CHAPTER 17

ENHANCING KNOWLEDGE FOR FOOD SECURITY

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According to the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD, 2009), agricultural knowledge, science and technology (AKST) are of paramount importance to address different development and sustainability issues: hunger, poverty, rural livelihoods, human health, and sustainable development. AKST become even more important when considering that achieving development and sustainability goals has to be placed in the context of a rapidly changing world of urbanisation, growing inequities, human migration, globalisation, changing dietary preferences, climate change, environmental degradation and the growing use of alternative energy sources such as bioenergy including biofuels and an increasing population. Therefore, achieving development and sustainability goals would entail increased funds and more diverse funding mechanisms for inter- and multi-disciplinary agricultural research and development as well as associated knowledge systems.

According to Tara Garnett (2013), the food "problem" has become a global obsession. Feeding the growing world population requires new strategies and new multicultural and multi-sectoral rethinking capable of generating new forms of dialogue, at different specialist levels, to ensure food and nutrition security (Godfray *et al.*, 2010). An answer to this challenge is undoubtedly represented by the development of the research and innovation sectors and by an increase in the degree of the awareness of their actors on the needs for involving all the food chain operators in decisions pertaining to food and nutrition security. Accordingly, knowledge and innovation transfer should be effective and supported by appropriate policies and investments. This implies the creation of stronger linkages between researchers and producers thus shortening the knowledge chain (Adinolfi *et al.*, 2015). In order to elaborate tangible solutions, it is important to promote effective cooperation and dialogue among the agri-food system actors, established by innovative and evidence-based policy instruments that not only foster knowledge generation but also its multi-directional and circular flow. Policies should also help creating an enabling environment for innovation.

In this chapter we will explore options aimed at better linking supply and demand in the agri-food knowledge chain in relation to food security in the Mediterranean area, which would in turn make the agri-food research system more effective and efficient in the reduction of knowledge waste. The first section provides an overview of agricultural knowledge generation and dissemination and an analysis of the role of agricultural extension and advisory services within the agricultural innovation system. The second section highlights the main needs related to the four dimensions of food security (i.e. availability, access, utilisation, stability) in the Mediterranean with a particular focus on southern and eastern Mediterranean countries (SEMC). The third section presents different options and strategies for the development of an effective knowledge system for sustainable food security. We will see that these would include the adoption of a new transdisciplinary science of sustainable food systems and the participation and involvement of the different stakeholders in the governance and management of the knowledge chain.

Knowledge, technology and innovation in Mediterranean agriculture and the agri-food sector

Farmers' knowledge is continuously developing as a result of new insights, their day-to-day experience and their access to information. "Indigenous knowledge", which is not limited to technology, refers to knowledge that is unique to a given culture, society or environment, which forms the basis on which local decisions are made. It is dynamic and in a continuous process of change and therefore does not command the same status as what is referred to as "formal scientific knowledge" (Salm *et al.*, 2010). As David Millar *et al.* (2006) emphasise, we should be careful not to use western standards to measure traditional knowledge. Different worldviews, belief systems and visions of leadership, for example, influence not only which knowledge is relevant and prevalent in rural areas, but also how knowledge is developed and transferred. A type of education that is not linked to local views runs the risk of being irrelevant and disconnected from people's realities. This disconnection between formal education and indigenous knowledge, that is more context-specific and linked to reality, is one of the causes of knowledge waste as well as the ineffectiveness of education systems in many countries in solving real-world problems and addressing societal challenges.

Preserving and promoting traditional food knowledge in Lebanon: the TerCom project

As part of its activities, the TerCom cooperation project (*Activation of Mechanisms to Sustain Rural Territories and Communities*) in Lebanon prepared an Atlas of Traditional Products. The project was financed by the Italian Ministry of Foreign Affairs and International Cooperation and the Apulia Region. Published by the Lebanese Ministry of Agriculture, the Atlas represents a new initiative to promote local and traditional knowledge with regards to food preparation and culinary traditions. Divided into seven sections it gathers 88 fact sheets about typical products (cereals, beverages, culinary specialties, animal and vegetal products and desserts) and 72

typical traditional recipes identified through several visits made jointly by the project team and the experts of the Lebanese Ministry of Agriculture. This recovered knowledge has been also made available for the three Local Action Groups (LAGs) created by the same project in Tyr, Baalbek and Byblos. Thanks to this Atlas, small producers can be recognised at the local level and participate in the process of the development of the region. Promotion of Lebanese traditions at local and international level is also possible through this Atlas.

Source: Annarita Antonelli, CIHEAM-Bari.

According to the IAASTD (2009), the scope of agricultural knowledge goes beyond the narrow confines of science and technology (S&T) and encompasses other types of relevant knowledge (e.g. knowledge held by agricultural producers, consumers and end-users). Therefore, any assessment of agricultural knowledge should adopt a multidisciplinary and multi-stakeholder approach requiring the use and integration of information, tools and models from different knowledge paradigms including local and traditional knowledge. The IAASTD assessed both formal S&T and local and traditional knowledge, addressed agricultural production and productivity but also the multifunctionality of agriculture[1], and recognised that multiple perspectives exist on the role and nature of AKST. Once AKST are directed simultaneously toward production, profitability, ecosystem services and local food systems, then formal, traditional and local knowledge need to be integrated. Traditional and local knowledge constitutes an extensive realm of accumulated practical knowledge, especially by farmers and rural population, and has a knowledge-generating capacity that is needed if sustainability and development goals are to be reached (IAASTD, 2009).

