



A Global Vision and Strategy for Organic Farming Research

Condensed version
Evolution date: February, 2017

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The delicate seedling of global organic agriculture needs more public funding to grow into a strong plant.
Photo: Matthias Klais

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Executive Summary

Organic agriculture offers the global promise of a future in which food and other farm products are produced and distributed in a healthy, ecologically sound, truly sustainable and fair manner. Humankind has just begun to realize the multiple benefits of organic agriculture, ranging from ecosystem services to the provisioning of healthier foods. Yet, to reach its full potential, organic farming needs to address many challenges. While organic agriculture today finds itself in a more favourable position than ever, regarding market conditions, government policies, and international institutional support, it still does not have sufficient resources to continue its expansion.

The Technology Innovation Platform of IFOAM – Organics International (TIPI) - has developed a vision and strategy, as well as an agenda to advance organic agriculture through research, innovation development, and technology transfer. Today's prevailing agricultural technologies adversely affect human health and the environment. TIPI argues that such practices are incompatible with the sustainable intensification of global agriculture, which is needed to produce food while addressing climate change and degrading natural resources. Investments in ecosystem services and the development of resilient, yet productive technologies that are fairly shared among all involved in the food chain are more likely to sustain the world's population in a rapidly changing environment.

Sustainable pathways to innovation will, however, require the engagement of a wide range of stakeholders in inter- and transdisciplinary ways driven by science. Such an approach seeks to empower



rural areas, provide ecologically functional intensification to produce food while harnessing and regenerating ecosystem services, and strengthen resilience to climate change. Furthermore, it aims at providing healthy food that promotes well-being and is available to, and affordable for, everyone.

TIPI advocates that organic agriculture is a promising approach that can meet these high expectations quantitatively, qualitatively and structurally. However, organic agriculture needs to substantially reinforce its capacities if it is to fulfil its mission to meet the food needs of a world population projected to reach



Eco-functional intensification of organic food and farming systems to empower rural areas and produce healthy food in a fair way for the well-being of all. Photo: FiBL

9 billion by 2050. The new paradigm proposed by TIPI is based on a holistic systems approach, involving farmers, researchers and other stakeholders in innovative processes for the development of open access technologies that can be readily adapted to local conditions. TIPI acknowledges the fact that there are many bottlenecks, which will have to be overcome for this vision to be realized. Nonetheless, TIPI calls upon the global organic community to support its 15-point action plan in order to advance organic agriculture in a constructive and innovative way.

TIPI aims at fostering international collaboration in organic agriculture research, engaging and involving all stakeholders that benefit from organic agriculture research, facilitating the exchange of scientific knowledge of organic food and farming systems, and helping to disseminate, apply, and implement innovations and scientific knowledge consistent with the principles of organic agriculture.

This document lays down TIPI's Global Vision and Strategy to advance organic agriculture through research, development, innovation, and technology transfer.

1 About TIPI, the Technology Innovation Platform of IFOAM – Organics International

Technology platforms are stakeholder fora uniting key actors in driving innovation and knowledge transfer. They develop research and innovation agendas and roadmaps for action at the national and transnational level to be supported by both private and public funding. They mobilise stakeholders to deliver on agreed priorities and share information¹.

In the presence of researchers and stakeholders from all over the world, TIPI was launched at BioFach, the world's leading trade fair for organic food, in Nuremberg, Germany, in February 2013. TIPI's mission is:

- › to engage and involve all stakeholders that benefit from research on organic food and farming systems,
- › to foster international collaboration in research and facilitate exchange of scientific knowledge about organic food and farming systems,
- › to develop a global research agenda for organic food and farming systems,
- › to advocate for research on organic food and farming systems in order to achieve the Sustainable Development Goals (SDGs) of the United Nations,
- › to influence government policies that lead to a fostering of organic food and farming systems worldwide, and

- › to help disseminating, applying, and implementing innovations and scientific knowledge consistent with the principles of organic food and farming systems.

TIPI is unique as the global technology innovation platform for research on organic food and farming systems that includes all stakeholders. It seeks to cooperate with regional, national, and transnational innovation platforms and research networks such as the European Technology Platform for Organic Food and Farming Research (TP Organics). TIPI works with all organizations involved in research on organic food and farming systems for technology and innovation development. In particular, TIPI will assist IFOAM – Organics International to unite and mobilize different organizations working on issues related to research on organic food and farming systems. TIPI promotes continuous discussions led by relevant research networks. These discussions cover issues such as modern production and food techniques for organic products, animal welfare, agroecology, agroforestry, climate change adaptation and mitigation, conservation of natural resources, landscape ecology, and soil fertility maintenance. TIPI facilitates knowledge exchange, dissemination, and communication via its website², as well as by using international archives containing materials about organic food and farming systems.

TIPI membership is open to all stakeholders with an interest in advancing research on organic food and farming systems. TIPI welcomes organizations

¹ http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=etp

² www.organic-research.net/tipi.html

and individuals representing farmers, processors, traders, suppliers, consumers, scientists, states, foundations and civil society, and any other individual members interested in research on organic food and farming systems. A list of TIPI members and supporting organizations can be found on the TIPI website.

As an innovation platform within IFOAM – Organics International, TIPI is an informal network and sector group

that is self-organized and self-governed. TIPI members may develop their purposes, terms of references, goals, strategies and activities independently.

More information

TIPI – Technology Innovation Platform of IFOAM – Organics International, % Research Institute of Organic Agriculture (FiBL), Ackerstrasse 113, 5070 Frick, Switzerland, tipi@ifoam.org, www.organic-research.net/tipi.html



TIPI facilitates knowledge exchange, dissemination, and communication. Photo: Thomas Alföldi, FiBL

2 Strengths, weaknesses, challenges and opportunities of organic farming

2.1 Strengths

Profitability^[1]

In many cases, organic agriculture is significantly more profitable than conventional agriculture when premium prices are considered.

Multi-functionality and resilience^[2-11]

Besides producing food, organic food and farming systems usually enhance the resilience of agro-ecosystems by contributing to many ecosystem goods and services, some of which are outlined below. Thereby, they may fulfil environmental and social policy targets. For example, they encompass the livelihoods of farmers and farm workers, as well as animal welfare. Grazing animals are an integral part of the land use.

Biodiversity, pollination and pest regulation^[12-28]

In most cases, organic food and farming systems increase overall biomass abundance and conserve biodiversity both within and between species, which in turn may enhance pollination of crops and natural pest regulation.

Healthy planet, healthy humans^[29-37, 63]

In general, organic food and farming systems ensure higher animal welfare, exhibit higher nutrient and energy use efficiencies, cause lower eutrophication, and reduce adverse health effects associated with pesticide use.



Organic agriculture ensures multi-functional land use. Photo: Lukas Pfiffner



Organic agriculture conserves biodiversity. Photo: Thomas Alföldi



Organic food and farming systems for human and environmental health. Photo: Bio Suisse



Organic agriculture protects soils.
Photo: Matthias Klaiss

Soil protection and carbon sequestration ^[38-47]

Organic food and farming systems generally conserve soil fertility in a sustainable way, and may reduce soil erosion, and store carbon in organic matter.



