological, sociological and economic aspects through a combination of studies in case areas in Sub-Saharan Africa and South Asia. The possibilities for generalization and up-scaling will be tested through the use of appropriate models at regional levels. For more details consult TP Organics Strategic Research Agenda, p. 53 ***Proposed as a high priority topic for 2012*** *(reformulated).*							
Social sustainability impact of organic and low external input farms and supply chains		Social Organisational	Short term		Academia	Producers Policymakers Society	EU
Social sustainability comprises human capital, skills, entrepreneurial capabilities, social cohesion and quality of life in rural areas. Low external input and organic farms may enhance job satisfaction and quality of life, but sound and systematic evidence of this is still scarce, not least due to a lack of agreed-upon indicators. The project aims to develop reliable indicators of social sustainability and to assess the contribution that organic farming makes. For more details consult TP Organics Strategic Research Agenda, page 45. Proposed as high priority topic for 2012.							
Organic farming policies and climate change		Knowledge	Short term		Academia	Policymakers Producers	EU
The project will be based on an integrated impact assessment of organic farming's contribution to reducing greenhouse gases in the EU. To analyze different pathways of organic farming policy development in the context of the Common Agricultural Policy, the environmental impact assessment will be linked to Policy Impact Assessment Models covering the European dimension of the EU. For more details consult TP Organics Strategic Research Agenda, page 57. ***Proposed as high priority topic for 2012****.*							
The socio-economic impact of care farming in Europe		Social Organisational	Short term		Academia SMEs	Producers Society	EU Private or industry
The objective of the project is to provide information on the socio-economic costs and benefits of care farming for farmers, communities and the general public. More details consult TP Organics Strategic Research Agenda, page 47.							

Research goals related to Theme 1: Empowerment of rural areas (continued)

Project Idea	Activity type	Innovative activity	Time-scale	Budget	Participa-tion	Beneficiaries	Funding Source
Evaluation of the sustainability of local food		Social Organisational	Short term		Academia NGOs	Policymakers Consumers Civil Society	EU Trans-national
By identifying best practice examples from a range of product categories and supply chains, the project will identify critical control points for fairness, economic efficiency and environmental sustainability. For more details consult TP Organics Strategic Research Agenda, page 48.							
Innovative ways to implement key principles in organic standards and regulations		Social Organisational	Short term		Academia Organic Standards Control Bodies	Policymakers	EU Private
The translation of principles into certifiable practices remains challenging, particularly for more specialised production systems and for international trade. The aim of the research is to develop innovative ways to include key principles in organic standards and certification procedures. For more details consult TP Organics Strategic Research Agenda, page 50.							
Urban food production and gardening for food security and sustainable development		Knowledge	Long term		Academia Producers NGOs	Producers Consumers	Trans-national
The aim of the project is to evaluate the potential contribution of urban food production and gardening to food security and environmental health in Europe. For more details consult TP Organics Strategic Research Agenda, page 54.							
Sharing best practices to promote sustainable, large-scale transition to organic agriculture in the Mediterranean and Western Balkan regions		Knowledge	Short term		Academia Producers Organic sector	Policy Producers	Trans-national
The project aims to promote large-scale transition to organic farming and food production in European Mediterranean countries and the Western Balkans, with the focus being on policy and governance aspects to foster the sustainable growth of organic agriculture in particular regions. For more details consult TP Organics Strategic Research Agenda, page 55.							
Resilience and diversity of farming business models in the context of climate change		Knowledge	Short term		Academia Consul-tants Producers	Producers	EU
The project will reconceptualise the farm business as an embedded entity whose decisions and performance both influence and are influenced by the various networks (ecological, market, social) to which its components belong. By focusing on resilience and vulnerability questions the project will explore diversity as a new business model, including biodiversity, diversity of enterprises and diversity of success factors. For more details consult TP Organics Strategic Research Agenda, page 48.							

Project Idea	Activity type	Innovative activity	Time-scale	Budget	Participa-tion	Beneficiaries	Funding Source
Determination of reasons for re-conversion of organic farms to conventional agriculture and development of support measures to address these reasons and avert the need for re-conversion		Social	Short term		Academia Control bodies	Policymakers	EU

Re-conversion of organic to conventional agriculture has to be regarded as a policy failure and a failure of agricultural advisory services. It is a waste of know-how and financial resources invested in conversion. For more details consult TP Organics Strategic Research Agenda, page 58

Mutual benefits of organic agriculture and urban areas		Social	Long term		Academia Control bodies	Policymakers	Trans-national

The project will apply a systems level approach and will stimulate and develop multifunctional organic farms near urban areas. It will focus on the needs of urban areas and their townspeople and the contribution organic practices can make to meet these needs through urban agriculture. For more details consult TP Organics Strategic Research Agenda, page 46.

Research goals related to theme 2: Eco-functional intensification

Project Idea	Activity type	Innovative activity	Time-scale	Budget	Participa-tion	Beneficiaries	Funding Source
Breeding for within-crop diversity		Technology	Long term		Academia Industry	Policymakers Producers	Trans-national

There is a need to develop crops with traits specifically suited to organic production. The project will include field-level, regional and global analysis of the impact of lack of diversity in terms of economics and the spread of plants disease. Improving within-crop diversity is expected to yield innovative strategies for heightened resilience and genetic material for use in erratic climatic conditions and low external input ecosystems. For more details consult TP Organics Strategic Research Agenda, page 79. ***Partly addressed in 7th Framework Project "Solibam" – www.solibam.eu.***

Innovative forms of mixed farming for optimized use of energy and nutrients, with improved yields		Knowledge Technology	Short term		Academia Producers	Producers Policymakers Environment Society	National

The project will evaluate innovative ideas and develop new strategies to connect livestock and crop production at farm, district and landscape levels in order to optimise energy and nutrient flows while preserving natural resources and maximising production. Profitability, socio-economic aspects of collaboration models and implementation potential in different systems (organic, low external input, integrated, etc.) across Europe will be assessed. For more details consult TP Organics Strategic Research Agenda, page 66. ***Called in FP7:KBBE.2011.1.4-07***

Integrated disease management strategies for organic livestock		Technology Knowledge	Short term		Academia SMEs	Producers Animals Consumer	EU Private or industry

Organic livestock farming deploys strategies to support general health and welfare. Nevertheless, there is still a need to reduce the input of chemical synthetic drugs in European organic livestock production systems. Integrated strategies for addressing health problems and diseases should combine animal welfare promotion (through well designed management and housing systems including access to range) with disease prevention and targeted treatment. The research should focus on species and disease challenges that have received less attention in research, such as small ruminants and beef systems. For more details consult TP Organics Strategic Research Agenda, page 71. ***Proposed as high priority topic for 2012 (reformulated).***

Assessment of organic aquaculture for further development of regulatory framework		Knowledge Technology	Short term		Academia NGOs	Consumers Policymakers Producer	Trans-national

Organic aquaculture is a relatively young market segment which as of 2009 is regulated at the EU level (EC Reg 710/2009). Research is needed to support a possible revision of this regulation planned for 2013. Impact assessments of different organic aquaculture production systems and management strategies, nutritional resource utilisation, fish welfare and the environmental impact of different fish species and production sites are needed. For more details consult TP Organics Strategic Research Agenda, page 73. ***Proposed as high priority topic for 2012.***

Project Idea	Activity type	Innovative activity	Time-scale	Budget	Participation	Beneficiaries	Funding Source
Improved use of ecological support functions for resilient organic and low external input crop production		Knowledge Technology	Short term		Academia Producers Environment	Producers Policymakers	Trans-national

Research should improve the use of functional biodiversity and environmental diversification through novel cropping systems (intercropping, crop rotations and companion crops) and proper management practices (soil, nutrient supply, nutrient losses as well as weed, pest and disease management). Research should improve the farming design to combine productive and non-productive areas and then to improve crop performance by the use of natural resources. Research should focus on a major annual cropping system (e.g. cereals, and/or vegetables) and a perennial one (e.g. fruit production) under different European conditions in order to obtain workable results to be extended afterwards to other systems. For more details consult TP Organics Strategic Research Agenda, page 60. ***Potentially partly addressed in CORE Organic II funding in 2011.***

Soil disease suppression in organic farming as alternative to off-farm inputs		Knowledge Techno-logy	Short term		Academia SMEs	Producers	Trans-national

Organic production systems rely to a large extent on internal mechanisms for sustaining soil health and productivity. The aim of the research is to direct soil towards natural suppression of soil borne diseases. It will lead to the development and use of models linking soil biodiversity with plant rooting and plant growth, with the aim of improving crop health and productivity at the same time as sustaining soil fertility. For more details consult TP Organics Strategic Research Agenda, page 62. ***Proposed as high priority topic for 2012.***

Designing resilient cropping systems for organic fruit production		Knowledge Technology	Short term		Academia Producers	Producers Consumers Environment	EU Trans-national

The project aims to fulfil needs for cultivars with low disease susceptibility, for cropping systems of high resilience, and for optimised ecological support functions that enhance biological control for limiting pests and diseases. The research will help to reduce dependency on pesticides permitted in organic farming and thereby will improve the long-term sustainability of organic fruit growing systems. For more details consult TP Organics Strategic Research Agenda, page 64. ***Potentially partly addressed in CORE Organic II funding in 2011.***

Enhanced sustainability through innovative nutrient sources and recycling		Knowledge Technology	Short term		Academia SMEs	Producers Environment	EU Private or in-dustry

The agricultural use of organic matter and nutrients from sources outside agriculture is a subject which has not been much researched. Taking into account the degradation of soils and our limited sources of phosphorus and potassium, there is a need to research the feasibility of short and long term use in agriculture of a wide variety of industrial and societal waste products. The project will focus on regional solutions with local consumption of waste resources. For more details consult TP Organics Strategic Research Agenda, page 63. ***Potentially partly addressed in CORE Organic II funding in 2011.***

Research goals related to theme 2: Eco-functional intensification (continued)