Involving coastal communities in knowledge conservation and natural resources management: the NEMO initiative (Tunisia)

The NEMO project ("Cross-border rural coastal communities development in Libya and neighbouring countries – Egypt and Tunisia") is a cooperation initiative for the development of the region funded by the Italian Ministry of Foreign Affairs (Directorate General for Development Cooperation) carried out through a voluntary contribution of the CIHEAM-Bari, which is the implementing agency of the project, jointly with the General Direction of Fishery and Aquaculture and some Tunisian institutions. The project includes three main areas for local development: improving local governance, stopping the migration of local fishermen and enhancing local production.

The multi-purpose fishing centre in Zarzis archives local and traditional knowledge that has been discovered during the implementation of the project. This centre is to become the core of a development strategy for the local coastal communities and hosts activities to promote the main fishery knowledge and products, local foods and craftsmanship. Ancient knowledge and innovation are disseminated through meetings and training sessions targeting especially young fishermen.

Source: Daniele Galli, CIHEAM-Bari.

1 - The terms "multifunctionality in agriculture" or "multifunctional agriculture" are generally used to indicate that agriculture can produce various non-commodity outputs (e.g. environmental services, positive externalities, public goods) in addition to its primary function i.e. food production.

In many areas, traditional agricultural knowledge systems have evolved in the last years towards an innovation systems approach. In this approach, innovation is regarded as an interactive process between individuals and organisations possessing different types of knowledge within a particular social, political, policy, economic, and institutional context. This approach has seen its origins in the 1970s and 1980s when production had become more knowledge-intensive with a greater role played by non-material assets (research, training, management, etc.). This kind of knowledge has been defined as "tacit", often embedded in skills, beliefs or ways of doing things. Mastering tacit knowledge requires a conscious effort at learning by doing, using, and interacting (World Bank, 2007a). The innovation system approach should be considered as complementary to previous approaches (NARS and AKIS) that are still valid when analysing or promoting agricultural development.

In the 1980s the "National Agricultural Research System" (*NARS*) approach was applied focusing on strengthening research supply by providing infrastructure and developing capacity, management and policy support at the national level. The NARS comprises all the entities in a given country that are responsible for organising, coordinating, or applying research that contributes explicitly to the development of its agriculture and the maintenance of its natural resource base (World Bank, 2007a). In the 1990s, the "Agricultural Knowledge and Information System" (*AKIS*) concept appeared that recognises that research is not the only means of generating or gaining access to knowledge. This approach gives much more attention to the links between research, education, and extension and the farmers' demand for new technologies. The AKIS links people and institutions to promote mutual learning and to generate, share and utilise agriculture-related technology, knowledge, and information. An AKIS integrates farmers, agricultural educators, researchers, and extensionists to harness knowledge and information from various sources (World Bank, 2007a).

Besides farmers, the main components of any agricultural knowledge chain including agricultural innovation systems are research, training, education and extension. The linear model and the agricultural innovation system perspective have different views on the role of actors in innovation. The linear model emphasises on research and extension organisations to promote agricultural development. Nevertheless, experience has proved that multiple sources of innovation actors outside government have significant contribution to the creation, diffusion and application of knowledge. For instance, the World Bank (2007a) revealed that the private sector and farmers play a central role in the innovation process. The adoption of a linear model, which assumes that research centres are the only source of knowledge (scientific and formal), is also one of the causes of knowledge waste as it does not give the other types of knowledge (local, traditional, indigenous) the importance they deserve.

In the innovation system perspective, the role of research is different. It bases innovation on the diverse and interactive generation of knowledge in the public and private sectors and in civil societies (World Bank, 2007a) and supports the fact that research must focus more on developing strong interactions and linkages between research and relevant sectors. It is essential that the research system engages universities and research institutions, the private sector, producer organisations and cooperatives as well as civil

society organisations and stimulates the scaling-up of farmers' local innovations (Hall *et al.*, 2007; World Bank, 2007b). According to Norman Clark (2002), the Agricultural Innovation System (AIS) concept recognises that the innovation process involves not only formal scientific research organisations, but also a range of other organisations and other non-research tasks. Moving from the formal, linear agricultural innovation model towards transient interactive knowledge networks has very considerable implications for the role of public research and development (R&D) organisations that need to accept that science is by no means the only driver of innovation and that innovation can result from new social, economic and environmental challenges and opportunities (Daane, 2010). Traditional R&D must evolve towards Agricultural Research for Development (AR4D), which integrates research much more into the processes of transforming the agricultural sector (Daane *et al.*, 2009).