Organic agriculture mitigates climate change.
Photo: Thomas Alföldi

Climate change mitigation and adaptation ^[48-55]

Organic food and farming systems emit fewer greenhouse gases under best farm practice, show higher yield stability in climatically extreme years, and reduce the risk of floods.



Organic products are of higher quality.
Photo: Thomas Alföldi

Product quality and food safety ^[56-58]

In some cases, organic food contains higher concentrations of secondary plant metabolites, antioxidants and vitamins, as well as polyunsaturated fatty acids. Furthermore, organic food is often less contaminated with cadmium, nitrate, nitrite and other residues.

2.2 Weaknesses and challenges

Only an increase in public funding, using schemes like those implemented in Europe, will foster global organic agriculture^[59].

Yield gap^[1, 60-61]

Organic food and farming systems generally have lower yields and need more land to produce the same amount of food, which may have negative impacts on the environment and food security. Moreover, lower yields may translate into higher unit costs of production and lower profits for farmers in the absence of price premiums. The many excellent examples of best organic practice frame the way future innovations must go.



Generally, organic agriculture produces lower yields. Photo: FiBL

Economy penalizes diversity^[62]

Current policies and markets stimulate the production of single commodities in large quantities that are sold at distortedly low prices at the cost of the environment and humankind.



Current policies favour unsustainable monocultures. Photo: Andreas Krebs

Deficits of standards and regulations^[56, 63]

Social standards and animal welfare are not consistently codified. In addition, the sensory quality of organic products is not part of the certification. Organic standards prohibit or restrict the use of certain technologies, and a scientific case-by-case assessment is not in place. The standards require burdensome and bureaucratic certification procedures.



The use of certain technologies is restricted in organic agriculture. Photo: Matthias Klais



Lack of research funding for organic food and farming systems. Photo: Pixabay

Insufficient funding ^[64-67]

With less than one percent of the budget for food and farming systems research spent on organic, there is a lack of funding for basic and applied projects, which hinders development of innovations by scientists and farm advisors.



Other standards compete with organic food and farming systems.

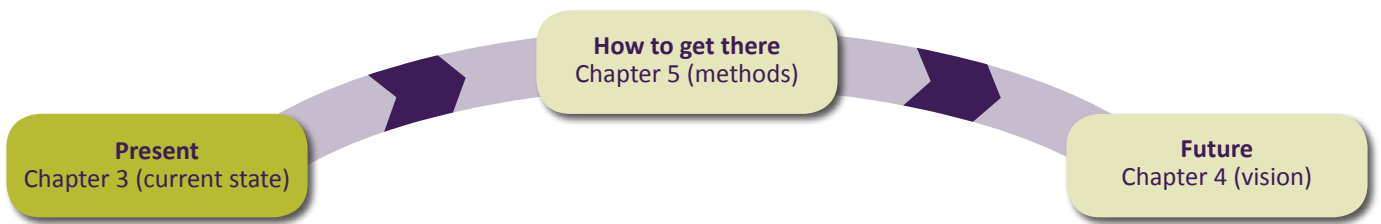
Competition ^[68-69]

Other sustainability standards compete with organic production, and the multitude of labels causes confusion amongst different stakeholders such as consumers.

2.3 Opportunities for organic agriculture in the tropics

The huge number of smallholders in the tropics who produce ‘organic by default’ using traditional methods presents an opportunity to get good and rapid returns to research funding by facilitating science-driven innovations. This may reduce the trade-offs between productivity and sustainability ^[70-74], and lead to self-sufficiency in times of limited resources ^[75-76]. To achieve this, sound organic regulations, more multi-actor cooperation, and active participation of farmers are required ^[77-79].

3 The current state of organic farming research



The next three chapters address the current state of organic farming research (chapter 3), TIPI’s vision for the future development of organic farming until 2030 (chapter 4), and the strategy to move from the current state to the future (chapter 5).

3.1 Global overview

Agriculture faces the challenge of feeding a rapidly growing population while maintaining the capacity to provide for future generations. Future food production is jeopardized by unsustainable

practices that lead to climate change, depletion of non-renewable resources, and water pollution. Holistic farming systems that ensure high productivity by making use of locally available resources and ecological processes are more suitable to meet these challenges than reductionist approaches whose focus is on maximum productivity alone^[80]. Sustainable agricultural systems also rely on the traditional knowledge and entrepreneurial skills of farmers^[70], and include both organic farming and agro-ecological methods.

International cooperation has the potential to uplift research on organic food and farming systems, which in turn may raise organic agriculture’s produc-