Project Idea	Activity type	Innovative activity	Time-scale	Budget	Participation	Beneficiaries	Funding Source
Innovative outdoor pig systems: sustainable strategies to increase pig welfare and longevity		Technology Knowledge	Short term		Academia Producers	Producers Animals Consumers	National
In organic outdoor pig husbandry, major challenges include: how to ensure adequate rotation; how to ensure that natural behaviours can be expressed; how to increase longevity; and how to improve biosecurity in disease management. For more details consult TP Organics Strategic Research Agenda, page 73. ***Potentially partly addressed in CORE Organic II funding in 2011.***							
Designing resilient cropping systems for pest and disease control		Technology Knowledge	Short term		Academia SMEs	Producers	Trans-national
Pests and diseases such as aphids, whiteflies, botrytis and downy mildew are an enormous threat to organically produced fruits and vegetables. The project aims to design resilient cropping systems that maximize the use of ecological support functions to suppress horticulture pests and disease and enhance biological control. For more details consult TP Organics Strategic Research Agenda, page 61.							
Implementation of organic principles at landscape level: organisational and regulatory constraints and needs		Knowledge	Short term		Academia Others	Policymakers	Trans-national
The project will provide guidance on how to overcome organisational, regulatory, legal and fiscal obstacles to implementing organic farming principles at landscape level. For more details consult TP Organics Strategic Research Agenda, page 69.							
Developing alternatives to critical inputs in organic farming systems		Technology Knowledge	Short term		Academia SMEs	Producers	EU
Current organic practices often include use of inputs such as copper and sulphur to prevent fungal diseases and use of manure from non-organic farms. Such practices reduce consumer confidence in organic farming. The aim of the project is to develop alternative methods and inputs to reduce the severity of pest and disease attacks while improving and reinforcing the self-defence capacities of crops. An additional topic will be better nutrient management to reduce the need for conventional manure and slurry. For more details consult TP Organics Strategic Research Agenda, page 65.							
Development of organic poultry systems which combine high animal welfare and ethological needs with environmental sustainability		Technology Knowledge	Short term		Academia Producers	Consumers Animals Environment	Trans-national
The aim of the project is to balance animal health and welfare factors on the one hand with negative effects on the environment on the other, to generate best practice guidelines for organic poultry production. In particular, the project will focus on developing methods for minimising the mineral impact of manure on outdoor runs and on elucidating the relationship between quality of organic poultry feed, animal health and behaviour, and product quality. For more details consult TP Organics Strategic Research Agenda, page 74. ***Potentially partly addressed in CORE Organic II funding in 2011.***							

Project Idea	Activity type	Innovative activity	Time-scale	Budget	Participation	Beneficiaries	Funding Source
Sustainable feeding of organic fish: nutritional, environmental and welfare aspects		Technology Knowledge	Short term		Academia SMEs	Producers Environment	Trans-national

Research will deal with topics such as improved utilisation of plant nutrient sources in organic fish feed, evaluating productivity, physiological health and welfare as well as environmental protection. The end goals include reduction and optimised use of of marine resources in organic aquaculture feed with respect to metabolic programming, optimum fish development, physiological performance and product quality, as well as improved management of organic fish farming systems taking into consideration nutritional and physiological welfare. For more details consult TP Organics Strategic Research Agenda, page 91. ***Potentially partly addressed under CORE Organic II funding in 2011.***

Mixed livestock systems for improved farming and food system resilience		Techno-logy Knowledge	Short term		Academia Produ-cers	Producers	Trans-national

The project aims to identify, explore and assess different pathways to more robust and resilient livestock systems which include more species within the same farming system and in this way utilise and exploit the potential synergies between them, at the same time as exploiting all aspects of the farm and its different enterprises. For more details consult TP Organics Strategic Research Agenda, page 75.

Genetic improvement of minor (less frequently grown) crops to improve food security and agricultural biodiversity		Technology	Short term		Academia SMEs	Producers Sociey	EU Trans-national

It is essential in organic farming to promote diversity within the cropping system in order to stabilise yield and quality. Therefore, there is a need for a revival of less frequently grown crops, locally important crops and fruits, and crops for specialist purposes. The project aims to collect and characterise available germplasm of underutilized crops in different geographic regions and to develop efficient breeding and optimized selection methods with special emphasis on yield stability and quality. For more details consult TP Organics Strategic Research Agenda, page 81.

Breeding of varieties with improved rhizosphere development and activity for organic and low external input food production		Technology	Short term		Academia Industry	Producers	EU Trans-national

The project has several goals: to identify genotypic effects in crop plants' abilities to sustain beneficial microorganisms; to quantify the impact of plant-soil microbial interactions on plant nutrition, plant health and yield under organic farming conditions; and to validate under different pedo-climatic and agronomic conditions the most efficient methods to identify and breed for varieties with improved rhizosphere competence. For more details consult TP Organics Strategic Research Agenda, page 82.

Research goals related to theme 2: Eco-functional intensification (continued)

Project Idea	Activity type	Innovative activity	Time-scale	Budget	Participation	Beneficiaries	Funding Source
Novel tools and strategies for efficient weed management		Technology	Short term		Academia SMEs	Producers	Private or industry

Inadequate management of weeds is one of the most significant factors in yield reduction in organic crop production. The project will aim to improve weed management techniques. Strategies and tools for improved weed management will be evaluated according to multiple criteria: agronomic; economic; social; energy consumption; greenhouse gas emission; and impact on soil structure and fertility. For more details consult TP Organics Strategic Research Agenda, page 84.

Physical control of pests		Technology	Short term		Academia SMEs	Producers	Private or industry

The aim of the project is to test and develop different possibilities for physical pest control. For more details consult TP Organics Strategic Research Agenda, page 85.

Combining field crop diversity with novel technologies		Technology Knowledge	Short term		Academia Industry	Producers Environment	Private or industry

There are many novel technologies, such as GIS, GPS, crop and landscape modelling, computer vision and automation, which have potentially valuable applications in organic farming systems, where crop diversity is acknowledged as a crucial instrument to achieve stable yields, quality and other benefits. Their potential, however, has so far been little explored. The research will promote and encourage communication between interdisciplinary research institutions, end-users like farmers, and manufacturers of various technologies. For more details consult TP Organics Strategic Research Agenda, page 86.

Innovation in sensors and automation for organic livestock production		Technology	Short term		Academia Industry	Producers	Private or industry

Sensor technology and automation help farmers to enhance animal welfare and increase profitability through greater animal longevity, while lowering veterinary costs and increasing the efficiency of feed, energy, and labour. These technologies can also facilitate management of larger herds and improve product quality. The project aims to develop and assess novel technologies with respect to ecological, economical and social sustainability criteria. For more details consult TP Organics Strategic Research Agenda, page 87.

Assessment and sustainability of novel technologies for organic agriculture		Social and societal	Short term		Academia Others	Policymakers	Trans-national

Present crop production technologies are not always adapted to organic crop production principles. Research into such issues as maintaining rational production methods, enhancing yield and product quality, or minimising resource inputs in organic farming will assess the potential of advanced technologies applied in conjunction with optimised management practices. Current technical innovations supporting farming tasks will be assessed, and terms of reference for developing future technical solutions will be identified. Research will evaluate novel scalable technologies. For more details consult TP Organics Strategic Research Agenda, page 88.

Project Idea	Activity type	Innovative activity	Time-scale	Budget	Participation	Beneficiaries	Funding Source
Alternative raw-material sources for aquaculture feeds from integrated by-products management		Technology	Short term		Academia SMEs	Producers	EU Private or industry
The project will focus on alternative raw material sources for aquaculture feeds. Systems need to be developed for exploiting integrated by-products, converting the recyclable fraction of agricultural and food processing operations into valuable feedstuffs. Combined action of engineering and biotechnological sciences will lead to effective and economically feasible processes and competitive products. For more details consult TP Organics Strategic Research Agenda, page 92.							
Organic seaweed: sustainable harvesting methods and management systems		Technology	Short term		SMEs	Consumers	EU Private or industry
The project aims to undertake annual monitoring of approaches applied in different European regions with regard to: 1) sustainable harvesting of wild seaweed, and 2) the management tools set up by different stakeholders. For more details consult TP Organics Strategic Research Agenda, page 93.							
Development of on-farm livestock and plant breeding integrating modern technology		Technology	Long term		Academia SMEs	Producers Policymakers	EU Private or industry
There is a need to improve crop varieties and animal breeds adapted to organic farming conditions, especially with respect to low levels of external inputs. Research will include assessment of the value of traditional and modern genetic resources within plants and animals, with special emphasis on robust and multifunctional traits. It will also address the development of a more appropriate regulatory framework. For more details consult TP Organics Strategic Research Agenda, page 78.							
Improvement of production efficiency in organic and low external input farming systems through multidisciplinary breeding approaches		Technology	Long term		Academia Industry	Producers Environment Society	EU Trans-national
Sensor technology and automation help farmers to enhance animal welfare and increase profitability through greater animal longevity, while lowering veterinary costs and increasing the efficiency of feed, energy, and labour. These technologies can also facilitate management of larger herds and improve product quality. The project aims to develop and assess novel technologies with respect to ecological, economical and social sustainability criteria. For more details consult TP Organics Strategic Research Agenda, page 87.							
New peri-urban mixed organic farming systems based on combinations of greenhouse, open field and livestock production, with improved energy and nutrient cycles		Knowledge Technology	Long term		Academia SMEs	Producer Consumers Environment Society	EU Private or industry
The aim of the project is the development of new mixed organic and low external input food and farming systems in peri-urban areas benefiting from proximity to consumers, with improved recycling of energy and nutrients. The project will lead to new mixed production systems that produce organic food in the vicinity of metropolitan areas based on small-scale innovative technologies. For more details consult TP Organics Strategic Research Agenda, page 68.							

Research goals related to theme 3: Food for health and well being

Project Idea	Activity type	Innovative activity	Time-scale	Budget	Participation	Beneficiaries	Funding Source
Effect of organic and non-organic foods on risk and severity of allergies and on general health and well-being in children		Knowledge Social	Short term		Academia	Policymakers Consumers	EU

Allergies affect many people and the number of sufferers is rising (some estimates suggest that up to a third of Europe's population is affected). Research is needed in the form of a long-term intervention study with children, to compare organic with non-organic foodstuffs in their effects on risk and severity of allergies and on general health and well-being. Defined biomarkers and techniques from the social sciences should be used. For more details consult TP Organics Strategic Research Agenda, page 104. ***Proposed as a high priority topic for 2012****.*

Development and validation of image creating methods and their standards for assessing quality of vegetables, grains and processed foods		Technology Knowledge	Short term		Academia	Producers Processors Consumers	EU

The aim is to further develop complementary image creating methods to assess food quality, probing for the presence or absence of scientific evidence differentiating organic from non-organic food. Research will validate laboratory standards for these methods. These complementary quality testing methods are innovative in being better able than standard chemical analyses to represent the effects of the systems approach of organic food production. Quality assessments must be related to EC 834/2007 food quality definitions (Article 19, §6c, d), such as of levels of vital quality and organic integrity. Standards need to be developed for various food product types: for vegetables and grains in the short term and for milk and other products in long term. For more details consult TP Organics Strategic Research Agenda, page 96 and 97. ***Proposed as a high priority topic for 2012*** *(reformulated).*

Processing with care: development of a Code of Practice for organic food processing		Technology	Short term		Academia	Producers Processors Consumers	EU

The project will develop criteria to evaluate the principles of organic integrity, vital qualities and the true nature of the product. Existing processing techniques will be evaluated at critical control points for the most relevant product groups. A Code of Practice for processing with care for the most relevant plant product groups will be developed to serve as a support document for the certification process. For more details consult TP Organics Strategic Research Agenda, page 100. ***Proposed as a high priority topic for 2012****.*

Development of more natural functional ingredients or new technologies to improve organic food quality and replace additives for a broad range of product groups		Technology	Short term		Academia	Producers Processors Consumers	EU

Possibilities for replacing additives with functional ingredients or new technologies should be evaluated. Food products and raw materials with promising properties or new technologies will be tested in collaboration with organic processors and the food additives industry. Functional ingredients should be developed and tested for specific uses, and the necessary adaptation of connected processing techniques should be evaluated. For more details consult TP Organics Strategic Research Agenda, page 97. ***Proposed as a high priority topic for 2012****.*

Project Idea	Activity type	Innovative activity	Time-scale	Budget	Participation	Beneficiaries	Funding Source
Development of tools/methods to differentiate between organic and conventional products		Technology	Short term		Academia Industry	Industry Control bodies Consumers	EU

Often, consumers expect a difference between organic and conventional products. Whereas production methods are regulated in EC Regulation 834/2007 and EC Regulation 889/2008 for organic production, the presence or absence of distinctive quality characteristics in end products should be investigated; from both consumer and market chain perspectives, there is a need to develop methods for authentication in this area. For more details to consult TP Organics Strategic Research Agenda, page 98.