"Agricultural extension" is the defining metaphor for all technology transfer activities and models in agriculture. In the context of the innovation system, this transfer does not only include the dissemination of "pre-defined" technologies but also interactive and learning approaches. According to Cees Leeuwis (2004), communication for innovation should serve as a "two-way" or "multiple-way process", in which several parties involved in the process of knowledge generation and dissemination – not only research centres – can be expected to contribute with relevant insights. Agwu Ekwe Agwu *et al.* (2008) emphasise that the new approach should promote not only technical innovations, but also institutional, organisational and managerial innovations. Extension needs to provide a wider range of services to a more diverse clientele to improve their capacity to access, adapt, and use knowledge, inputs, and services. So, extension systems must be flexible, user-driven, and focused on local problems. Developing better habits and practices that promote wider interaction and learning is perhaps the greatest challenge for extension organisations (World Bank, 2007b). Extension must serve as a bridge to link farmers with other farmers and the research world, the private sector, training organisations, input and credit suppliers and policy makers to demand-driven innovations.

The education system also needs to adapt to meet the needs of the enhanced dynamics of agricultural innovation. Education institutes must offer more relevant subject matter for agricultural innovation, but this is not enough. It is also important to foster co-innovation initiatives, which entail working in inter-organisational and multi-actor teams. Effective co-innovation teams require competent individuals, not only in their profession's subject matter, but also in solving complex problems jointly with people from complementary professions and with non-professionals by exchanging knowledge and mutual learning. Performance will depend on the soft skills of the team's members (teamwork, communication, leadership, facilitation, negotiation and conflict-management skills) (Daane, 2010) but can also be enhanced by abilities in systems thinking and the adoption of a soft system methodology (Checkland *et al.*, 1990) or the multi-actor and participatory management of processes (Daane, 2010).

Investments in agricultural research and development (R&D) have paid off abundantly. Information from the Agricultural Science and Technology Indicators (ASTI) database suggest that R&D spending produced average returns in the order of 36%

(Alston *et al.*, 2000). Still, investment in agricultural R&D in SEMC is very low compared with the world average (FAO, 2015). In 2012, the highest agricultural R&D spending as percentage of agricultural GDP and number of agricultural researchers per 100,000 farmers was recorded in Lebanon and the lowest in Algeria (Table 1).

Table 1 - Agricultural R&D indicators in public institutions for selected Mediterranean countries in 2012

Country	Spending (millions of constant 2005 USD) at purchasing power parity (PPP)	Spending as percentage of AgGDP	Total number of agriculture researchers (in fulltime equivalents, FTEs)	Number of researchers per 100,000 farmers
Algeria	91.6	0.21	593.4	17.6
Egypt	528.4	0.44	8,419.7	133.3
Morocco	147.3	0.49	556.3	19
Lebanon	38.2	0.95	209.2	747.1
Tunisia	63	0.64	541.6	66.1
Turkey	537.3	0.51	3,009.4	38.5

Source: ASTI database (www.asti.cgiar.org/data).

In most SEMCs the traditional approaches of agricultural knowledge generation and dissemination based on technology transfer and delivery have gradually changed, fostering decentralisation, involving private actors and civil society organisations and improving institutional capacity. However, despite the various reform processes of innovation and knowledge systems, there are still several constraints that limit the concrete possibility for some groups to adopt innovations (e.g. smallholder farmers, marginal livestock producers and women farmers). Also, this process presents some criticalities due to constraints of the institutional, economic and financial context of some Mediterranean countries. In this regard, literature case studies show that the presence of the following key conditions might lead to interesting experiences of innovations adoption: effective participatory approaches, activation of appropriate financial and credit facilities, reactive institutional framework (Adinolfi *et al.*, 2015; Feeding Knowledge, 2015).

Knowledge and research needs for food security in the Mediterranean

The Rome Declaration on World Food Security in 1996 defined its three basic dimensions as: availability, accessibility and utilisation. In 2009, the World Summit on Food Security completed this definition by adding the dimension of stability/vulnerability (Berry *et al.*, 2014). Therefore, food security is built on four pillars (CFS,

2012; UN-HLTF, 2011; Ericksen *et al.*, 2010; FAO, 2008): *availability* of sufficient quantities of food on a consistent basis; *access* for everyone to the necessary resources to obtain appropriate foods for a nutritious diet; appropriate *use* based on knowledge of basic nutrition and care; and *stability* in food availability, access and utilisation.

According to Tara Garnett (2013), three perspectives are broadly emerging on how to achieve sustainable food security and food system sustainability: efficiency orientation focuses on changing patterns of production, demand restraint focuses on reducing excessive consumption; food system transformation considers both production and consumption. These perspectives are neither rigid nor mutually exclusive. A composite approach to tackling the food sustainability problem, drawing upon all three perspectives, is needed.

A comprehensive approach for tackling the issue of food and nutrition security requires: 1) taking into account the interconnectedness and interactions between the four food and nutrition security dimensions mentioned above (availability, access, utilisation and stability); 2) integrating all the stages of the food chain, including food production, sourcing and distribution; and 4) ensuring multi-sectoral engagement and coordination of sectoral policies (e.g. agriculture, trade, health, education, nutrition) (UN-HLTF, 2011). Achieving sustainable food security requires transition towards more sustainable food consumption patterns and diets. It requires also efforts on both sides of the food chain: food production and food consumption (Capone *et al.*, 2014).