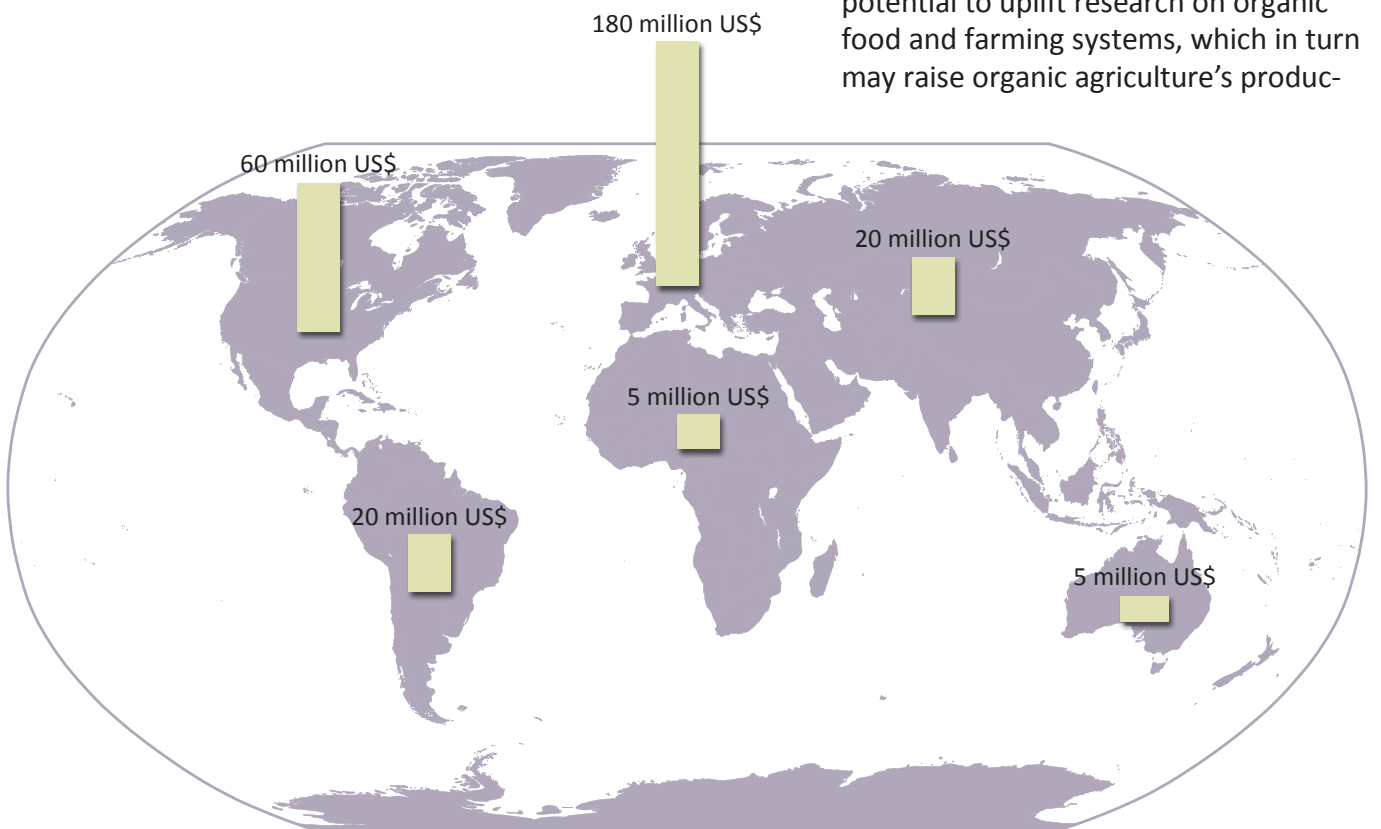


Figure 1: Annual spending on organic food and farming systems research, disaggregated by continents. 180 million = 0.4% of total research funding (estimations of FiBL).

tivity, improve livelihoods, preserve local cultures, maintain environmental services, and enhance the quality of rural areas. Organic food and farming systems can help smallholders in low-income countries diversifying and becoming locally self-sufficient in food, which may mitigate the adverse effects of exposure to price fluctuations on global markets of internationally traded commodity crops. Because results obtained in temperate zones cannot be readily transferred to (sub-)tropical and (semi-)arid zones, organic farming systems need to be adapted to local contexts and the associated socio-ecological trade-offs for sustainable agricultural intensification need to be studied.

Organic agriculture is based on IFOAM – Organic International’s principles of health, ecology, fairness, and care^[81]. Standards for organic production were developed from these principles to protect what it means in the marketplace. The integrity of organic food is verified by third-party certification and participatory guarantee systems (PGSs). To meet the growing demand for organic food and develop technologies that are consistent with organic principles, institutions around the world have built the capacity to conduct research on organic farming systems. However, those capacities are not evenly distributed, leading to research gaps, limited access to published results, and lags in technology transfer.

The highest annual spending on organic food and farming systems’ research occurs in Europe and North America (Figure 1). Research is mostly carried out in a national context, but international coordination and collaborative efforts are increasing. However, only a few countries provide data on their funding for organic farming research.

Table 1: Evaluation of key indicators describing the performance of the organic sector worldwide.

Continent	Research (million US\$)	Extension	Networks	Farmland (million hectares)	Share of total farmland (%)	Markets (billion US\$)	Challenges
Africa	~ 5	poor	poor	1.7	0.1	<0.1	big, poorly addressed
Asia	~ 20	poor	insufficient	4.0	0.2	6.9	big, poorly addressed
Europe	~ 180	moderate	moderate	12.7	2.5	33.0	addressed with some progress
Latin America	~ 20	insufficient	moderate	6.7	0.9	<0.1	big, poorly addressed
North America	~ 60	insufficient	moderate	3.0	0.7	42.8	addressed, but insufficient
Oceania	~ 5	poor	poor	22.8	5.4	1.2	big, poorly addressed
World	~ 290	poor	poor	50.9	1.1	84.0	big, poorly addressed

Colour code:

moderate	insufficient	poor
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Sources: Research, Extension, Networks and Challenges: FiBL estimates. Farmland and market data are figures for 2015^[82].

3.2 Continental comparisons

The first private research institutes working on organic food and farming systems emerged in Europe and North America in the 1950s and proliferated in the 1970s and 1980s. Government funding in Europe started around 1990. However, with less than one percent of the budget for food and farming systems research spent on organic (Figure 1), research on organic systems is still marginal today^[64-66]. There is a huge gap between countries leading research on organic food and farming systems and those where this is not a priority, which underlines the great scope for mutual learning between the two country groups. Table 1 shows the performance of the organic sector worldwide by evaluating certain key indicators.

3.2.1 Africa

The African Union recognizes that organic food and farming can play a positive role in the continent's development by generating foreign exchange through export-oriented organic agriculture^[83]. However, policy makers often ignore the broader benefits of organic farming. In contrast to a general lack of governmental support for organic agriculture, subsidies for synthetic fertilizers and pesticides decrease the competitiveness of organic agriculture. In 2011, IFOAM – Organics International launched the 'IFOAM Organic Alternative for Africa' (TOFA) campaign aiming to build a united continental approach

to advocating organic agriculture and its multiple benefits, and ensuring that Ecological Organic Agriculture (EOA) is included in national development policies.

The African Organic Network (AfroNet), complemented by the Network for Organic Agriculture Research in Africa (NOARA), is developing a research agenda for EOA^[84-85]. EOA was the first high-profile political endorsement of organic farming in Africa. The Mediterranean Organic Agriculture Network (MOAN) is the most important network in North Africa^[86].

Box 1: African organic agriculture facts, 2015^[82].

- › Total organic agricultural area:
- › 1.7 million hectares (0.1% of Africa's agricultural area, 3% of the world's organic agricultural area)
- › 719'000 producers (most of them in Ethiopia, Uganda, and Tanzania)
- › Leading country by area: Ethiopia (almost 0.3 million hectares, 0.5% of total agricultural area)
- › Markets: The majority of certified organic products are for export markets
- › Key products: Coffee, oilseeds, olives, cocoa, and textile crops

The limited evidence about the productivity and profitability of organic agriculture under African conditions presents a challenge for advising policy based on sound science. Limited access to organic seeds, equipment, bio-pesticides and other inputs, as well as access to information and technology transfer are obstacles for farmers who want to transition to organic. The extreme nature of many African soils, from highly acidic to highly alkaline, leads to low nutrient availabilities for plants, particularly phosphorous. Closing nutrient cycles is a challenge in many countries, especially where crop and livestock production are separated by social structures (i.e., different ethnic groups). Pest and diseases of both crops and livestock develop much more rapidly in tropical conditions, and their prevention

and biological control are major issues. More breeding efforts are needed to develop varieties and landraces suitable for organic production in Africa. Finally, the strong export orientation presents a big challenge for the development of sustainable food systems, as the production of the cash crops presented in Box 1 is of higher environmental concern than the staple crops, and because of the high dependency on world markets.



African farmers need suitable crop varieties and livestock races for organic production. Photo: IFOAM

3.2.2 Asia

Most governments have policies to promote food production without little regard for quality, food safety, and environmental impacts. With a few exceptions, organic farming is not a priority. In 2013, IFOAM Asia initiated the Asian Local Governments for Organic Agriculture (ALGOA) with the aim to foster dialogue and cooperation among local Asian governments for the development of organic agriculture and its related industries. Despite having a large number of producers, the Asian organic movement is not well organized. Organic regulations have been implemented in 23 countries^[87].