Quality analysis at critical (control) points in processing, and development of technologies for safeguarding quality at crucial stages in processing		Technology	Short term		Academia	Producers Processors Consumers	EU

The research will further develop the QACP instrument for the typical quality analysis needs of different product groups. For more details consult TP Organics Strategic Research Agenda, page 101.

Identification of appropriate biomarkers through animal feeding studies to evaluate health effects from consumption of food from different production systems		Knowledge Technology	Short term		Academia	Policymakers Consumers	EU

Biomarkers so far used in food studies are typically disease markers, whereas the focus here will be on defining subtle health markers like resilience, robustness and long lifespan. For more details consult TP Organics Strategic Research Agenda, page 103.

Observational studies isolating and evaluating the effects of organic food consumption on specific health problems		Societal	Short term		Academia	Policymakers Consumers	EU

This research will investigate health effects of organic food consumption on groups with specific health problems, controlling for relevant life style factors. The two groups and the health problems to be examined are as follows: 1) children of primary school age, to be studied with respect to the development of allergies and obesity; 2) identified cancer risk groups and diagnosed cancer sufferers, to be studied with respect to the development of the disease and quality of life. For more details consult TP Organics Strategic Research Agenda, page 106.

Nutrient availability in organic and non-organic foods; effects of these foods on health and well-being of adults		Knowledge	Long term		Academia	Policymakers Consumers	EU

There is a need for controlled intervention studies with adults to compare foods from organic, high external input and low external input production systems with respect to their nutrient availability and their effects on the development of health markers. This project will use biomarkers (including traditional disease risk biomarkers), new exploratory analyses and techniques from the social sciences for assessing well-being. For more details consult TP Organics Strategic Research Agenda, page 105.

4. A participatory model for knowledge generation and knowledge exchange

A key objective of TP Organics is that research in organic food and farming systems generates output of relevance to a wider user ship, i.e. that it is useful not only to organic and other farmers, businesses, consumers and other stakeholders, but also to civil society at large and policymakers. In the first instance, it explores the relationship between the research method, the application of the knowledge generated, and the final outcomes. In the previous chapter, the discussion of Know-how Innovations revealed that the way in which knowledge is generated and applied to achieve desired social, ecological or economic outcomes can itself be an innovation. This chapter considers different models to organise the whole research process from priority setting, over approaches to conducting research and finally disseminating results and contrasts the respective contributions of 'top-down' and 'bottom-up' approaches in developing responses to the grand challenges. The chapter thus explores how research processes in the field of organic food and farming can create value within the sector and beyond the sector's boundaries.

Organic farming relies on appropriate design and management of biological systems using natural resources and very restricted use of external inputs. Utilisation of natural cycles and ecological support functions both local and landscape-wide, and site-specific adaptation of practices are crucial to success. Management must be planned and preventive as opposed to reactive and curative (where reliance on the prescriptive use of external inputs tends to be higher), which requires meticulous and detailed observation. The challenge for research is to clearly distinguish between what knowledge can and cannot be generalized beyond the specific circumstances.

Driving innovation for the development of the organic sector will require the intelligent integration of sources of knowledge – research and development – and its users – producers, processors, consumers and so forth. Models of knowledge generation and management must be suitable for the sort of systems and supply chains represented in organic production. They must be dynamic, respect and bear out the organic principles, and involve end-users.

Arguably, the most successful innovations arise from research approaches that engage all the main actors and the end users in the research. End-users of organic sector research efforts include farmers, SMEs involved with organic food production, consumers, and also civil society organisations and policymakers.

This chapter begins by exploring different models of knowledge generation followed by a review of the roles of participatory research in farming with different levels of involvement. Based on this necessary steps of institutional learning in moving towards a participatory model of research are outlined and some criteria to monitor participatory projects are proposed. The second part of the chapter returns to the issue of a developing a knowledge management strategy for the organic sector

(*see Schmid et al. 2009 page 38-42*) and present a brief descriptive analysis of the current state of the organic farming knowledge system in Europe before conclusions are presented.

4.1 Different models of knowledge generation

Traditionally, research programmes are concerned with activities that generate new knowledge which may then be published in scientific journals and/or feed into an innovation process leading eventually to patenting[39] or a change in industry practice. European agricultural research is currently not delivering the full complement of knowledge needed by needed by actors and stakeholders of the agricultural sector and in rural communities. There are two obvious reasons for this:

- Research policy failures, such as lack of stakeholder involvement at the stage of identifying research priorities or in the research process itself.
- Knowledge exchange failures due to lack of ownership, relevance or dissemination of research conducted.

This has resulted in a large body of research material being produced that is neither relevant to end users nor even made available to them. This situation repeats itself within the organic sector (*see TP Organics SRA p. 38-42*).

Traditional research approaches generally utilise a top-down model, based on a clear boundaries between those undertaking the research (mainly scientists) and the recipients or end-users of the information coming from the research. This model of research and technology transfer needs to be radically changed if the sustainability and rural development goals identified by IAASTAD 2009[40] and in Anon 2001[41] are to be achieved.

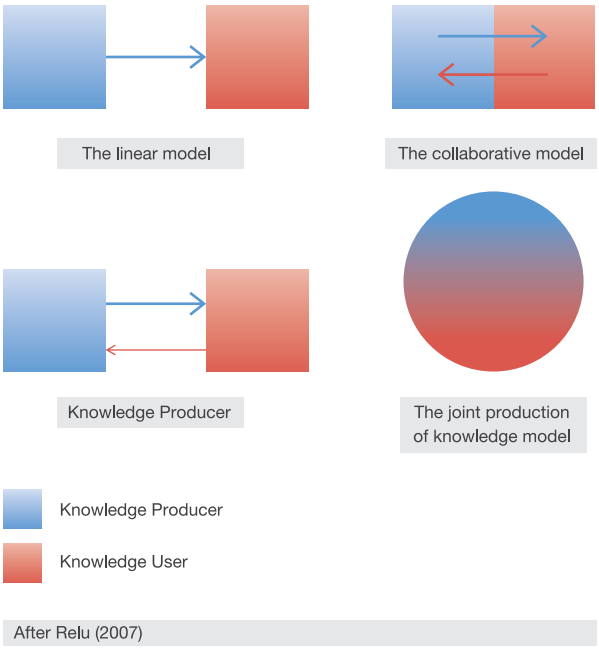

Figure 6: Model of research and knowledge transfer activities

Four approaches to research and knowledge transfer activities can be distinguished[42]: (*see figure 6*)

1. The linear model assumes that users passively receive knowledge, whether as technological products or training.
2. The feedback model instigates a dialogue between knowledge generation (i.e. researchers) and knowledge users who can

give feedback on the outcomes of research but not the process itself.

3. The collaborative model is a more integrated approach that puts knowledge generators and users alongside each other and allows them to communicate about problem framing, research methods, context and site-specific conditions and dissemination of research outcomes.
4. The joint production of knowledge model transgresses the boundary between knowledge generators and users, so that *all* partners involved may be undertaking research. Expertise is sought in multiple forms from academics, practitioners, businesses, land managers and the public, all of whom can make valuable contributions to knowledge production. There is an emphasis on how scientific and non-scientific knowledge can be mutually enriching. The joint production of knowledge model underlines the need to move from ideas about one-way "knowledge transfer" to mechanisms that will facilitate "knowledge exchange" in networks. This model is also known as "participatory research."

Also the organic sector in Europe needs to move towards a process where knowledge flows through a web of equitable exchanges among the actors involved. Such a change brings complex challenges for organic research. The focus should be on supporting learning by all actors, based on the experience of discovery that nurtures intrinsic motivation, rather than on developing and imparting blueprint solutions. Methods and approaches need to be appropriate to the questions asked, and there is a need for constant mindfulness of keeping research outcomes relevant to the end user and society whilst at the same time maintaining credibility and methodological rigour.

In this context, the diversity and multi-functionality that are core strengths of organic farming become obstacles. The European organic sector is characterised by diverse geo-graphical conditions in terms of soils and climate, by differences in access to markets and inputs, diversity of culture and in traditions, and differences among people in terms of personal ambitions and business goals. All this makes it difficult to distinguish between knowledge that is generic, i.e. relevant to the whole sector, and knowledge that is specific. Moreover, different levels of specificity must also be distinguished: specific to one farm? to the supply chain? to one region?...

Systems thinking in agriculture and farming systems research

Systems thinking in agricultural research is related to the belief that change in agriculture cannot be understood in isolation but is inextricably linked to other developments in the environment and in society.[43]
A system is a construct with arbitrary boundaries for discourse about complex phenomena to emphasise wholeness, interrelationships and emergent properties[44].

Systems theory (or systems thinking) provides concepts and tools to better understand complex developments in agriculture and society.
Systems research traditions can be divided into 'hard' (systems as they are presumed to exist in nature) and 'soft' (human activity is a strong influential force). Most agricultural systems research focuses on the bio-physical and ecological aspects of the farm and belongs to the 'hard' systems tradition, such as agricultural systems analysis. In contrast, Soft Systems Methodology[45] and Farming Systems Research (FSR) argue that research should consider the social, cultural, ecological and economic context.[46, 47]
The different traditions are also referred to as systematic and systemic approaches. A systematic approach emphasises objective measurements, quantification, reductionist thinking and mechanistic synthesis. The observer does not affect the 'clockwork', but 'he' knows what happens anywhere if one part of the system is changed. Parts can be studied in isolation and they can be engineered to 'control' the future.
A systemic approach assumes that the observer is part of the system through the choice of parameters and methods made. It stresses change in and around a system, as well as the need to include qualitative aspects of the mind in addition to 'hard facts' about matter. Indeed, systemic approaches stress that, for example, the direction of agricultural development depends on whether the researcher chooses to include non-physical aspects of farming and/or different perceptions of reality such as those of agro-industry, politicians or organic farmers.
Schiere et al. (2004)[19] refer to the division between hard and soft research traditions as the "gap between matter and mind". Much agricultural research focuses on biophysical entities (matter) that can be quantified, thus leaving qualitative, intangible and psychological (mind) effects exclusively to considerations of society and politics. At the same time, many socially oriented disciplines have difficulty in understanding and/or accepting the importance of physical laws.
According the International Farming Systems Association (IFSA), farmer participation is crucial to a well applied farming systems research approach.[48]

4.2 The role of participatory research in farming

The basic idea of participatory research is that farmers and professional researchers have different knowledge and skills, which may complement each other and that by working together the two groups may achieve better results than by working alone. (Hoffmann et al. 2007, p. 355)[49]
Participatory approaches have been spreading, thanks to a growing number of successes with farmers in developing countries and in countries where agricultural production is not supported by government such as Australia.[50, 51, 52, 53, 54] In facilitating ecological knowledge systems, the emphasis of research should shift from developing technologies for farmers to working with farmers.[55]
In European agriculture, participatory research has been less widely used, but the second SCAR foresight study acknowledges the importance of such 'niche' experiments in developing profoundly

creative, step-wise mitigation and adaptation strategies against climate change.[56]

Recent examples of participatory work in the organic farming sector in Europe exist in crop experimentation and breeding,[57, 58, 59, 60, 61] in relation to weed management,[62] and in relation to animal production where there has been work on breeding strategies,[63] milk quality evaluation[64] and herd health.[65] Participatory research approaches are often seen as effective means of enhancing end-user learning and instigating change in the relationship between the researcher and the end user.