The main challenge of AKST is to increase the productivity of agriculture in a sustainable manner. This knowledge must address the needs of small-scale farms in diverse ecosystems and create realistic opportunities for their development where the potential for improved area productivity is low and where climate change may have its most adverse consequences. Sustainable agricultural production can be established by expanding and extending the use of local and formal AKST to develop and deploy cultivars adaptable to site-specific conditions; improving access to resources; improving soil, water and nutrient management and conservation; pre- and post-harvest pest management; and increasing small-scale farm diversification.

Ensuring food security in arid areas: the MARSADEV project for promoting community management of natural resources (Egypt)

The MARSADEV project is funded by the Italian Ministry of Foreign Affairs (General Directorate for Cooperation and Development, IMFA-GDCD) through the Italian Food Aid Fund. Implementing agencies are the Ministry of Agriculture of Egypt and the Desert Research Center (DRC of Marsa Matrouh, Egypt). The CIHEAM-Bari is the executing agency. The project has developed several key activities to improve the living conditions of the Bedouin rural communities in the North West region of the Matrouh Governorate. The recovery of irrigation systems in Wadi systems helped to provide water for crops and families, and thus ensure food security of the population. By merging valuable local knowledge with modern technologies, typical

crops yields (figs, olives) have increased by improving agro-processing quality and safety. To achieve its goal, local researchers have been involved in a productive dialogue merging technical and traditional knowledge with beneficiaries whereas local plants and crops such as *Opuntia ficus-indica*, *Atriplex litoralis spp.*, *Moringa oleifera*, *Medicago arborea*, which are used for both income generation and erosion control were promoted.

Source: Ivan Virtuosi and Pandi Zdruli, CIHEAM-Bari.

With virtually no spare land and water resources left for agriculture expansion, except in very few SEMCs (Bruinsma, 2009), growth in agricultural production will be primarily driven by increases in agriculture productivity, increases in value addition and reduction in food losses (FAO, 2015).

Palm dates and fig value chain enhancement: a community-based approach in Tunisia

The Tunisian project is based on a new approach aiming to add value to local products and reinforce capacities of concerned vulnerable communities including women and youth. At a first stage, the analysis of the palm dates and fig value chain identified stakeholders and partners that could develop these local products and facilitate their market access. Many training and awareness-raising workshops were organised to implement an action plan through a participatory approach involving rural youth and women. The methodology was based on a "participatory analyses of competitive advantages" aiming to implement a concrete action for a sustainable rural development. The SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) was an important tool used to perform a diagnosis of the advantages and difficulties of each locality involved in the value chains of palm dates and figs. At each stage of the study, the local community was involved in the diagnosis and the decision making through investigation meetings, interviews, capacity-building workshops, discussion of results, main findings and recommendations.

Source: Mohammed Bengoumi, Subregional Office for North Africa (SNE), FAO.

Addressing food and nutrition challenges in the Mediterranean region requires many actions. One of these is a better involvement of food chain actors in the research cycle management and food system governance.

Involving research institutions and producer organisations to ensure food security: a participatory approach in Morocco

The Moroccan agricultural strategy, Green Morocco Plan, established in 2007 by the Ministry of Agriculture and Fisheries aims to consolidate the success achieved by Moroccan agriculture and to meet the new challenges of competitiveness related to the opening of markets. The programme set up to establish an enabling environment for producer organisations includes a new legal framework governing inter-professional organisations and gathering all the value chain actors and new institutional partnerships with the Ministry of Agriculture. The inter-professional organisation is the only representative of the value chain with the Government. It contributes to

the formulation and implementation of the national value chains development strategies. Programme agreements are signed between the Ministry of Agriculture and each inter-professional organisation mainly for extension activities and also applied research. Considering this, tripartite agreements have been concluded between the Ministry of Agriculture, inter-professional organisations and research and academic institutions. Inter-professional organisations play an important role in the design of applied research and innovation. They contribute to funding some research activities using allocated funds in support to the value chain by the Ministry of Agriculture. The results are transferred to farmers using adapted extension programmes including Farmer Field Schools.

In support of the Green Morocco Plan, the FAO has initiated several projects in Morocco to establish an enabling environment for the better contribution of professional organisations to food security (reform of the legal framework) the establishment of the new national Office for Agricultural Advice and the design of a national platform for extension using new technologies for information and communication.

Source: Mohammed Bengoumi, Subregional Office for North Africa (SNE), FAO.

The use of new information and communication technologies (ICT) is also a key factor in increasing productivity while reducing food losses especially those caused by pests and diseases.

Supporting local cooperatives in the main olive producing regions: the *Olio del Libano* project

The "Social and economic support for the families of producers in olive-growing marginal regions in Lebanon", also named "*L'Olio del Libano*" project, was implemented from 2008 to 2012 by the CIHEAM-Bari in partnership with the Lebanese Ministry of Agriculture and funded by the Italian Cooperation. The main objective of the project was to improve the economic conditions of the Lebanese olive growers through actions of support for the olive industry. In an Internet portal (www.olio-libano.net), users can find useful technical documents and news about the Lebanese olive oil chain as well as technical information resulting from the demo plot experiences. The portal describes the main goals; the calendar (trainings, workshops, field days and events), the monitoring of pests and diseases, the field's activity, downloadable information sheets, phytosanitary bulletins, technical brochures and other materials; 27 regional satellite imagery olive maps (maps); pictures and press releases; updated information. Data may be inserted online in the technical access area (intranet) available for the project's technicians.