The Asian Network for Sustainable Organic Farming Technology (ANSOFT) facilitates information exchange and strengthens the organic sector by generating scientific evidence. The Asian Research Network of Organic Agriculture (ARNOA) is a network of individual researchers scattered in 17 Asian countries. The Network for Knowledge Transfer on Sustainable Agricultural Technologies and Improved Market Linkages in South and Southeast Asia (SATNET) facilitates knowledge transfer through the development of a portfolio of best practices on sustainable agriculture, trade facilitation, and innovative knowledge sharing. IFOAM Asia was established in 2012 and currently has more than 100 members. National net-

Box 2: Asian organic agriculture facts, 2015^[82].

- › Total organic agricultural area: 4 million hectares (0.2% of Asia's agricultural area, 8% of the world's organic agricultural area)
- › 851'000 producers, mostly in India
- › Leading countries by area: China (1.6 million hectares, 0.3% of total agricultural area) and India (1.2 million hectares, 0.7% of total agricultural area)
- › Markets: Continual growth. Sales of organic products in China: 4.7 billion Euros (world's fourth biggest market for organic products)
- › Key products: Cereals, oilseeds, textile crops, coconut, and coffee



Asia needs more long-term research programmes and extension services for farmers. Photo: Paul van den Berge

works include the Bangladesh Organic Agriculture Network (BOAN), the Korean Society of Organic Agriculture, and the Iranian Scientific Society of Agroecology (ISSA).

The most important challenge for organic food and farming systems in Asia is the limited number of long-term research programmes. The severe shortage of extension services presents a critical problem for farmers.

3.2.3 Europe

In Europe, organic farming is recognized for its dual role of meeting consumer demand for high-quality products and securing certain public goods (environment, biodiversity, soils). Since 1992, the EU has had a regulation that defines organic farming, and support payments for conversion and maintenance are granted under the Common Agricultural Policy (CAP). Since 2004, two EU action plans have supported organic agriculture with promotion campaigns, standards development, and research funding. Similar developments have taken place in non-EU countries, where organic farming is both legally protected and financially supported. The European strategy seeks to fine-tune social, ecological and technological innovation.

About 20 universities and public research centres are actively involved in a number of projects. Substantial research is also carried out by 10 private research institutes that are funded through

both private and public money. Today, substantial funding is available through both national research programmes and projects funded by the European Union³. In the last 25 years, the EU has substantially increased funding for organic food and farming systems. The European Technology Platform for Organic Food and Farming⁴ (TP Organics) joins the efforts of the industry and civil society in defining organic research priorities and promoting them to policy makers. Europe has a long tradition of well-established (bi-)annual conferences at national or regional levels. Additionally, inter- and transdisciplinary conferences unite scientists, farm advisors and farmers.

European countries cooperate to develop common priorities in organic food and farming systems based on national stakeholder dialogs (CORE Organic). One priority of European stakeholders is to achieve further increases in productivity by means of various ecosystem

Box 3: European organic agriculture facts, 2015 ^[82].

- › Total organic agricultural area: 12.7 million hectares (2.5% and 6.2% of Europe's and the EU's agricultural area, respectively. 25% of the world's organic agricultural area)
- › 349'000 producers
- › Leading countries by area: Spain (2.0 million hectares, 7.9% of total agricultural area), Italy (1.5 million hectares, 11.7% of total agricultural area) and France (1.4 million hectares, 5.0% of total agricultural area)
- › Markets: Strong annual growth rates. Consumption of organic food greater than five percent in several markets. Sales of organic products: 29.8 billion Euros (EU: 27.1 billion Euros)
- › Key products: Cereals, green fodders, and olives

³ www.organic-research.org/european-projects.html

⁴ www.tporganics.eu

functions – so-called ‘eco-functional intensification’. This research area also encompasses precision farming, robot technology, sensor technology, and information and communication technology (ICT). A second set of priorities emphasizes the role organic agriculture plays in keeping rural areas economically, ecologically, and socially attractive (i.e., ‘empowerment of rural areas’). A third set of priorities revolves around food quality (i.e., ‘healthy food for well-being’). This scheme is the overall European strategy for uniting social, ecological and technological innovations.



In Europe, support payments for organic agriculture are granted under the Common Agricultural Policy. Photo: dreamstime

3.2.4 Latin America and the Caribbean

Most countries have a third party certification system, but Participatory Guarantee Systems (PGS) are commonly used in local markets in several countries. The Inter-American Commission for Organic Agriculture (ICOA), composed of the region's ministers of agriculture and the USDA, contributes to the development of the organic sector and facilitates trade.

The Latin America Society for Agroecology (SOCLA) is the main regional network that promotes research, communication, and collaboration between farmers and researchers throughout Latin America. SOCLA works with national universities and the Spanish Society for Ecological Agriculture (SEAE). The Iberoamerican Agroecology Network for the Development of Climate Change Resilient Agricultural Systems

(REDAGRES) was developed by SOCLA and SEAE. The Latin American Meeting on Organic Agriculture, 'Encuentro Latinoamericano de Agricultura Orgánica' (ELAO), promotes farmers' research in organic production through conferences in which 70% of speakers are farmers, sharing their results with 30% researchers and technicians. Highly active national networks, such as the Mexican Society of Sustainable Agriculture (SOMAS), organize national conferences and keep a record of publications.

A top research priority is defining appropriate indicators to measure the performance of agro-ecological systems. Research networks working on resilient agro-ecological systems should be consolidated, and more inter- and transdisciplinary research should be conducted. Research in the following areas should

Box 4: Latin American organic agriculture facts, 2015 ^[82].

- › Total organic agricultural area: 6.7 million hectares (0.9% of Latin America's agricultural area, 13% of the world's organic agricultural area)
- › 450'000 producers (most of them in Mexico)
- › Leading countries by area: Argentina (3.1 million hectares, 2.1% of total agricultural area), Uruguay (1.3 million hectares, 9.0% of total agricultural area) and Brazil (0.8 million hectares, 0.3% of total agricultural area , 2014 data)
- › Markets: The majority of certified organic products are for export markets. However, the domestic organic market is developing in Brazil and Peru.
- › Key products: Coffee, cocoa, tropical fruits, and cereals



Latin America needs sound indicators to measure agro-ecological systems' performance. Photo: Christian Andres

be promoted: livestock, seeds and fruits, waste management, post-harvest storage, losses and processing, nutrition and marketing. In addition, more nutrient efficient agroforestry systems and fair marketing strategies should be promoted to farmers and traders, respectively. Technical challenges include weed management in organic agriculture and the development of equipment suitable for smallholders in hilly areas. Finally, the consumption of organic products in family farming systems should be enhanced.

3.2.5 North America

In the USA, the Scientific Congress for Organic Agriculture Research (SCOAR) promoted a research agenda for the organic farming sector, which led to the creation of the Organic Agriculture Research and Extension Initiative (OREI) in the 2008 Farm Bill. In Canada, the Canada Organic Office implements the Canada Organic Regime regulatory framework, and certification bodies verify the application of standards. The Canadian Organic Trade Association, the Organic Federation of Canada, and other provincial and national bodies influence Canadian policy on organic farming.

An Organic Agriculture Research Symposium is held annually in the US in conjunction with a regional organic farmers' meeting. An International

Organic Research Conference at the American Society of Agronomy was held in 2014. The Organic Agriculture Centre of Canada (OACC) at Dalhousie University coordinates science and knowledge transfer in organic agriculture as well as industry-supported research and development endeavours ('Organic Science Cluster') in collaboration with the Organic Federation of Canada.