Farmers, processors and other actors throughout the food chain are experimenting regularly and are generating innovations, and have done so since agriculture began.[66] Indeed, organic food and farming as a system represents one example of bottom-up innovation. Some bottom-up initiatives involve formal research partners and/or public or private organisations, while others are embedded in civil society networks and movements of varying scale.[67] Such processes tend be less formalised, and scientists will consider them as having limited rigour.

Stated advantages of participatory research include recognition of the importance of local knowledge, enhancement of local capabilities, and accommodation of diversity and complexity. Farmer decision making processes, including their willingness to make changes to their farming systems and adopt innovations, are influenced by a wide range of factors: personal attitudes towards the environment, social factors and professional relationships, agricultural policy, farm natural resources and profitability all play a significant role.[68, 69, 70, 71, 72] Participatory research processes such as farming systems research enable all these drivers to be taken into account when setting research agendas and also help to facilitate the farmer's adoption of research and innovation. Farmers bring experience from their lifelong work on one complex farm experiment, which leads to a largely tacit body of knowledge. There is an ethical argument that stakeholders should be involved in research that is likely to have social and financial impacts on them. This requires the utilisation of group approaches, and encouragement of producer ownership of the problems and solutions.[73]

The majority of participatory work has focused on agricultural production, but the model is equally suitable for other parts of the supply chain and for rural development issues. Such work would extend participation to a wider range of actors and would make the process more complex and challenging, but even so, it should not be shied away from.

It also necessary to reflect on potential disadvantages of participatory methods. The most common concerns relate to, "Who is in charge?" as no single group among the end users, researchers or funders can make decisions alone. There is a need for flexibility in project funding applications to allow for genuine participation of stakeholders in identifying research questions and scoping the research activities to take place. Research funding bodies are often hesitant to fund projects which

do not present detailed research plan with methods related to specific research objectives, even though the same funding body in their guidelines may demand extensive dissemination efforts aiming at high impact. Therefore, proposals building on participatory research methods need to engage with stakeholders well in advance of proposal formulation and to define researchable questions, so that a number of well defined research activities may be described in the application phase.

Problems can also arise in the operational phase. Managing projects with multiple stakeholders and multi-functional outputs may be complicated by the following factors: very different expectations of end users/stakeholders versus researchers; underestimating the time needed for active engagement; different opinions on what data can and cannot be delivered; and who owns any IP that might be generated. Some of this can be attributed to the present lack of institutions fostering rigour in participatory and systems research. However, there are other background reasons. For example, it is often a challenge that farmers and researchers have different motives and interests in the research activities, which have to be openly addressed in the negotiation phase. Farmers may be satisfied once they personally feel they have learned which experimental interventions will work and which not within their systems and may lose interest in experiments before researchers have had time to record enough data for reliable data treatment required for publication in journals.

4.3 Different levels of involvement

Models differ in the level of input from participants in the research process (*see also Figure 6*). In this discussion 'the farm' is usually used as a default example, but participatory research can be undertaken throughout the supply chain with a range of actors and end users; 'the processor plant' (particularly the SME companies), for example, could be substituted for 'the farm'.

On-farm research is a methodological choice where data recording will happen on private farms. This can be achieved through a study of production carried out according to usual farm practice, or the establishment of interventions (test of management plans), or controlled experiments. Thus, the research is shaped by the specific conditions of the farm where it is run, a context which includes farmer needs, demands and potential solutions. Data are then compared with those recorded on other farms if there has been a study of farm practice, or otherwise processed according to possibilities for decontextualising and extrapolating for application and learning to a wider set of conditions/farms. This is the exact opposite of a conventional approach where often generalised research findings are applied in specific farm context. An example of on-farm research is a randomised field trial on a farm site. The work is managed and controlled by the researchers but with some input of the end user (in this case, the farmer). The basic research question and the applicability and flow of the outcomes are improved through the farmer's involvement, providing an

example of how the collaborative model can work.

In participatory on-farm research (also referred to as 'action research' or trans-disciplinary research) the researcher participates in the farm process under investigation. The farmer reveals his/her tacit knowledge through dialogue with the researcher. The research process is complemented through observations and experiences of the working farm, or the farm organism. The assimilation of the knowledge gained from the site-specific research is utilised by the actors (farmer and researcher in this case) to become more expert in the areas addressed, and later in their passing on this expertise through farming practice, further research or other knowledge transfer processes.

Due to the context dependency and holistic nature of participatory on-farm research, the problems in focus will often require contributions from several knowledge disciplines, generally including soil, plant and animal science as well as economics. Trans-disciplinary research breaks down interdisciplinary boundaries to create a holistic approach, and allows people to design research appropriate to their own needs and local conditions. A critical step is the first contact with farmers when the researcher should be able to establish relationships where partners have equal rights. This is achieved by listening to farmers (and not only talking to them, too often taken to be a sufficient manifestation of farmer participation), and even more, by being prepared to accept their opinions, suggestions and criticisms. The research question and design can change during the process. At the same time, co-research activities should be designed to strengthen the farmer's experimentation skills.[74,75]

4.4 Working towards a participatory research model for the organic sector in Europe

TP Organics believes that the organic sector needs to work towards models with closer links between researchers and end-users, using collaborative and joint production of knowledge approaches. This would make joint knowledge production more commonly included as a standard element among a raft of research approaches, but would require some changes:

- Researchers and research funders dealing with the organic food and farming sector have to ensure that research is addressing end users' needs. For this to occur successfully, end users must be part of the research process as opposed to being seen as passive recipients of its end products. Institutes and researchers who have undertaken participatory research (particularly the collaborative model and joint production of knowledge model) have had to go through a considerable amount of institutional learning.
- A wide range of stakeholders involved in the organic food and farming sector are potential end-users of research, and their needs should be considered. This includes producers (farmer and growers) but also processors, market partners, consumers, control bodies, civil society organisations and governments.

Participatory or experiential science; towards an integration of 'hard' science and practitioner-expert knowledge

For the further development of organic/sustainable farming, it will become increasingly essential to integrate experienced, innovative practitioners into research projects, as this will increase the possibilities for translation of research results into practice. Integration of such practitioners will, however, require a process of co-learning by researchers as well as practitioners. Unlike researchers, practitioners are bearers of implicit, tacit knowledge, based on substantial, long-term and reflected experience which functions in a rather intuitive process. The characteristics of a successful process of integration of researchers and practitioners into a so-called 'experiential science' are described by Baars (2010).[1] The process integrates social sciences, natural sciences and human sciences. In a dialogue-based culture of equality and mutual exchange, the principle of a 'bottom-up' experiential learning process can be stimulated and become fully reflective, making possible a synthesis of different approaches to research: quantitative and qualitative, subjective and objective, reductionist and holistic, practical and scientific. This synthesis and the experiential learning associated with it provide the opportunity to develop best multiple best practises in organic/sustainable agriculture, based on trans-disciplinary projects, case studies and case series.

- Stakeholders need to be involved as true equal partners at all stages of the research process: identification of knowledge and innovation needs (where stakeholders should be represented on committees defining research and innovation programmes); scoping of the research activities; engagement with the research and implementation; and adoption of outcomes. Stakeholders should be aware of the methodologies used and why they were chosen. Such close engagement requires stakeholders' time, for which they should be appropriately remunerated.
- In developing more sustainable systems, there is a need to accept that there is no 'one size fits all' research model. Research needs to consider the specific site and context of the system in which the work is done, for a 'tailor-made' approach in line with farming systems research theory.
- Participatory research as such may not be the most appropriate method for all areas of research (lab work, for example, may not benefit from it), but a joint knowledge model should ensure that outcomes of any research are relevant to its specific end users.

4.5 Criteria for success of participatory research

Criteria for success of participatory research must be different to success criteria of more traditional scientific approaches. Currently, scientific success is judged mainly through publication in peer reviewed scientific journals and through recognition from colleagues. Scientific peers exchange ideas about respectable and rigorous research methods and offer insight into donor policies to help each other obtain funding. Indeed, donors' funding criteria often end up being more relevant to the researcher than generating results applicable on the farm.[76] To ensure wide dissemination of results in the sector, this dominant paradigm of scientific success has to change and the balance to be redressed between successful publications (which do need to be made) and the generation and uptake of applicable results

that make a real difference to the systems that are being studied. In the 7th Framework Programme, the EC has made considerable effort to involve SMEs in research activities, as representatives of end users. This is a welcome development, although the administrative hurdles for SME active participation are considerable.

TP Organic believes that participatory processes are important in ensuring that more sustainable farming practices become more widespread in the future in line with ISTAAD's assertion that "business as usual is no option"[77] and proposes three elements to defining their success:

- Farmers and other stakeholders are satisfied with their participation and make full use of the results;
- The results allow farmers (and other stakeholders) to keep their independence and their sovereignty of knowledge and property rights;
- There are real improvements of the system in terms of sustainability.

Further indicators of success could include stakeholder involvement, the direct effects of the project on immediate beneficiaries, and also any indirect effects on the whole sector or on wider public policy goals in areas such as environmental protection, public health or animal welfare.[78]

The ideal of true equality in the overall research process should not mask the fact that the stakeholders will contribute to and be responsible for specifically defined parts of the knowledge generation in accordance with the nature of their roles and competencies. For example, farmers and advisors should be involved in defining research needs from observed problems, challenges and potential opportunities for farm improvement or market access, but researchers will often need to interpret this input into researchable questions which take into account the state-of-art in theoretical knowledge, methodologies and needs for replicability and generalisations (including for publication). Thus, participatory research need not necessarily mean that all stakeholder groups are involved in all processes of the research cycle.

With more research conducted in this way, there is an increasing opportunity to advance our understanding. Partners of TP Organics are involved in developing an European initiative to further develop the model of participatory research for the sector. An EU-wide proposal for training in innovative research methodologies was submitted in 2010 under the Grundtvig framework. Both researchers and organic farmers associations recognise the need for this sort of training, and for the exchange of experiences even with non-EU countries where the participatory approach has seen more extensive implementation over the last few decades. Therefore, a new proposal will be prepared and submitted in 2011. This will focus on analysing recent experiences, formal and informal, successful and unsuccessful, with the ultimate goal of producing a guideline for local implementation of innovative research methods in organic and low external input food and farming systems.