Source: Enrico Azzone, CIHEAM-Bari.

The focus of knowledge generation and dissemination in the Mediterranean should not only be on crop production because the contribution of animal production is also crucial to achieve food and nutrition security. This also implies actions regarding the increase of aquacultural production of fish that would reduce pressure on marine ecosystems.

Developing innovative technologies for the production of quality fingerlings: the MADE projects in Egypt

Fish is healthy and reduces the risk of coronary heart disease up to 36% thanks to omega-3 fatty acids. Egyptians usually have a high consumption of fish and this consumption is increasing. Therefore, the country's fish production models require new adaptive strategies. Marine aquaculture could play a greater role in increasing fish supplies and strengthening the national economy. This is a completive sector as production costs are much lower than in Europe. The *Marine Aquaculture Development in Egypt* (MADE) projects – funded by Italy and Egypt (Debt for Development Swap Programme) and coordinated by CIHEAM-Bari and the General Authority for Fish Resources Development (GAFRD) – aim at consolidating marine aquaculture through the development of new hatchery technologies for the production of fingerlings of sea bass (*Dicentrarchus labrax*) and sea bream (*Sparus aurata*). The new plant, Agami K21/Alex, produces 5-7 million of 1.5g fingerlings a year, thus supporting the private sector in the Nile Delta area. The MADE projects promote among Egyptian investors to foster the dissemination of innovative technologies and soft knowledge related to aquaculture, thus contributing not only to achieving food and nutrition security in the country but also to the economic development of coastal areas.

Source: Roberto Ugolini, CIHEAM-Bari.

The Feeding Knowledge programme, carried out in the framework of Expo Milan 2015, is aimed at identifying knowledge and research needs for food security in the Mediterranean area.

Feeding Knowledge programme for the Expo Milano 2015

Launched in 2012, the Feeding Knowledge programme has been developed by the CIHEAM-Bari in partnership with the Politecnico of Milan in the framework of the 2015 Expo Milano with the theme "Feeding the Planet, Energy for Life". The Feeding Knowledge Programme is part of the intangible legacy of Expo Milan 2015 (www.feedingknowledge.net). It already led to many important outcomes: a Mediterranean network of skills on food security in 10 countries with a Local Point placed at ministries and scientific institutions; an International Network on research and innovation for food security with over 3,000 members (and a database with over 1,000 researches); an International Technology Platform to share information, ideas and researches; five white papers and one policy paper on research and innovation policies for food security; 786 Best Sustainable Development Practices for Food Security candidates at the international competition of Best Practices for Sustainable Development (BPSD) for Food Security (Expo Milano 2015) (more than half of the eligible applications by Euro-Mediterranean countries); models of agricultural enhancement and exploitation experimented with 18 best practices selected among the winners of the competition. Feeding Knowledge assisted National Extension Services in the transfer of knowledge to operators and farmers. The final aim of the programme is the creation of a Euro-Mediterranean Centre of Knowledge for Food Security: a hub of knowledge and expertise based on a consolidated network of research organisations and national institutions.

Source: Damiano Petruzzella and Marinella Giannelli, CIHEAM-Bari; Feeding Knowledge (www.feedingknowledge.net).

The policy paper of the Feeding Knowledge programme has been built following a comprehensive analysis of different elements of the knowledge chain in the Mediterranean region, with a particular focus on the main dimensions of food security: availability, access, utilisation and stability. Table 2 briefly summarises the results of this activity (Adinolfi *et al.*, 2015; Feeding Knowledge, 2015).

Table 2 - Main research needs related to food security in the Mediterranean area

Food security dimension	Research theme	Description
Availability	Managing ecosystem services	The main challenge seems to be the enhancement of ecosystem services, whilst maintaining a productive agriculture. Intensifying production, within environmental boundaries, requires research on the practical assessment and application of technologies such as conservation agriculture, no till or reduced tillage, agro-forestry, mulching, cover crops, controlled grazing, integrating crop and livestock production, well-designed terracing to control soil erosion and the use of halophyte crops in saline areas. Agricultural and innovation policies should be based on the principle of "sustainable intensification", requiring significant efforts in research as well as in knowledge transfer. There is need to manage scarce water resources in a sustainable manner.
Availability	Enhancing quality and quantity of crops and products	Sustainable integrated management and control of biotic and abiotic factors (both during preharvest and postharvest stages) are fundamental to enhance quantity and quality of products. To this aim, research should focus on the efficiency of Integrated Pest Management and organic production systems under an eco-functional intensification approach. This objective needs to be accompanied by actions aimed at developing a better knowledge about food losses throughout the supply chains.
Access	Fostering sustainable development of small rural communities in marginal areas	The lack of human, financial and structural resources in remote communities and isolated households living in low potential areas has implications in terms of food accessibility and affordability. In these contexts the mechanisms of learning and innovation transfer are of pivotal importance in maintaining the wellbeing of local communities.