North American organic agriculture is among the most advanced in the world and has the technological capacity for high production on large scales. Despite the recent global economic crisis, the organic sector continues to grow, as do its research needs. Even though considerable progress has been achieved over the past 20 years, researchers in both

Box 5: North American organic agriculture facts, 2015 ^[82].

- › Total organic agricultural area: 3 million hectares (0.7% of North America's agricultural area, 6% of the world's organic agricultural area)
- › 19'138 producers (most of them in the USA)
- › Leading country by area: United States of America (2 million hectares, 0.6% of total agricultural area)
- › Markets: Sales of organic products: 35.8 billion Euros (11% increase between 2013 and 2014 in the USA) and 2.8 billion Euros in the USA and Canada, respectively
- › Key products: Cereals, green fodders, and vegetables

the US and Canada face limited capacity and an uncertain funding climate. However, there is no question that capacity to conduct organic agriculture research has increased in the US over the past 10 years. Whether it will continue to grow, has hit a plateau, or will fall because of the combined fiscal and economic crises, remains to be seen. Continued growth of the organic farming research capacity, as well as technology transfer, is needed to ensure that the growing needs of the organic sector are met in the future.



North America has the technological capacity for organic production on large scales. Photo: Chloé Raderschall

3.2.6 Oceania

Even though Oceania has the largest areas under organic farming in the world (albeit extensive grazing land), both Australia and New Zealand have little policy support for organic agriculture. In 2014, the Organic Federation of Australia (OFA) submitted recommendations^[88] to support organic agriculture in response to the National Food Plan published by the Government in 2012^[89]. In New Zealand, the government facilitates organic exports through the Official Organic Assurance Programme (OOAP). Currently, Organics Aotearoa New Zealand (OANZ) together with the respective Ministries are working on the development of a single national standard. In the Pacific Islands, the

Secretariat of the Pacific Community (SPC) developed a brief with seven policy recommendations to strengthen organic agriculture in national policies in 2009. However, in most cases, this has not evolved into legislation. SPC continues to provide support, but there is a critical need for a long-term funding strategy^[90].

Among several regional conferences, the National Association for Sustainable Agriculture Australia (NASAA) organized the Organic World Congress, which included an International Scientific Conference in 2005. However, there is no regular conference schedule. Organic Trust Australia – Research and Education (OTARE) manages funds received from

Box 6: Oceania organic agriculture facts, 2015^[82].

- › Total organic agricultural area: 22.8 million hectares (5.4% of Oceania's agricultural area; 45% of the world's organic agricultural area)
- › 23'000 producers (most of them in Papua New Guinea)
- › Leading countries by area: Australia (22.7 million hectares, 97% is extensive grazing land; 5.6% of total agricultural area), New Zealand (74'000 hectares, 0.7% of total agricultural area) and Samoa (almost 30'000 hectares, 9.8% of total agricultural area)
- › Markets: Strong growth rates in Australia, New Zealand, and the Pacific Islands due to rapidly growing demand overseas. Sales of organic products: 1.3 billion Australian Dollars (2014 data) and 124 million Euros in Australia and New Zealand
- › Key products: Animal products, tropical fruits, coconut, coffee, and nuts

private and public sources for research and education in organic agriculture in Australia. Regional journals include the Journal of Organic Systems, the Future Farming Centre's Bulletin and Soil & Health's 'Organic NZ'. The website Organics Knowledge Hub⁵ has a tailored search engine providing access to Australian research reports. In the Pacific Islands, the Pacific Organic & Ethical Trade Community (POETCom) hosts an annual technical exchange, bringing together regional farmers to share learning.

In 2006, the Organic Federation of Australia published its position paper, 'Priorities for Research and Extension

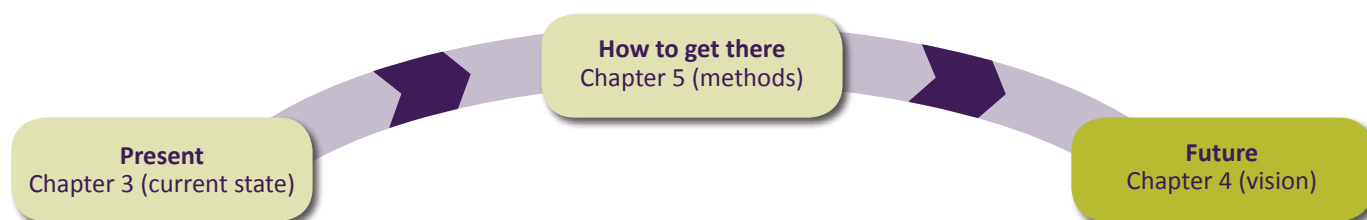
in Organic Agriculture in Australia'^[91], in which it laid out its priorities for research, extension, and education. The conclusion was that, as Australia has such a dearth of funding in this area, it would be best to invest most of the available funding into the collection and dissemination of information rather than into original research. Educating consumers about organic quality, how to recognize it in markets, as well as identifying bottlenecks in the supply chain were considered to be of prime importance. Topics of research projects to be undertaken need to be determined by a consultation with a range of relevant stakeholders.

Oceania has the largest areas, but little policy support for organic agriculture. Photo: Chloé Raderschall



⁵ www.organicshub.com.au

4 Vision 2030 for the future development of organic farming



4.1 Organic 3.0 contributes to the resolution of the future challenges of global agriculture

Global agriculture must minimize its negative impacts and achieve productivity gains if it is to be sustainable, foster rural development, and support peoples' livelihoods. Organic food and farming systems can contribute to solving these challenges: besides the various benefits and strengths mentioned under Section 2.1, organic agriculture develops co-innovation between farmers, farm advisors and scientists^[76-77, 92-100], and can improve farmer-to-farmer as well as farmer-to-consumer communication and cooperation. Organic agricultural systems are also the best solution for buffer zones between agriculture and nature conservation areas, as well as for the management of watersheds^[29-37]. However, current policies do not recognize most approaches employed in organic agricultural systems^[2-11]. The concept of Organic 3.0 seeks to change this by positioning organic as a modern, innovative system, which foregrounds the results and impacts of farming^[101].

The overall goal of Organic 3.0 is to enable a widespread uptake of truly sustainable farming systems and markets, based on organic principles and inspired by a culture of innovation,

transparent integrity, inclusive collaboration, holistic systems, and true-cost accounting. Organic 3.0 is not prescriptive but descriptive: instead of enforcing a set of minimum rules to achieve a final static result, it is outcome-based and continuously adaptive to the local context. It calls for a culture of continuous improvement through private and stakeholder-driven initiatives towards best practices based on local priorities. If we develop current organic food and farming systems to meet these criteria, they may be a model to resolve future challenges of global agriculture.