4.6 Towards a knowledge system for organic food and farming in Europe

The TP Organics Strategic Research Agenda addresses the importance of knowledge and advocates the need to develop a knowledge management strategy for the organic sector. A knowledge system for the organic food and farming sector requires research generation, knowledge dissemination and education and training strategies. All three elements are important but the boundaries between them are not always crystal clear.

■ **Options for action to reshape agrifood knowledge systems** (IAASTD 2009, Chapter 6)

Strengthen human capital and reconfigure organizational arrangements to facilitate the development, dissemination and wide use of AKST (Agricultural Knowledge, Science and Technology).

- Reinforce interactive knowledge networks by involving multiple and more diverse stakeholders including researchers, educators, extension staff, producers and commercial businesses.
- Improve processes for involving, informing and empowering stakeholders, in particular women and others whose interests have not been adequately addressed previously.
- Enhance interdisciplinary cooperation in research, educational programs, extension and development work without compromising disciplinary excellence.
- Strengthen information and knowledge-based systems to enable a rapid, interactive flow of information and knowledge between the wider agricultural sector and the AKST system.
- Strengthen links between research and higher education and among researchers, farmers and other agrifood actors to promote lifelong learning and the development of a learning society.

The whole process of participatory research, if implemented and undertaken correctly, has a major role to play in this. An equitable relationship between diverse research partners during the research process means that information is disseminated at the same time as it is gathered, which means that participatory research can reduce the need for activities to facilitate the implementation and dissemination of results. More extensive participation in research allows those that generate and those that use knowledge to meet as equal partners and focus on end-users' needs, an optimised knowledge system needs to accept and work with the complexity and diversity of the organic sector in Europe.

However, this does not negate the need for more formal and structured knowledge exchange systems, as it will not be possible for all potential end users of knowledge generated through participatory research to be involved directly with the research. There is no quick fix for effective and appropriate dissemination of research knowledge. With the reduction of government advisory provision in most EU countries, the role of dissemination of research outputs has fallen to the projects themselves. It takes place through existing business or personal networks and is often limited to the length of the projects.

More locally, this function could be performed through producer groups, marketing groups, business alliances such as networks of organic

advisers, and so on. At the EU level, transnational organisations such as TP Organics and IFOAM EU Group as well as research bodies that publish newsletters could all play an important role in knowledge exchange.

In this section, a very brief review of Europe's organic farming knowledge system is presented.

Ecologically sound practices in the food sector are complex, and need to consider not only interactions at the level of natural resources but also human interactions with the natural environment.[79] In Chapter 7 of the TP Organics Research Vision (*p. 24-27*), important weaknesses and knowledge gaps in the organic sector in Europe are identified, such as productivity shortfalls, the need for reduced energy use and improved efficiency, variability in the provision of ecological goods and services on commercial organic farms, variability of food quality, and how to improve fairness along supply chains. In the Strategic Research Agenda, proposals for research topics to address these gaps and weakness were made (*see p. 43*). The topics proposed clearly show the need for continuous improvement of knowledge building on existing principles.

Research with participatory methods has a role to play in ensuring that the innovative potential of Europe's organic farmers and businesses can be fulfilled and that results have relevance to the future development of the organic sector. In the organic sector in Europe, stakeholders are involved in a variety of ways in standard setting, in participatory research programmes, in extension and advisory networks. The majority of initiatives have focused on the farmer stakeholders, but there are also professional networks for shop owners and processors. However, participatory methods cannot replace a need for wider support of farmer learning. The focus on learning implies supporting discoveries in how practises can be implemented under specific circumstances, rather than offering blueprint solutions. Support can be given in various ways, through self-help groups and through organic advisory services that exist in a number of countries. Past examples of facilitation of learning activities in relation to organic farming include various participatory breeding networks for crops and livestock, stable schools reducing antibiotic use (DK), and the organic weeds project (UK). Experience shows that challenges occur in relation to intellectual property rights and for any businesses active participation in research and knowledge networks is very time-consuming.

So far there has been no initiative or common project to mobilise and link together European organic farming advisers, either with each other or with researchers and other experts at European or international levels. Advisers have both the knowledge and skills necessary to act as an interface between research and production, facilitating adaptation of results to the local and commercial context. In the joint production of knowledge model, advisers also have an important role in supporting the communication by farmers and producers of their research and development needs. The SCAR group on Agricultural Knowledge and information systems (AKIS) argued that ad-

visory and extension services are likely to play a significant role in the development of any future European agricultural knowledge system.[80] European innovation and competitiveness in this area will thus be strengthened substantially through better links between research, advisors and producers, including SME.

At national levels, a number of initiatives exist that support organic farming knowledge. These include organic farmer groups and networks, organic producer associations, public and private advisory and information services, organic centres, control bodies as well as dissemination activities of research projects and research institutes, and education and training projects (of which there are in fact European in addition to national examples). Examples of more advisory oriented networks include financial and other benchmarking systems, coaching for strategic decision on farms (DE), and German experimental farmer associations (Versuchs- und Beratungsring or Ökoring). There are likely to be many more examples. EU member states and regions vary considerably in their support for such initiatives.

There is a need to map existing extension and advisory services and activities of other bodies that disseminate research in Europe with the aim of identifying examples of best practise that can be shared more widely.

4.7 Conclusions

Experience has shown us that driving innovation from research for the organic sector is not straightforward, but momentum is lent by models for the joint generation and exchange of knowledge that integrate and build on the diversity of the natural environment and of people. A joint (or participatory) production of knowledge model should ideally reduce the boundaries between knowledge generators and users, while respecting and benefitting from transparent division of tasks. Trans-disciplinary research attempts to straddle disciplinary boundaries, and therefore requires all participants to recognise different forms of knowledge and different ways of discovering knowledge. Researchers and end users need to learn new forms of active engagement in joint innovation and knowledge production.

It must be accepted that there is no 'one size fits all' research model. Different research models will be appropriate for different research questions. All research, however, should consider the specific site conditions and context of the system in which its work is done. Only by adopting 'tailor-made' approaches we can develop systems that are genuinely sustainable.

Developing participatory research methods for the organic sector will involve the development of appropriate monitoring criteria. These might include the involvement and satisfaction of stakeholders, improvements in sustainability, and progress on public goals towards which the organic sector can contribute, like environmental protec-

tion, public health or animal welfare. Members of TP Organics are involved in developing a European initiative to further develop the model of participatory research for the organic sector.

In the TP Organics Strategic Research Agenda[82] an initiative for knowledge management is proposed for the organic sector in Europe. The continuing importance of this is illustrated by the third collaborative working group of SCAR on Agricultural Knowledge and Innovation Systems in Europe (AKIS).[83]

The main aim of a European organic knowledge management strategy to facilitate the transfer and exchange of scientific and technical knowledge in organic and low external input agriculture, by putting in place that essential link between research activities and the food and farming sector. Building on an inventory of existing actors, systems and best practise examples of facilitated communication, a further aim should be to better understand the potential roles of participatory research, knowledge exchange networks, decision-making tools and coaching in influencing the uptake of new management practices. A new EU funded project, "Agricultural Knowledge Systems in Transition: Towards a more effective and efficient Support of Learning and Innovation Networks for Sustainable Agriculture (SOLINSA),"[84] will provide valuable input to the process of organising effective knowledge exchange networks, driving innovation, and improving the multi-functional sustainability of organic farming in Europe. TP Organics, with its close connections to both researchers and business networks, could be instrumental in developing such a platform.

5.Research themes to address food and agriculture challenges in the 8th EC Framework Programme

Challenges of our times include food insecurity, climate change, resource scarcities and lack of social cohesion. In order to address and overcome these grand challenges agriculture and food needs systems-based *multi-* and *trans-disciplinary* research *activities* that recognise and work with natural ecosystems and the services they provide.
TP Organics believes that in the development of research priorities, the interconnections between biodiversity, dietary diversity, diversity in farmed and natural landscapes and health and wellbeing of citizens must be taken into account.
European agriculture faces specific challenges but at the same time Europe has a unique potential for agro-ecological development. Sound and sustainable development of the agricultural sector and green/ecological innovations must be supported through well focused research. TP Organics has identified six thematic areas which could organise research and innovation into sustainable agriculture under Europe's Eight Framework programme on Research Cooperation:

1. Eco-functional intensification
2. The economics of high output/ low external input farming
3. Health care schemes for livestock
4. Resilience and "sustainagility"
5. From farm diversity to food diversity to the health and wellbeing of citizens
6. Creating centres of innovation in farming communities

Rising energy and fertiliser costs, fiercer competition for land use between food, feedstuff and energy crop production, and temporary shortages in food stock levels are leading to increased global food insecurity, profoundly affecting the lives of 1.2 billion people. Climate change scenarios predict that agricultural production in many parts of the world is likely to become increasingly vulnerable to floods, droughts and novel invasive weeds, pests and diseases.

Agriculture is currently responsible for 10–15 per cent of all greenhouse gas (GHG) emissions. And when land use change is taken into consideration – for example, the clearing of primary rainforests for palm oil production or to grow soy for animal feed – then agriculture's real contribution reaches almost 20 percent of all GHG emissions. Consequently, the entire food chain may emit up to 30 percent of global GHGs. As other economic sectors develop and adopt low-carbon technologies, it is likely that agriculture will become the greatest GHG emitter of all unless significant changes are undertaken.

As a consequence of increasing demand for agricultural land, pressure on the environment is becoming a threat to the stability of our planet. A group of leading scientists has classified biotic and abiotic planet-level dynamics into a series of 'earth system processes', and it is clear that most of the key processes are significantly impacted by agricultural activity, in particular: nitrogen and phosphorous cycles, land use change, loss of biodiversity, climate change and the acidification of oceans. Farm animals play a prominent role in agriculture's impact.[86]

The unsustainable production of food, feed, fibre and fuel has dramatically degraded global ecosystems, diminishing the services those systems are able to provide for human survival.[87,88] It is in view of this that the International Assess-

ment of Agricultural Science and Technology for Development (IAASTD 2008)[89] has called for inter-disciplinary research based on the ecosystems services approach and for trans-disciplinary research that acknowledges and draws on farmers' skills and knowledge as a valuable resource. The United Nations special rapporteur on the right to food, Professor Olivier De Schutter, has noted that "agro-ecology outperforms large-scale industrial farming for global food security".[90]

These widely accepted analyses and recommendations should become the foundation for agriculture and food research under the EC's 8th Framework programme. European agriculture needs to develop novel system-based approaches that are productive, perform well in relation to environmental effects, and effectively utilise renewable resources.[91]

European agriculture faces specific difficulties identified by the European Environment Agency (EEA): water deficiencies, especially in Southern Europe; increased specialization and monoculture, with negative consequences for landscape diversity and farm resilience; regional concentration of livestock production and hence inefficient or expensive manure handling; land abandonment in less productive regions; and, finally, soil erosion and loss of soil organic matter.[92] Europe as an economic community and a society enjoys a unique potential to achieve wider development and application of agro-ecological approaches accompanied by full cost models for better considering externalities.[93]

A recent Chatham House report on food and agriculture in the 21st century distinguished four potentially competing goals: resilience, sustainability, competitiveness and managing consumer expectations.[94] These, it said, must all be considered individually by policymakers and reconciled with one another for a sustainable food supply.