Utilisation	Promoting sustainable food consumption patterns	There is an urgent need to assess the environmental, economic, social, cultural, health and nutritional sustainability of the current food consumption patterns and diets in order to design comprehensive, coherent and multifaceted nutrition-sensitive policies. These research activities should deal, among others, with: diet nutritional and health implications, food-related environmental footprints, economics of Mediterranean food consumption patterns, food cultures and sociology in the Mediterranean, food system governance and food policies.
Stability	Managing food in an increasingly globalised food system	A main topic for future research in this domain is to strengthen the availability of information as a prerequisite to afford appropriate policy analysis. In this regard, an important priority is to set up tools that help understand how local and regional food systems might be affected by hitherto inexperienced events such as multiple breadbasket failure and what would then happen to trade, price, food access and local land-use decision.

Source: adapted from Adinolfi *et al.* (2015); Feeding Knowledge (2015).

Matching research needs and results

The need for a "short" knowledge chain is becoming increasingly urgent in SEMCs. It is certainly easier to measure the effectiveness of research that is able to address the needs expressed by operators and that is better tailored to the regional context, and able to identify its criticalities and to trace its future developments. Thus, innovation becomes the result of the creation of a network, of an interactive learning process, of a negotiation among heterogeneous stakeholders (Adinolfi *et al.*, 2015).

Successful innovation requires both the "supply-push" of the research community and the "demand-pull" of the users of new knowledge. Indeed, a successful system of innovation requires constant interaction between many organisations and individuals in both camps. Innovation can only take place within an interactive social system, composed of research and researchers, but also of networks of actors that provide communication channels linking organisations and individuals. Such networks can be both formal and informal (Arnold and Bell, 200; Roseboom, 2004; Hall *et al.*, 2005).

According to Cosimo Lacirignola (2015), in order to achieve food security, we should also fight against the waste of knowledge. Traditional agricultural skills deserve greater attention and locally found solutions should be better and more broadly disseminated thanks to modern communication technology. Encouraging the sharing of knowledge, experiences, good practices and ideas is essential. The circular economy of knowledge is incredibly powerful. Innovation is above all the power of federating energies and intelligence put at the service of common goals. To avoid knowledge

waste, it is also important to improve access to knowledge by end-users. Thus, the decentralisation of knowledge systems is a key element not only to achieve an effective dissemination of agricultural knowledge but also for the fostering of local innovation systems. However, that may make the governance of the knowledge system more complicated without forgetting the financial implications of a move in this direction.

To avoid knowledge waste, Felice Adinolfi *et al.* (2015) called for the development of an effective knowledge system for food security in the Mediterranean by exploring all the possible options. Feeding Knowledge shares the same aim and tries to enhance dialogue among researchers, policy makers, farmers and all the other stakeholders involved in the food security domain: the needs of local stakeholders gathered in target countries of Feeding Knowledge and the perspectives for research outlined by its network of experts are consistent with each other. The need to bridge a gap of awareness and the adaptation of research results to the local context has clearly emerged. This requires not only the strengthening of services for the transfer of information, but also the adoption of new formulas through which knowledge is mediated and made available for use. Accompanying the introduction of technical innovations with the possible functional organisational adjustments is therefore possible. The divide between knowledge and production systems deepened by the small size of holdings. This pushes towards specific policies for small farmers and towards the adoption of transfer models, which can connect research to family and small-scale agriculture.

Some options for the development of an effective knowledge system for food security in the Mediterranean area

– *Renewing tools and approaches for the re-formulation of social and agricultural policies*: fostering innovation and knowledge development in building agricultural and social policies is a priority. Indeed, in order to make these policies effective and mutually coherent, the decision-making process should be based on accurate and comprehensive information and should be re-organised according to innovative strategies.

– *Supporting new paradigms for access to innovation*: there is a need to strengthen the decentralisation processes of national systems for the spread of innovations, to promote local institutional capacity-building and to develop a participatory approach able to link needs and solutions thereby enhancing formal and informal knowledge resources. This option would lead to several benefits: a shorter knowledge chain, new mechanisms of knowledge co-creation and the transfer of research results also to marginal organisations.

– *Opening up knowledge for food security*: all the potential of new tools and methods for the collaborative creation and sharing of knowledge should be exploited. The common objective should be the inclusion in the knowledge chain of every person who holds knowledge that really matters regarding food security and nutrition. At the same time, access to knowledge should be guaranteed to whoever is interested in it. Massive online open courses allowing social learning, event-based learning paths, peer-to-peer learning processes, citizen science initiatives developed in an integrated way might set the toolbox for the opening up of a new knowledge eco-system for food security.

Source: adapted from Adinolfi et al. *(2015); Feeding Knowledge (2015).*

Feeding Knowledge experts explored several options to build a sustainable approach for research and innovation on food security in the Mediterranean including:

– Reducing knowledge waste: we talk a lot about food waste and the reduction of losses but knowledge waste should also be avoided. Research is often duplicated, repeated or not promoted and enhanced. It is time to produce a useful and innovative body of knowledge and analyses, capable of helping political and economic decision makers.

– Enhancing research complementarities: researching on all issues in all countries at the same time is not sustainable. Yet, research facilities and funds are limited. The pooling of research efforts and scientific capacities is essential. Given the constant reduction of funds for research, international scientific diplomacy should be promoted. Greater attention should be paid not only to technical options for improving efficiency and promoting food security, but also to policy options that ensure cross-institutional collaboration.