Agronomic issues and high labour demand influence productivity and profitability. More research can improve the economic competitiveness of agricultural systems. Current policies and market dynamics favour unsustainable agronomic practices by stimulating the production of single commodities in large quantities. Such commodities are sold at distortedly low prices at the cost of the environment and, ultimately, humankind. If these costs were internalized (True Cost Accounting (TCA)), conventional produce would become more expensive and sustainable produce more competitive. Science has to develop feasible TCA solutions for all stakeholders, which may translate into a shift towards higher sustainability of

agricultural production. However, there are major research gaps in the quantification of the true environmental, social, and health costs of different agricultural production systems. Furthermore, we lack a common, feasible and scalable TCA framework, and the practical implementation of such accounting systems is understandably complex, requiring dedicated efforts by policy institutions based on comprehensive research findings^[102].



‘Organic 3.0’ seeks to position organic agriculture as a modern, innovative system. Photo: Paul Mäder

Research on organic agriculture and food systems is likely to follow three main pathways (Figure 2):

1. Pathway 1 improves and enables organic agriculture to become the preferred land use system in rural areas worldwide,
2. Pathway 2 improves and enables organic agriculture to feed the world and conserve the planet's natural resources,
3. Pathway 3 enables organic agriculture to produce healthy food in a fair way for the well-being of all.

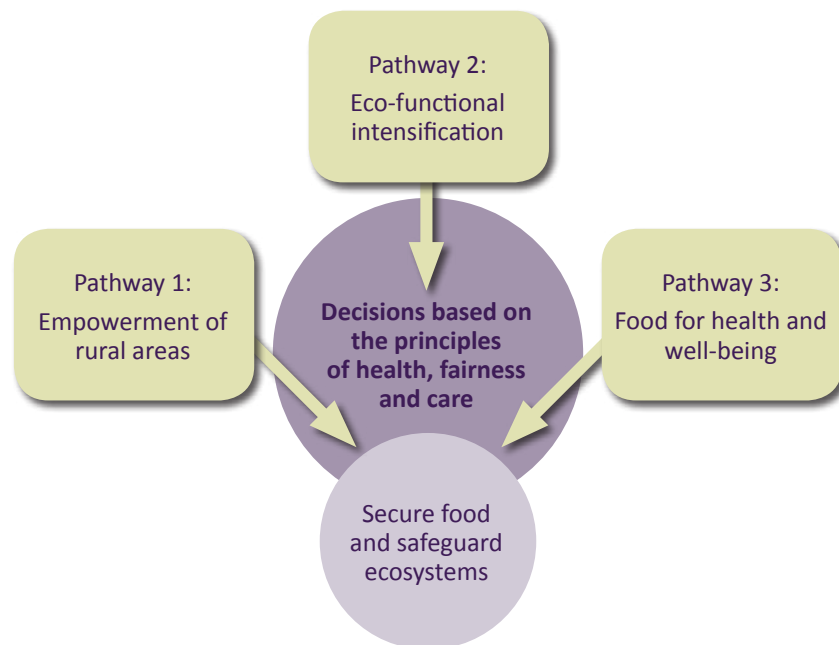


Figure 2: Pathways for future development of organic agriculture research.

4.2 Pathway 1: Organic agriculture will become the preferred land use system in rural areas worldwide.

Examples of research fields and activities that are derived from this vision include:

- › Inclusion of all stakeholders,
- › Creating value-added food chains and improve their governance,
- › Improving the economic viability of short food chains,
- › Comparing the transformation costs and macroeconomic efficacy,
- › Further improvements of the ecological, social and economic sustainability of organic farms,
- › Regionalization of organic farm practices,
- › Improvements of the methods and concepts for alternative, transparency-based assurance schemes (e.g. Participatory Guarantee Systems (PGS), 3rd-party certification, etc.),
- › Studying consumer preferences and barriers for consuming organic products,
- › Develop certification schemes based on continuous improvement and integration of local specific aspects,
- › Application of indicator-based benchmarking and certification schemes.



'Organic 3.0' seeks to empower rural areas. Photo: Matthias Klais

Vision

Organic agriculture will be the preferred land use model and thus empower rural economies. Viable local economies will attract people, improve livelihoods and halt migration to cities. Organic farming will intensify partnerships between consumers and producers by fostering dialogues between them. Through best use of natural and social resources, organic agriculture will be a powerful intensification strategy in rural areas and for subsistence farming.

4.3 Pathway 2: Secure food and ecosystems through eco-functional intensification.

Examples of research fields and activities that are derived from this vision include:

- › Closing yield gaps, while improving the resilience and stability of farms,
- › Enhancement of systems' diversity at field, farm and landscape levels (including habitat management),
- › Becoming truly independent of fossil P sources by recycling of waste and human faeces,
- › Soil health (including soil fertility-building techniques such as the use of legumes, etc.),
- › Plant health and productivity (including intercropping),
- › Animal health and welfare (including land use and feeding strategies),
- › Closing yield gaps between organic and conventional farming,
- › Breeding of crops and livestock for organic conditions, targeting resilience,
- › Improvement of climate-smart farming systems (including landscape aspects), and
- › Organic agricultures' contribution to a circular economy, integrated with bio-refinery.

Vision

Eco-functional intensification will increase the availability of food and stabilize food supplies. Use of non-renewable resources and off-farm inputs will become obsolete. High standards in animal welfare will be maintained and sustainable ecosystem management will be state-of-the-art. Organic farming will minimize negative trade-offs between productivity and sustainability, making it the benchmark for the responsible and precautionary use of science in food and farming systems. Organic farmers will be the best agricultural ecosystem managers, co-researchers, and resource optimizers.

4.4 Pathway 3: Organic agriculture will produce healthy food in a fair way for the well-being of all.

Examples of research fields and activities that are derived from this vision include:

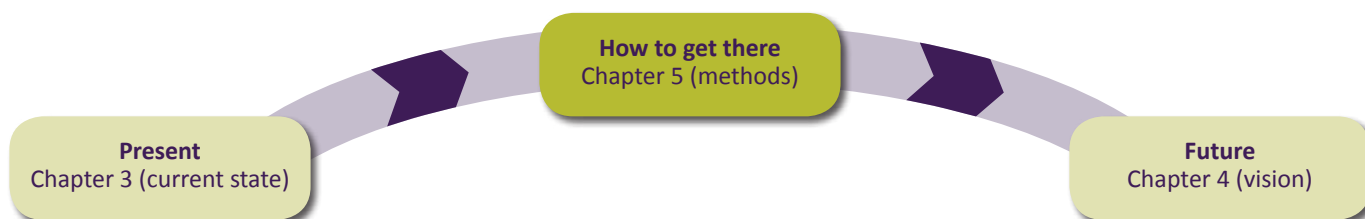
- › Intrinsically sustainable food systems (including diets, eating habits and food waste),
- › Interactions between food quality, organic diets, people's health, welfare, and climate mitigation^[56],
- › Value of biological diversity,
- › Traditional and gentle, yet innovative processing techniques for authentic food products,
- › Prevention of contaminants that are prohibited in organic production and handling,
- › Development of eco-friendly packaging for organic foods,
- › Resource management in food distribution systems,
- › Improvement of concepts for inspection and certification,
- › Improvement of methods and concepts for Participatory Guarantee Systems (PGS),
- › Implementation of indicators and metric-based certification systems^[62].