In the following paragraphs, TP Organics presents the outcome of the organic sector's careful deliberation and debate on how research can help to lay the foundations for a fundamental change to both policy and practice in agriculture. At times of great uncertainty, it is necessary for policymakers to maintain a diverse range of options by investing in multiple strategies, as opposed to putting all their eggs in one (technological) basket.

5.1 Eco-functional intensification

Eco-functional intensification is an approach which aims to harness beneficial activities of the ecosystem to increase the productivity of agricultural systems. It is a new area of agricultural research, and represents an approach to global food security which aligns stability of supply with maintenance of ecosystem services.

Further intensification of agriculture is needed if humanity is to survive and prosper, but this must be achieved under a new paradigm, breaking with the narrow focus of a productionist commodity approach. The concept of **eco-functional intensification**[95] represents a reinterpretation of agricultural productivity, and with a focus on working with and through existing natural processes to achieve increased outputs.

Eco-functional intensification means intensifying the beneficial activities of the ecosystem, for example biomass production, habitats and biodiversity, water cleansing, or recycling of organic material and nutrients. Doing so can lead to improved homeostasis and soil fertility. Eco-functional intensification uses the self-regulating mechanisms of organisms and of biological and agro-ecological systems in a highly intensive way. It closes material cycles in order to minimise losses, with strategies such as composting and manuring. It searches for the best match between environmental characteristics and the genetic variability characteristics of plants and livestock. It reverses the loss of natural capital and increases its supply in order to maintain long-term economic and social performance.[96]

Eco-functional intensification will require, first and foremost, activating more knowledge and achieving a higher degree of organisation per land unit. It will ultimately lead to broadening the scope of agricultural research beyond food, feeds, fibre and energy crops to all ecosystem services.[65]

Eco-functional intensification requires a wide range of inter- and multidisciplinary research activities closely involving producers, manufacturers and the food business. Priority questions include:

- How to better design landscapes, farms, fields and pasture for optimum genetic, species and habitat diversity? This research brings together theoretical modelling of ecosystem and community dynamics with the improving of practical farm and landscape designs. Examples of such work include spatial population models, trophic models at farm level, models of the spread of epidemics, and coupled ecological-economic models. Research tools and techniques such as biochemical and molecular methods are used in order to better describe agro-ecosystems, their complex interactions and the flows within and between them of energy, mass and information.
- How to use modern farm technologies (especially Information and communication technologies like robots, cameras, differential GPS and sensors) to manage diversity in such a way as to get the same crop productivity as from undiversified farm systems?
- How to better quantify the economic and social value of public goods provided by very productive high nature value farming systems? This includes improved impact assessment models for very complex farming systems.
- How to design appropriate policy approaches and value chains which support very productive high nature value farming systems and which make them economically viable?
- How to develop so-called 'full-costing trade principles' which incorporate environment, biodiversity and climate change abatement into food purchase decisions?

5.2 The economics of high output/ low external input farming

I*ntra- and inter-farm recycling of nutrients and organic matter, symbiotic fixation of nitrogen and recycling of nutrients from human waste can all be developed as strategies to increase input/output efficiency. The next step is reliable socio-economic and environmental assessment of such strategies.*

The efficiency with which natural resources such as water, oil and phosphorus are used in food production has decreased significantly. For example, the efficiency of nitrogen use in cereal production decreased from 80 percent to 30 percent between 1960 and 2000.[97] During the same period, nitrogen and phosphorus emissions from agricultural systems increased dramatically. It is now widely accepted that phosphorus mines will be depleted within 40 to 60 years.

The most effective strategies to increase input/ output efficiency are – in addition to the techniques described under eco-functional intensification (see above) – the intra- and inter-farm recycling of nutrients and organic matter, symbiotic fixation of nitrogen, efficient management of non-renewable inputs, and the recycling of phosphorous, nitrogen and potassium from human waste back to farms.

Currently, systems-oriented sustainable practices include organic farming, low external input sustainable agriculture (LEISA), integrated pest management, integrated production (IP) and conservation tillage.[98] All these low or reduced input farming systems can be substantially improved.

Agri-environmental instruments have been used for improving the environmental performance of European agriculture since 1992. Besides targeted measures, multi-objective policies supporting low external input farming systems can also provide a major contribution to sustainable development.

Research projects dealing with systems-based sustainable agricultural practices have by and large focussed on their ecological performance; such research should continue, but it is imperative that these practices be made financially viable compared with conventional practices if their uptake is to spread. Analyses must consider that financial performance of operators both at farm and sector level is affected by multiple factors including producer prices, costs of inputs and the CAP.

Existing economic models rarely consider low external input cropping and livestock systems. Reliable economic assessments are needed in addition to further environmental competitiveness assessments in the following areas:

- Carbon capture farming, combining the advantages of the best sustainable farming techniques (= low external fertilizer input **plus** no pesticides and herbicides **plus** recycling of organic matter and nutrients from livestock **plus** soil conservation tillage).
- Recycling of nutrients from human waste (phosphorus, nitrogen, potassium) back into the farm cycle: technology development; agronomic assessments of the use of recycled nutrients in the context of sustainable farming systems; environmental

and ecological impact assessments.

- → Traits for low external input agriculture in plant breeding.
- → Traits for low external input agriculture in livestock breeding.
- → Non-chemical and organically appropriate control of plant diseases for horticultural crops.

In partnership with technical analyses, socio-economic analyses will be required to address the following issues:

- → Incorporating teams from multiple scientific disciplines with farmers, policymakers and consumers/citizens in collaborative research activities.
- → Optimising the commodity and non-commodity outputs of farming systems according to the needs of the European population.
- → Evaluating the environmental and economic performance of multi-objective system approaches, relative to specific, targeted agri-environmental schemes.
- → Interactions and comparisons between the environmental effects and transaction costs of multi-output or systems-based production schemes (such as organic farming) and those of single agri-environmental policy instruments.
- → Optimising the portfolio of agri-environment measures for the effective and efficient performance of the agricultural sector.

5.3 Health care schemes for livestock

A shift from the application of therapeutics to livestock health care schemes based on good husbandry and disease prevention requires a wide range of inter- and multidisciplinary research activities closely interlinked with producers, advisors, veterinarians and livestock scientists.

Many economically important livestock diseases are not mono-causal but are caused and influenced by a combination of various factors. Therefore, pharmaceutical treatment of diseases is often ineffective, with repetition of treatments necessitated by the limited duration of effects, and/or the development of pathogen resistance. This is especially true of clinical and sub-clinical mastitis disease of cattle, sheep and goats, and for many endoparasites of livestock species, but it is also true of many other diseases such as TB and FMD.

In general, the most effective and affordable strategy to health care in animal husbandry is thus to combine the selection of well-adapted breeds showing functional traits with sound production and management practices and preventive sanitary measures. This approach also meets with consumer preferences for meat and dairy products without pharmaceutical residues and produced under high-welfare husbandry regimes. It also avoid the 'withdrawal period' necessitated by pharmaceutical use (especially in organic systems that required longer withdrawal periods), which is an economic burden on the producer. In addition, some veterinary drugs like antibiotics and anthelmintics might have negative eco-toxicological impacts on soil organisms

and microorganism populations, and might reduce the efficiency of drugs used to treat human disease.

Research for innovative livestock healthcare should aim to achieve the following:

- Epidemiological analysis of zoonoses (animal diseases transmissible to humans) and infectious diseases in production systems with high animal welfare status, high intra-farm livestock diversity or inter-farm cooperation.
- Development of strategies for the prevention of metabolic disorders, and infectious diseases and zoonoses in such systems based on improved management, feeding and selective breeding.
- Refinement of health and welfare data generation methods, with a particular focus on: Which livestock health data (e.g. animal based parameters) are effective at pinpointing on-farm health and welfare challenges? How should we aggregate and use health status data in advisory work with farmers and in breeding programmes?
- Development of communication strategies (such as farmer-field schools, farmers groups, one-to-one advice) for the improvement of livestock health and reduction of medicine use.
- Reduced-chemical or non-chemical regulation of important diseases with bioactive herbs and forages as well as with other alternative therapies.
- Analysis of the economics of health promotion, disease prevention and animal welfare.
- Study of the interactions between production intensity, livestock diseases and animal welfare.

5.4 Resilience and "sustainagility"

Focusing on 'adaptive capacity' as a predominant concept in the development of resilient farmers, farms and production methods will secure productivity and competitiveness in times of uncertainty and change. "Sustainagility" emphasises the importance of flexible strategies that take account of trade-offs at multiple scales and levels.

As a result of climate change, agricultural production is expected to face less predictable weather conditions than experienced during the last century.[99] Moreover, political and economic competition over scarce resources will increase. Thus, the adaptive capacity of farmers, farms and production methods will become especially important. Robust and resilient farm production will become more competitive and farmers' local experiences will be invaluable for quick and agile adaptation. Developing adaptive capacity relies on a better use of farmer and farmer-community knowledge, particularly about such aspects as farm organisation, crop design, and manipulation of natural and semi-natural habitats on the farm. It also relies on diversity, such as the use of locally appropriate seeds and breeds as well as selection for more robust plants and animals. Other aspects of adaptive capacity

are on-farm preparation of fertilizers, natural plant strengtheners and traditional drugs and therapies for livestock, and innovative and low budget technologies. Tengö and Belfrages (2004)[100] described such knowledge as a "reservoir of adaptations." Jackson et al. (2010)[101] used the term "sustainagility" to emphasise the importance of developing flexible strategies for adaptive capacity and transformability that consider trade-offs at multiple scales and allow producers to cope with uncertainty.

Techniques for enhancing soil fertility help to maintain crop productivity in cases of drought, irregular rainfall events, floods and rising temperatures. Therefore, soil fertility building with crop rotations, legumes and the recycling of organic matter to cropland from producers of livestock and processors of food and biomass will become as important as drought tolerant varieties.[102, 103]

The capacity of farms to adapt to change and uncertainty depends not only on soil qualities, but also on the diversity of species present and the diversity of farm activities. The parallel farming of many crop and livestock species greatly reduces weather-induced ri sks. Landscapes rich in varied natural features and habitats buffer climate instability effectively. New pests, weeds and diseases – the results of global warming – are likely to be less invasive in natural, semi-natural and agricultural habitats that contain a high number and abundance of species.[104, 105, 106] In general, building and maintaining a farming landscape with diverse assets able to perform multiple functions (ecosystem services) will help to open up more options for adaptation to environmental and socio-economic changes. However, such an approach will require coordinated and long-term planning, so there is a need to combine research on agro-ecological, social and institutional aspects at different levels of scale.

Therefore, the redesign of farming systems for improved adaptability to changing and irregular temperature, wind and water patterns should become the first pillar of agro-ecological research, on a level with crop and livestock breeding programs.

Predominant farming patterns must evolve if farmers are to cope with faster change. This opens up new research challenges, such as:

- Achieving more informed trade-offs between short and long term profitability in landscape management. How can the potential benefits of multi-functionality and ecosystem services in diversified landscapes, including their contribution to adaptive capacity, be understood, measured and implemented?
- How may flows of information and resources be improved at relevant scales and levels (field, farm or landscape) for the benefit of soil fertility and other ecosystem properties?
- Which methods, tools and institutional capacities should be developed and provided for improving adaptability of farming systems through enhanced ecosystem services at different levels and scales?