– Improving research investments targeting: improving food security in the Mediterranean countries also means providing support family farming and smallholders in rural areas. Optimising investments in research could only have an impact on productivity and profitability if the farmers are directly involved and targeted. Dissemination of knowledge to farmers, young people and women, should be improved. In order to achieve this, a more inclusive approach for territorialised food security strategies should be adopted.

These recommendations clearly show that a new science considering the food system in its entirety and taking into account relations and interactions between the different actors is needed.

The need for a new transdisciplinary science of sustainable food systems

According to IPES-Food (2015), a one-way street of knowledge transmission, from scientists to policymakers, will not suffice to foster a genuine transformation of food systems to make them more sustainable. What is needed is a multi-directional flow of knowledge between the worlds of science, policy and practice. This shift is urgently required for many reasons: food systems are complex "social-ecological" systems that require different sources of knowledge to be combined; political and ethical choices cannot be made by scientists alone; scientific methodologies are not immune from biases and assumptions, and must be subject to deliberation; the recommendations made by scientists must be context-specific and adaptive in order to succeed; and social actors hold unique knowledge that can catalyse change. So, there is a need for a real food-related knowledge revolution to overcome persistent paradigms.

Food systems have to be considered in their entirety, acknowledging the interdependency of sustainable consumption and production. An analytical lens is needed in order to understand the various problems in food systems as the component parts of wider systemic problems. Food systems also refer to the vast web of sectoral policies and regulatory frameworks (agriculture, environment, health and safety, trade, energy, etc.) that shape the food arena (IPES-Food, 2015).

Significant progress has been made over recent years in accommodating different actors, framings and sources of knowledge in leading science-policy initiatives – the IAASTD and also the Intergovernmental Panel on Climate Change (IPCC); the Millennium Ecosystem Assessment (MA); the High Level Panel of Experts (HLPE) of the Committee on World Food Security (CFS). These initiatives have been equally open to diverse sources of knowledge and the diverse worldviews underpinning them. However, initiatives at the science-policy interface have struggled to capture all the aspects of food systems. Assessments have been disproportionately centred on boosting food production, a focus that has found a new incarnation in "sustainable intensification", now widely adopted as a means of squaring environmental concerns with the imperative to grow more food. This tendency to narrow the analytical lens risks perpetuating the agronomic knowledge bias and agro-industrial political bias of the "green revolution". It may also reflect a tendency to prioritise technological innovations over social innovations (IPES-Food, 2015).

In addition to highlighting the importance of access to food, the more holistic concept that recent definitions of food security embody identifies a wide range of research challenges spanning the humanities and social and economic sciences (Pálsson *et al.*, 2011), as well as nutritional sciences. In order to achieve sustainable food security a food system approach is required. Polly J. Ericksen *et al.* (2010) argue that as food systems encompass social, economic and political issues as well as ecological ones, different disciplines must be bridged in order to develop a holistic analytical and research framework.

As most food comes from crops, research has historically concentrated on agronomy and its associated sciences, although livestock and fisheries also received considerable attention. However, the fact that so many people are still facing food insecurity despite global production currently being sufficient for all, indicates that research which considers multiple aspects of food security and food systems is needed (Ingram, 2011). While research on producing food has allowed remarkable gains, the dominance of this research has overshadowed many other important aspects related to the entire food system. While production increase continues to be an important goal, other activities such as food processing, packaging and distributing food, and retailing and consuming food are now all receiving increased attention, and the whole food chain concept is now well established (Maxwell and Slater, 2003; ESF, 2009). More effective policies, practices and governance (institutions and organisations) are needed at a range of levels including spatial, temporal, jurisdictional and other scales (Cash *et al.*, 2006; Termeer *et al.*, 2010). Research has an important role to play in providing knowledge (Ingram, 2011).

In order to improve the sustainability of Mediterranean food consumption patterns a multidisciplinary and holistic regional research agenda is needed. Research results should help in designing adequate policies, guidelines and recommendations for the main Mediterranean food system actors. Research and policy activities must be well coordinated if sustainable qualitative and quantitative results are to be achieved (CIHEAM and FAO, 2015).

Involving farmers and producers in agricultural and food-related knowledge generation and dissemination

Investments in public R&D are not sufficient to boost agricultural productivity. For these investments to pay off, a sound system that brings new knowledge to the farm is required. Unfortunately, this is not happening at the right pace and extent in SEMCs. There are both deficiencies in the extension system and a lack of incentives for farmers to apply new technologies. Key elements of a comprehensive approach to increasing agricultural productivity in the region include: 1) public-private partnerships in extension services and up-scaled farmer field schools; 2) strengthening farmer associations and cooperatives and putting the farmer at the centre of the agriculture productivity enhancement programme; 3) ensuring that expenditures in R&D are sustained over time; and 4) promoting regional collaboration to spur investments, reduce unit costs, and accelerate dissemination and adoption of new and existing technologies (FAO, 2015).

Involving actors from outside the traditional bounds of the scientific community in devising food systems reform is essential, in order to bring in knowledge that scientists may not hold. Agroecology, with its focus on innovation in the field, is a striking illustration of why this matters, and how it can be a catalyst for change (IPES-Food, 2015). While traditional systems marry researchers, popularisers, educators and farmers, numerous studies have highlighted the value of opening the field to other actors, such as consumers, decision makers, industry or other stakeholders, to maximise the impact of innovations (FAO, 2005).