Vision

Healthy diets, consisting of fresh and whole foods with intrinsic qualities, which are only minimally altered by processing will be a standard. In terms of taste, regional variation will be preferred over artificial design. Organic farmers, food processors, and distributors will jointly spearhead the transition to more conscious consumption patterns and the renaissance of authentic traditional foods. Members of the organic movement will be innovative in the design of cooperative and participative models of transport, as well as safe and traceable food systems.



Organic food and farming systems produce healthy food for the well-being of all. Photo: Thomas Alföldi



5 Strategies to advance global organic agricultural research and innovation

For organic agriculture to grow, and to make significant progress in providing organic food and fibre for a growing population, several long-term strategies are needed to build research capacities throughout the world, disseminate research results, and help farmers and other value chain actors developing and adopting better technologies. TIPI identifies three strategic approaches, which can help advancing global organic agriculture research and innovation:

1. Development of research methods appropriate for organic farming systems and practices,
2. A renewed partnership between farmers, farm advisors, scientists, and consumers,
3. Integration of technological, social, and ecological dimensions of innovation.

5.1 Research methods appropriate for organic farming systems and practices

Well-maintained agronomic field trials are essential to collect good quality data, which can be shared with the international research community through publications in peer-reviewed journals. Furthermore, such field trials should be used for meetings with various stakeholders, especially farmers (who

may validate or complement the results with their own practical experiences) and students, who can increase their knowledge of organic food and farming systems.

While on-station, component-focused research helps clarifying underlying mechanisms and rules out the confounding effects of extraneous variables, multi-locational, inter- and transdisciplinary systems' research with different crops can aid in understanding the interactions between multiple factors within a given system. Such studies should focus on self-reliance and local food systems^[103-105], and should include measures of internal stability, resilience and environmental indicators^[62].

5.2 Co-innovation between farmers, farm advisors, scientists, and consumers

On-farm transdisciplinary research – in which participating farmers influence the research agenda from the very beginning – may help defining the best organic practices for local conditions, thereby increasing the likelihood of research results being widely adopted on project completion. This approach may encompass several methodologies, including initial interviews with knowledgeable farmers, veterinarians, and farm advisors, classical on-farm research^[106-107], 'mother-baby' trials, participatory action research and farmer field schools^[108-111]. Interactive knowledge-sharing approaches may stimulate farmers' to adapt their practices, while scientists

and external consultants act as facilitators who integrate different forms of knowledge and make them more accessible to different stakeholders.

In such processes, farmers do not only ensure that their needs are addressed, but validate research results and further test innovations on their farms, which increases their confidence and improves their income. As a result, some may become 'lead farmers' or advisors to their peers. These collaborations have high potentials for success because they focus on actual farmers' practices, their constraints, and possible improvements. Success stories result in farmers disseminating information, and help enhancing the adoption of research-based innovations. However, these processes necessitate education of both researchers and farmers in order to enable mutual understanding and respect. Ideally, farmers should be compensated in the period before their efforts start paying off. Examples of successful partnership models include participatory plant breeding clubs (e.g. Solibam⁶), farmer innovation networks (e.g. Practical

Farmers of Iowa, Farm Hack, Syprobio or iCow⁷ [112-113], innovation platforms (e.g. TP Organics)^[114] and farmer-to-farmer exchanges (e.g. Via Campesina⁸).

Since many years, consumers and citizens are successfully involved in research activities in the field of rural development, landscape restoration, environmental protection, climate mitigation or diet-related health problems. Organic agriculture needs similar approaches as many research activities address not only technical and economic changes of farmers, but also consumption preferences and patterns, human diets, as well as repositioning of farmers and their services in the society. 'Citizen Science' is meanwhile used by many applied research disciplines and across prestigious universities. Modern media enable remote people to build virtual research teams and help researchers and user groups increasing creativity and innovation.



Co-innovation between farmers, farm advisors, scientists and consumers to advance organic food and farming systems. Photo: Thomas Alföldi

⁶ www.solibam.eu

⁷ www.icow.co.ke

⁸ www.viacampesina.org

5.3 Integrate dimensions of innovation

Agricultural innovation has three dimensions: technological (including products, services, procedures, and processes), ecological and social. Approaches that solely focus on technological innovations (e.g. the ‘Green Revolution’ model) may increase vulnerability and dependency in agricultural value chains. The two key elements caution and responsibility in agricultural management of IFOAM – Organics International's principle of care stimulate the implementation of organic standards. This,

in turn, has led to organic agriculture being among the leading models of sustainable business practices in the agricultural sector, and an exemplar of social innovation in the 21st century^[115]. The best practice guideline for agriculture and value chains developed by the Sustainable Organic Agriculture Action Network aims to lead, guide and inspire people to reverse the destructive path modern agriculture has taken on our planet (Figure 3).



Figure 3: Best Practice Sustainability Flower for Agriculture and Value Chains⁹.

⁹ <http://www.ifoam.bio/en/organic-landmarks/best-practice-guideline-agriculture-and-value-chains>

Future technological and institutional innovations should be measured by their contribution to the transformation of both society and food systems in light of global challenges such as population growth, climate change, environmental pollution, and deterioration of natural resources. Incentives should be given to supply chain actors who improve the sustainability of their business model by going beyond minimal compliance with organic standards. In general, IFOAM – Organics International’s holistic principles, with social indicators such as justice, gender, employment, etc., should be applied to assess the sustainability and resilience of technological innovations in the organic farming sector [62, 116]. There remains a strong need to further develop appropriate tools, which include both qualitative and quantitative indicators to allow for such assessments (e.g. RISE and SMART¹⁰) instead of life cycle assessments (LCAs), which fail to consider all sustainability dimensions¹¹ [117].

Interdisciplinary collaborations are needed to understand how organic farming systems work and how to make further improvements. Transdisciplinary research involves not only academics and farmers, but also civil society representatives. Application of basic research requires an interdisciplinary approach. For innovations in organic agriculture to be broadly adopted, academic institutions need to develop research curricula that are both truly inter- and transdis-

ciplinary, and support projects where natural and social scientists co-operate on a common frame of reference and methods. It is vital for the future success of organic agriculture that institutions impartially recognise the full potential of organic food and farming systems to provide for current generations without compromising the needs of future generations [7, 118].



Institutional innovations to transform society and food systems.
Photo: Mathias Marx

¹⁰ www.fibl.org/de/themen/smart.html

¹¹ www.sustainable-food-systems.com

6 Four exemplars of innovation development based on agricultural research

6.1 Innovation based on tacit knowledge

A team of pharmaceutical and veterinary scientists from FiBL interviewed more than 200 farmers and veterinarians in Switzerland. These document 1'025 homemade remedies and the therapeutic use of 100 plants on livestock. This vast array of information, including modes of action from the scientific literature, application rates, frequencies, and farmers' experiences of the efficacy of these solutions is being made available for other farmers via internet databases ^[119].

6.2 Innovation based on farmer participation

Syprobio ¹² is a EuropeAid funded research and development project to produce farmer-proposed innovations to be jointly tested by farmers and researchers. Syprobio works with farmers in Benin, Burkina Faso, and Mali to identify production challenges and promising solutions for cotton-cereal crop rotation systems. Farmer groups identified innovations based on their own ideas and experiences in five key areas: soil fertility, plant health, seeds, crop management, and socio-economics.