→ How can animal and plant breeding be used to increase the adaptive capacity of farm production?

5.5 From farm diversity to food diversity and health and wellbeing of citizens

A growing group of farmers and consumers are engaged with grass-roots development of supply chains for a diverse range of high quality and natural products. This sort of 'whole food chain' approach to diversity of authentic and natural food reconnects consumers and producers, and will benefit public health and wellbeing linked to sustainable consumption.

Since the beginning of recorded history, human societies worldwide have cultivated an average of 7,000 plant species under cultivation at any one time. Yet today, only 120 of them are still important for agriculture, and just 30 species deliver 95 percent of all foods on the planet. Localised agricultural breeding y created a rich genetic resource base amongst agricultural crops and livestock throughout history, including, for example, 4,000 cultivars or varieties of potatoes and 100,000 varieties of rice; but much of this genetic resource base has been eroded by the industrialised production of mass foodstuffs, which has drastically reduced the number of plant and animal species used in agriculture and diversity within species. Meanwhile, fertiliser use has been driven up by preoccupation with high yields, and the need to transport produce over long distances has brought about the widespread practice of harvesting before full ripeness is reached. Plant products subjected to these practices typically lack the proper taste, aroma and nutritional qualities. A similar antagonism between quantity and quality can be seen in animal products.

The loss of diversity and quality in fields, herds and on farms has been compensated for through the use of sophisticated food processing technologies to artificially imitate variation in colour and taste. They present the consumer with easy-to-handle, highly processed, wrapped convenience foods. Food is anonymised and the consumer is disconnected from the food production process. There may well be interdependence, so far little studied, between the loss of food diversity and quality, the disconnection of the consumer from the process of food production, and the epidemic problems of obesity and other nutrition-related chronic diseases.

Many European farmers are beginning to move away from thinking in terms of 'cash crops' and standardised product quality which are so prevalent in today's long and anonymous food chains. Instead, they are producing regional specialities and re-establishing relationships within the food chain, replacing quality, authenticity and diversity as sources of value.

Such a move on the farmer side corresponds with the growth of consumer sentiment against anonymity and in favour of food which is authentic, natural, high quality and carefully processed. Often, it is the expectation of consumers that such products will benefit their health, and this is the foremost argument for change. There are more and more initiatives which allow consumers to con-

nect with local or regional producers who produce foods in a transparent way. Consumers have shown strong appreciation for this sort of connectedness and transparency, often related to the desire for a more responsible, sustainable and healthy lifestyle, which they experience as conferring increased wellbeing.

A 'whole food chain' approach which increases authentic food diversity and reconnects consumers with producers deserves support by research on the following questions:

- Which incentives can support and encourage public and private development of diverse crops and products?
- What Intellectual Property Rights mechanisms may be employed to allow farmers and other stakeholders to use and adapt traditional and local cultivars, varieties, breeds and genetic lines?
- How do consumers perceive 'real' and 'imitation' diversity and other quality patterns of foods, and how can recognition and appreciation of authentic foods be taught, especially to children?
- Is there evidence of an interrelationship between diversity of farm production, food diversity, food quality and public health and wellbeing?
- How can quality control concepts for optimum taste and health properties (Quality Analysis of Critical Control Points in the food chain, or QACCP) be improved and extended to include farm environment and agronomic practices?
- What tools can be used to identify authentic, natural, high quality and healthy food products, and how can we develop such tools?
- What health effects can be attributed to the consumption of high quality foods as opposed to a comparable diet of foods from industrialised production?
- How can connectedness of consumers to the process of food production be enhanced?
- How can labelling schemes enhance transparency and consumer trust in producers to provide healthy and authentic food of high quality? How can retail strategies ensure and enhance authenticity, quality and naturalness of food, especially when processed?
- How can we adapt diversified food systems for large-scale kitchens and catering?
- Are there relationships between levels of consumer connectedness to food production and patterns of sustainable food consumption, healthy diets and the experience of wellbeing?

5.6 Creating centres of innovation in farming communities

A network of centres in Europe based on developing and applying trans-disciplinary and participatory scientific approaches would support innovation among smallholders, farmers and small food businesses, making research more relevant to their needs and reducing discrepancies in research capacities across Europe.

Limited spread of research impacts and the slow adoption of new findings and techniques by the different stakeholders of the food production chain mean that practices generally lag behind the state-of-the-art. This is especially true for the complex knowledge needed to manage sustainable, multifunctional and high nature value farming systems.

Farmer participation in the research process is one way to counteract this, and is therefore currently being advocated by many researchers.[104, 105] articipatory research aims to involve farmers and SMEs in all stages of technology development in order to enhance adoption (*see also Chapter 5*).

In some instances, researchers have consulted farmers about the nature of a trial, involved them in its farming operations and even sought their opinion about treatments, but the approach still remained top-down. The farmer's input can range from problem identification and raising research questions to technology testing and evaluation. Ideally farmers should have a sense of ownership of on-farm experiments so that they can give a more detailed and thorough evaluation.[109] The same is true for other businesses in the supply chain. Farmer and stakeholder participation in research therefore strengthens the link between research and extension, and empowers them to adopt sustainable technologies.

Social learning processes should replace the inefficient approach to technology transfer represented by the linear model of research and extension as top-down processes. Research extension through social learning must integrate explicit forms of knowledge held by scientists and researchers (easily communicable through words) with the tacit knowledge of farmers (experiential knowledge not easily verbalised[107] (*see also Chapter 5*).

TP Organics advocates the creation of a network of innovation centres in farming communities across Europe to:

- Apply and further develop trans-disciplinary and participatory scientific approaches and methods

Such a network could have a major impact on regional and national agricultural research:

- By reducing the considerable discrepancies in research approaches and capacities across Europe, and by
- Making agricultural research more relevant to smallholders, other farmers and small food business.

6. Integration, cooperation and networking

The EU aims to develop the European Research Area (ERA)[108] as a cornerstone for a European knowledge society that contributes to the sustainable development and competitiveness of Europe. The development of ERA has been influenced by a strategic approach to European innovation conceived in the Europe 2020 strategy and the Innovation Union flagship initiative.[112]

TP Organics is proud to offer a significant contribution to the *2020 Vision for ERA*[113] in the area of agriculture, food and eco-system research. TP Organics is the only Technology Platform that deals with research in agriculture and food production as a science of complex ecological and socio-economic systems. The TP Organics Strategic Research Agenda takes into account the multifunctionality and complexity of systems in the diverse social and ecological contexts of agriculture and food production.

TP Organics seeks to cooperate with other initiatives, networks and institutions in order to join forces, multiplying its impact and creating synergies. TP Organics has initiated and will continue to invest in cooperation with different kind of networks and organisations, in particular:

- ERA-NETs
- Join Programme Initiatives
- European Technology Platforms (ETPs) and other organisations that offer opportunities for strategic cooperation, such as low external input food and farming organisations
- The Standing Committee on Agricultural Research (SCAR)
- The European Regions

6.1 ERA-NETs

Since the 6th Research Framework Programme, ERA-NET[114] has been the main instrument of the European Union for funding cooperation between national/regional research funding institutions. The aim of the instrument is improved coordination of member states' research activities in order to overcome the fragmentation of the European Research Area and to step up the coordination of research activities at national or regional levels in the EU member states and associated states, through:

- the networking of research activities conducted at national or regional levels
- the mutual opening of national and regional research programmes.

The ERA-NET scheme contributes to realising the aims of the European Research Area by improving the coherence and coordination across Europe of research programmes.

Several ERA-NETs have been established and have gone on to launch transnational research calls. In contrast to ETPs that are industry and stakeholder driven, ERA-NETs follow a more top-down approach. However, cooperation with ERA-NETs can create powerful synergies to maximise impacts and avoid fragmentation of research at European and trans-national levels.

TP Organics collaborates closely with one ERA-NET and is engaged in dialogues with a further eight ERA-NETs to scope out possibilities for joint work.

The closes collaboration exists with the ERA-NET CORE Organic II.[115] This is a follow-up of CORE Organic, which ended in 2007. CORE Organic II consists of a network of 27 partners from 22 European countries with a total budget of about 12 million Euros for three years. Its main aim is to establish common research priorities for several areas within organic food and farming, and to select transnational research projects which will be funded by the partners to address these priorities.

TP Organics and CORE Organic II are sending observers into each others' meetings and keeping each other well informed about activities. TP Organics seeks extended collaboration to make the partners of Core Organic II a "Mirror Transnational Group". TP Organics additionally facilitates transnational stakeholder involvement for CORE Organic II.

Following initial contacts, efforts are underway to deepen TP Organics' involvement with the other eight ERA-NETs with which it has identified synergies:

- Arimnet[116] - Food, agriculture and fisheries, and biotec hnology
- ICT Agri[117] - Integrated ICT and automation for sustainable agricultural production
- EMIDA[118] - Animal health
- ERNEST[119] - Sustainable Tourism
- RURAGRI - Rural areas and agriculture in Europe
- BIODIVERSA[120] - biodiversity in Europea and overseas
- CIRCLE 2[121]- climate adaptation, climate impact
- ARD (Agriculture Research for Development)[122] – fighting poverty and hunger and supporting more rapid and sustainable development

6.2 Joint Programming initiatives

Joint Programming Initiatives (JPI) are a concept introduced by the European Commission in July 2008 as one of five mechanisms for implementing the European Research Area (ERA).[123] JPIs are designed to enable EU member states to coordinate research activities (planning, implementation and evaluation) and pool their resources, with the ultimate aim of increasing the efficiency and the value of research and development funding. Each JPI deals with a particular theme. They are voluntary, and member states can choose to participate in specific JPIs dealing with themes they consider especially relevant to them. The EU hopes and expects that JPIs will become an influential force in EU research.

The Council of the European Union welcomed the concept and the objectives of Joint Programming in its conclusions adopted on 2 December 2008, and called for "the implementation of that process led by the Member States to step up their cooperation in the R&D area in order to better confront major societal challenges of European or worldwide scale, where public research plays a key role."[124] The Commission identified the first

themes for JPIs in November 2009 (now confirmed by the Council):[125]

- *Agriculture, food security and climate change*
- *A healthy diet for a healthy life (formerly known as Health, food and prevention of diet-related diseases)*
- *Cultural heritage and global change (formerly known as Cultural heritage, climate change and security)*

TP Organics seeks collaboration with JPIs, particularly with *Agriculture, food security and climate change* and *A healthy diet for a healthy life*, in the belief that it has valuable input to offer.

6.3 European Technology Platforms and strategic partners

Technology Platforms originate from industry led informal discussion networks. Today, European Research Technology Platforms (ETPs) remain industry led but bring together a wide range of stakeholders including key industrial players, SMEs, the financial world, national and regional public authorities, the research community, universities, non-governmental organizations and civil society. The first TPs were founded between 2002 and 2003, and DG Research has now given official recognition to 38, with several associated initiatives also established.