Farmers have experiences with homemade plant remedies for healthy livestock. Photo: Thomas Alföldi

¹² www.syprobio.net

¹³ <http://biofactor.info>

¹⁴ www.tilman-org.net



Adapted machinery for reduced tillage increases soil fertility, controls weeds and reduces labour. Photo: Tobias Eisenring

6.3 Innovation based on eco-functions

The project Biofactor¹³, funded by the European Union, unites 21 institutes to improve the efficiency of alternative fertilisation strategies, such as organic and low-input farming, use of waste-based fertilisers, and fertiliser placement technologies. Bio-effectors addressed comprise fungal strains of *Trichoderma*, *Penicillium*, and *Sebacinales* as well as bacterial strains of *Bacillus* and *Pseudomonas* with well-characterized root growth-promoting and nutrient-solubilising potential. In addition, natural extracts of seaweeds, compost and plants, as well as their purified active compounds, are being tested on various crops for their protective potential against biotic and abiotic stresses.

6.4 Innovation based on the smart use of technology

Several research teams in Europe investigated reduced tillage for organic arable crop rotations. The field research carried out by the TILMAN-ORG project¹⁴ (co-funded by pooled national and EU funds) showed that reduced tillage led to increased soil fertility and carbon sequestration. Through the integration of green manures and the use of adapted machinery (e.g. ploughs with shallow inversion, wide chisel blades, and automated, camera-driven inter-row weed-hoeing machines), weeds were effectively controlled and labour drastically reduced.

7 The knowledge chain

7.1 State of the art

Making informed decisions requires access to and exchange of information. These are key problems for farmers, researchers, and businesses wanting to develop markets. Here, applied research programs with a strong component in dissemination such as the Research Framework Programmes of the European Union can greatly contribute and accelerate the development of the organic sector. Strong associations of organic farmers in some European countries (e.g. Switzerland, Denmark, Germany, Austria, and Italy) as well as Canada, the United States, Australia, and a few countries in Latin America, Africa, and Asia mitigate the issue of access to, and exchange of information.



Exchange of information is vital for making informed decisions. Photo: Thomas Alföldi

7.2 Important online learning and information portals

Much information is available on different websites and databases such as:

- › Organic Eprints (international open-access archive for papers and projects related to research in organic food and farming, mostly English, www.orgprints.org)
- › BIOBASE (French, www.abiodoc.com)
- › SINAB (information system for organic farming, including research information, at the website of the Italian Ministry of Agriculture, Italian, www.sinab.it)
- › Information on organic farming research in Germany (German, www.forschung-oekolandbau.info)
- › Website of the Organic Agriculture Centre of Canada (English and French, www.organicagcenter.ca)
- › eOrganic – America’s Research-based Learning Network Extension (English, www.extension.org/pages/25242/webinars-by-eorganic#.VB8G-P4cQdU)
- › ATTRA’s organic resources for the USA (English, <https://attra.ncat.org/organic.html>)
- › Online shop of the Research Institute of Organic Agriculture (technical guides, leaflets, etc., in German, French, Italian, and English, shop.fibl.org)
- › YouTube channel of the Research Institute of Organic Agriculture (practical demonstrations of new equipment, etc., various languages www.youtube.com/user/FiBLFilm)
- › African Organic Agriculture Training Manual (English and Swahili, www.organic-africa.net/training-manual.html)
- › Bioaktuell (practical information for Swiss farmers in German, French, and Italian, www.bioaktuell.ch)
- › Organic Farming Association of India (English, www.ofai.org)

7.3 Bottlenecks

Bottlenecks for the availability of, and access to knowledge are: 1) the size of the research community, 2) coordination and cooperation among organic farmers, 3) willingness of the scientific community and policy makers to consider traditional knowledge, and 4) lack of adequate extension services to disseminate research-based solutions to end-users.

7.4 TIPI's potential role in knowledge exchange

TIPI may engage in different activities to promote knowledge exchange, such as:

- › Raising awareness about exemplars of farmer-driven innovations and international cooperation,
- › Maintaining important online learning and information portals (inventories of research programmes, institutions, and scientific literature),
- › Fostering knowledge exchange among TIPI members,
- › Consolidating existing data in one archive such as Organic Eprints,
- › Facilitating the co-production of practical leaflets and teaching materials by stakeholders,
- › Producing practical state-of-the-art knowledge kits about the most important aspects in international organic agriculture (mid-term vision),
- › Kick starting a website similar to Wikipedia with farmer entries from around the world (long-term vision).



TUPI fosters knowledge exchange among members such as farm advisors and farmers. Photo: IFOAM

8 Next steps

8.1 The role of TIPI

TIPI calls upon all stakeholders to discuss which stakeholder groups should drive what parts of the strategic research agenda, and how they could be better coordinated. Members of TIPI think that this will depend on farmers' organizational ability and willingness to express their needs at a higher level of administration. Therefore, TIPI members will facilitate exchanges and cooperation within the organic community – particularly between farmers' organizations and research institutions – as well as with policy makers, convincing them of the high importance of TIPI members' facilitating roles to exploit the full potential of organic agriculture to meet global challenges.

8.2 TIPI's action plan

TIPI's action plan defines the next steps towards empowering the organic community through social and technical innovations. This is a dynamic process leading to a work programme for the TIPI Council and its members once the members approve the vision and strategy document.

TIPI will then take the following actions:

1. Invite local, national and regional organic associations, as well as research institutes, civil society groups, NGOs, public administrations and governmental organizations to become members or supporters of TIPI,
2. pursue investments into the knowledge portal www.organic-research.net,
3. ensure that all stakeholders are represented in the TIPI Council,
4. build a database on the benefits and challenges of advancing global organic agriculture,
5. prepare evidence-based policy briefs for IFOAM – Organics International,
6. establish a worldwide registry of topic leaders for organic agriculture,
7. establish and promote networks to develop and transfer farmer-driven innovations,
8. publish case-studies of successful farmer-driven innovations,
9. mobilize a broad range of stakeholders for the conferences of IFOAM – Organics International and the International Society of Organic Agriculture Research (ISO FAR),

10. facilitate discussions on future pathways of global organic agriculture and 'Organic 3.0',
11. identify and demonstrate best organic practices from all over the world,
12. establish internship schemes for students working on organic agriculture worldwide,
13. build capacity in Sub-Saharan Africa, South Asia and Central America,
14. quantify and internalize the external costs of agriculture and food chains, and
15. develop a global research agenda for organic food and farming systems and create policies to promote it.



Just as a healthy soil supports a healthy plant, sound policies promoting a global research agenda will ensure organic food and farming systems to thrive. Photo: FiBL

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TIPI aims at fostering international collaboration in organic agriculture research, engaging and involving all stakeholders that benefit from organic agriculture research, facilitating the exchange of scientific knowledge of organic food and farming systems, and helping to disseminate, apply, and implement innovations and scientific knowledge consistent with the principles of organic agriculture.

This document lays down TIPI's Global Vision and Strategy to advance organic agriculture through research, development, innovation, and technology transfer.



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