TP Organics seeks active collaboration with some of these established TPs. Whilst TP Organics is the only platform that deals with the whole ecological and socio-economic system of agriculture and food production as well as the provision of public goods and services, several ETPs deal with overlapping areas where cooperation could be synergistic. Examples include the ETP for the EU food and drink sector, Food for Life,[126] the ETP for farm animal breeding and reproduction, FABRETP,[127] ETP for Global Animal Health,[128] the European Aquaculture Technology and Innovation Platform,[129] and the agricultural machinery working group of MANU*FUTURE*.[130]

The possibilities for further development of an existing relationship between TP Organics and the BEcoTePs project[131] are explored. The BEcoTePs project brings together nine ETPs[132] and other initiatives active in the Knowledge-Based Bio-Economy (KBBE) sector and is funded under the EC's 8th Framework Programme.

TP Organics is also investigating the potential for strategic cooperation with organisations active in the field of low external input farming and High Nature Value farming. Within its own history, TP Organics has experienced first-hand the value of synergies between organic research and low external input research, and is convinced that both can benefit from each other.

6.4 The Standing Committee on Agricultural Research and Collaborative Working Groups

The Standing Committee on Agricultural Research (SCAR) adopted a structured approach to the prioritisation of research topics for further collaboration, through the establishment of a number of

Member and Associated State Collaborative Working Groups (CWGs). CWGs are a more flexible and less formal alternative to the ERA-NET scheme, but share the same objective: to stimulate and increase transnational research collaboration between funders and programme managers on key research areas.

Since 2005, 17 CWGs have been set up by European countries engaging voluntarily and on a variable-geometry basis in the definition, development and implementation of common research agendas based on a shared assessment of the major challenges of agricultural research and a shared vision of how to address them. The dynamism and commitment of certain CWGs has lead to their becoming ERA-NETs under the 7th Framework Programme.

TP Organics has identified two CWGs with which it sees strong potential for fruitful cooperation and exchange:

- Agricultural Knowledge and Innovation Systems (AKIS), which provides European farming and its agro-industry with knowledge drawn from global sources, with the aim of improving European competitiveness;
- Sustainable food production for wealth, welfare and health (SUSFOOD), which aims to integrate environmental sensitivity into the creation of a more competitive, wealth-generating and welfare-enhancing food sector.

6.5 Regions

The Regions of Europe play a role in shaping local agricultural policy and regional research, although the nature of this role varies case by case. There are also examples of regions coming together for research and development initiatives as part of European networks.

The prominence of organic agriculture in the food systems of some regions encourages those regions to take a special interest in organic farming research. TP Organics will be proactive in pursuing opportunities for exchange and cooperation with individual European regions and with regional networks such as the European Regions Research and Innovation Network[133] or the European GMO Free Regions network.[134]

7. Future of TP Organics

Since its establishment in 2007 by ISOFAR and the IFOAM EU Group, TP Organics has developed into a dynamic network of EU umbrella organisations, scientists, companies, civil society groups, foundations and national platforms, also engaging with trans-governmental and governmental structures.

The organic movement has shown excellent capacities for networking and organising in the construction of a research vision and the setting of concrete research priorities to develop organic and low external input food and farming in concert with contemporary political concerns and societal needs. TP Organics is the direct manifestation of these capabilities, and will henceforth be the vehicle for coordination and strategic development of research in the organic sector. TP Organics will not only facilitate innovation in the organic sector, but is in itself organisationally innovative: its mechanisms for the close involvement of civil society, could also make it a useful prototype of a 'social' TP.

The completion of this Implementation Action Plan in December 2010 marks the end of the TP Organics initial project phase and its funding. The success of the project so far, however, has generated strong support from its stakeholders, and it has been decided that TP Organics will continue to operate with financing from industry, research institutes and private sector sponsorship, plus additional project-specific funding streams. The first financial commitments have already been made, and the IFOAM EU Group is to continue hosting the secretariat. A work programme of 2011–2013 is built around four cornerstones set out in the subsequent paragraphs.

7.1 Contribute to shaping EU research concepts and programmes

The European Commission is currently working on the initial conceptualisation of the successor to the 8th Framework Programme. There are indications that the name and structure will significantly change, with JPIs becoming a more prominent feature in the landscape of EU research. Meanwhile, the EC is planning to undertake a consultation and issue a communication about the European Strategy and Action Plan towards a sustainable bio-based economy by 2020.[135] TP Organics will actively involve itself in these discussions on how to shape EU research concepts and activities. It will mobilise its network to sharpen the ideas presented in this Implementation Action Plan and feed them into the political discussion.

TP Organics considers one of its key strengths in this process to be its inclusiveness, its unique ability to involve and represent a huge range of stakeholders, including civil society and members of the European Parliament.

7.2 Implement the Strategic Research Agenda and develop an action plan on innovation and education

TP Organics will work to translate its Strategic Research Agenda, with more than 60 concrete research project proposals, and this Implementation Action Plan into practical action. At the same time,

it will continuously refine and update the Strategic Research Agenda to react to developments in the field, and it will continue to integrate new members. Further, TP Organics will strengthen its efforts in the area of innovation and knowledge transfer and will develop an education and innovation plan. This will analyse all possibilities for leveraging research-generated knowledge to bring about improvements in on-the-ground practice in the organic sector, along with how to stimulate innovations and turn them into market successes.

7.3 Increase strategic cooperation and recognition of TP Organics

TP Organics has been successful in making itself known among policymakers and officials in EU institutions, with several members of the Parliament, DG Research and the European Commission, along with the Commissioner for Agriculture and Rural Affairs, having expressed their support for the project and its objectives. TP Organics will sustain and expand its dialogue with policy-makers. It will also pursue opportunities to promote its services through other channels, increasing its strategic cooperation with other networks, initiatives, organisations, ETPs and regions (*see Chapter 5*). Further, TP Organics will encourage and support the establishment of national organic platforms in addition to those already existing in the Czech Republic, Italy and Hungary.

7.4 Promotion of TP Organics amongst interested stakeholders and membership

TP Organics will seek to continue its growth beyond 2010 by recruiting new members from all sorts of organisations, companies, regional and national partnerships. To reinforce its capacity to smoothly incorporate additional members and fully integrate recent arrivals from the last two years, the platform will also make efforts to enhance its internal structure. This will involve enlarging its steering committee to include a direct representative of business and one representative of the national platforms.

Another priority will be increased communication. In order to make itself known to key stakeholders in the agri-food and agri-environment areas and within the organic movement, TP Organics will develop a communication concept encompassing visibility at events, newsletters, revision of its webpage, contacts with specialist press and communications literature.

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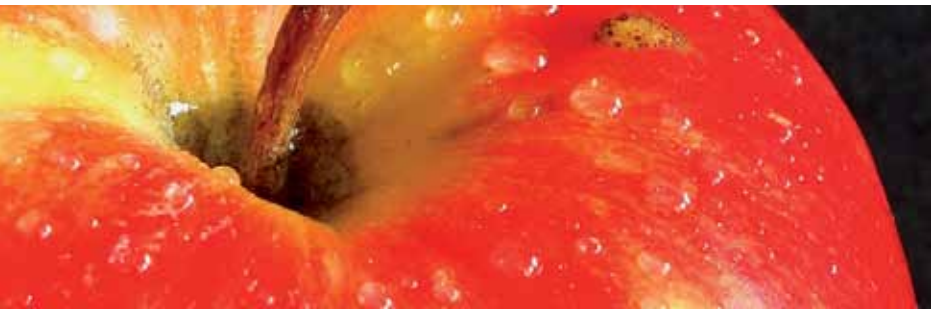

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Annex

Annex - Overview of EU Funding Opportunities for Research and Innovation Related to Organic Farming Research

This is a summary of EU funding opportunities for research and innovation activities relevant for organic food and farming. It provides an overview of three main EU funding instruments: the 7th Framework Programme; Competitiveness and Innovation Framework Programme; Structural Funds.

FP 7th - Framework Programme for Research, Technological Development and Demonstration activities:

Aim - Strengthening the specific and technological base of European industry; Encouraging its international competitiveness, through research that supports EU policies.

Support for Small Medium Enterprises (SMEs) is foreseen in the sub-programmes Cooperation, People (research performing SMEs) and Capacity (outsourcing research SMEs)

Sub-programmes:

1. Cooperation Programme

Aim – to foster collaborative research across Europe and other partner countries in a number of key thematic areas such as health; food, agriculture and fisheries, and biotechnology; energy; environment (including climate change).

This programme also includes the new Joint Technology Initiatives and Joint Undertakings[i].

Other highlights of this programme include programmes for Coordination of non-community research, which aims to bring European national and regional research programmes together, in particular through ERA-NETS (e.g. Core Organic I and Core Organic II). Special attention is also being paid to multi-disciplinary and cross-theme research, including joint calls for proposals between themes.

2. Ideas Programme

Aim – to support "frontier research" in any area of science or technology, including engineering, socioeconomic sciences and the humanities. Particular emphasis is being placed on emerging and fast-growing fields at the frontiers of knowledge, and on cross-disciplinary research.

3. People

Aim – to support mobility and career development for researchers, both within and outside Europe. This programme is implemented via a coherent set of Marie Curie Actions, designed to help researchers build their skills and competences throughout their careers.

4. Capacities

Aim – to strengthen and optimise the knowledge capacities that Europe needs to be a thriving knowledge

CIP - Competitiveness and Innovation Framework Programme

Aim - To encourage competitiveness of European enterprises by supporting innovation activities, providing better access to finance and deliver business support services in the regions. CIP is aimed to encourage a better take-up and use of information

and communications technologies (ICT) and help to develop the information society. It is also promoting the increased use of renewable energies and energy efficiency.

Specific programmes with CIP are:

1. Entrepreneurship and Innovation Programme (EIP)

Aim – to facilitate access to finance for the start-up and growth of SMEs and to encourage investment in innovation activities.

2. Information Communication Technologies Policy Support Programme (ICT-PSP)

Aim – to develop a single European information space, to strengthen the European internal market for ICT and ICT-based products and services.

2. Intelligent Energy Europe Programme (IEE)

Aim – to foster energy efficiency and the rational use of energy sources and to improve market conditions for untapped opportunities to save energy and encourage the use of renewable energy sources.

SF - Structural Funds

Aim - To reinforce economic and social cohesion by strengthening competiveness and innovation.

Three funds:

1. European Regional Development Fund (ERDF): for strengthening competitiveness through helping regions to anticipate and promote economic change through innovation and the promotion of the knowledge society, entrepreneurship, the protection of the environment, and the improvement of their accessibility.
2. Cohesion Fund: for the least-developed Member States and regions.
3. European Social Fund (ESF): strengthening competitiveness and employment by helping Member States and regions to adapt the workforce, their enterprises and entrepreneurs with a view to improving the anticipation and positive management of economic change.

[i] Joint Undertakings are legal entity established under the EC Treaty. The term can be used to describe any activity proposed for the "efficient execution of Community research, technological development and demonstration programmes". Joint Technology Initiatives are instruments proposed specifically within the Decision creating the 7th Research Framework Programme, and for which the identification criteria are clearly identified.

For notes:

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