In the last decades, the resources allocated to R&D in agriculture have increasingly been invested in knowledge transfer, reflecting the growing attention given to this issue in developing and developed countries. At the same time, there has been a gradual shift from the traditional linear model of innovation transfer to systemic approaches, where innovation is seen as a complex interactive process involving not only the technological and scientific sphere, but also the social one. As a consequence, the importance of communication and of the involvement of end users through specific activities (e.g. brokerage) has significantly increased. A valuable support to this development can today originate from new forms of spreading information: in the agricultural sector, enhancing or even creating new links between agriculture, local area, and consumers, allows the sharing of innovations and continuous updating, but also helps reach directly the user with precise and personalised messages (Adinolfi *et al.*, 2015).

Investments are needed in agricultural knowledge systems to promote interactive knowledge networks (farmers, scientists, industry and actors in other knowledge areas) and improved access to ICT (IAASTD, 2009). Thanks to new communication systems and to the development of web networks and communities in all SEMCs, users – from passive or uninformed actors – are becoming active participants and promoters of information. This represents a crucial asset for the Mediterranean, where the main problem today does not seem to be the lack of knowledge but rather the need to make good use of it. Therefore, strengthening local capacities to use modern information systems at a wider scale should become one of the policy

priorities of knowledge transfer and innovation in agriculture, in order to fill the "information gap", so often mentioned by research stakeholders (Adinolfi *et al.*, 2015; Feeding Knowledge, 2015).

Participatory collaboration in knowledge generation, technology development and innovation has been shown to add value, for instance in Farmer-Researcher groups (IAASTD, 2009). The role of modern ICT in achieving effective collaboration is critical to evolving culturally appropriate integration and therefore merit larger investments and support. Collaboration and integration should be supported by international intellectual property for example, which allow more scope for dealing effectively with situations involving traditional knowledge, genetic resources and community-based innovations (IAASTD, 2009).

Role of producer organisations

Evidence shows that for the development of effective agri-food innovation systems, skills and capacities of individual actors in the agri-food system are important as well as their ability to create synergistic relations and to act collectively. As a matter of fact, innovation presupposes a capacity to innovate at both individual and collective levels. The existence of effective networks and partnerships among the individuals and groups within the system is of paramount importance for building collective innovation capacity. Producer organisations can play an important role in the innovation system especially in areas characterised by the prevalence of smallholders and family farms (FAO, 2014). They can generate business models with a high level of economic efficiency. In addition to mere commercial activity, these producer organisations and cooperatives stand at the core of the development process (World Bank, 2007b), and can also play a key role as actors of change and innovation. Historically, they have often had the ability to find and adopt technical or economic solutions to the problems faced by their members such as difficult access to markets for inputs and outputs, to technologies and to financial services such as credit. They can also serve as an interface between farmers and other actors of the innovation system such as extension and advisory services, research institutions and policy makers. They also help better defining the farmers' service demand and monitor the quality of service supply (FAO, 2014).

Agricultural producers from both shores of the Mediterranean consider farmer organisations as key actors in the drawing up of agricultural policies (IFAP, 2008). Today, due to the pressures on Mediterranean agriculture, rural producers are forced to innovate constantly (El Dahr, 2012). According to Kees Blokland and Christian Gouët (2007), producer organisations represent an effective means of communication and information due to their social network and the many links woven between the members. A consensus is now emerging on their role in the innovation process: they can contribute important innovations at different levels (Gouët *et al.*, 2009) and are part of the social capital, which is the vector of change (El Dahr, 2012).

Promoting knowledge sharing and providing services to small farmers: the COPAG cooperative (Morocco), a success story

COPAG was created in 1987, initially, to support dairy producers. Today it supervises 72 small cooperatives and 14,000 members and deals with the dairy sector, "*primeurs*" and "*agrumes*". Farmers ensure a high quality product to small cooperatives who in turn provide services to all its members (milk collection and storage, use of agricultural material, provision of dairy cattle with high milking ability, capacity building, awareness, etc.).

COPAG provides direct services to small cooperatives such as animal feed and agricultural input supply. It also ensures the processing, packaging and marketing of product. By adopting this monitoring system, COPAG guarantees a better management and supervision of the organisation and also an efficient control of the value chain thus allowing producers to sell good quality milk at a higher price.

Actually, COPAG is the main operator dealing with livestock and dairy products and represents about 20% of the total milk processes. The quality of its products (milk and dairy products) has been recognised and its market is increasing. COPAG is also improving its material capacities, providing to its members, a cattle feed manufacturing unit, a slaughterhouse and other equipment. COPAG provides all technical and marketing services to its members in addition to social activities.

Source: Mohammed Bengoumi, Subregional Office for North Africa (SNE), FAO.

Despite progress in various fields of research concerning them, small-scale farmers and the rural world, especially in the southern Mediterranean, are often excluded from the main currents of innovation. Apart from the lack of financial resources, the chief obstacle hampering innovation by farmer organisations in the region, especially in SEMCs, is the problem of access to certain essential services, namely training, extension services and research. To alleviate these shortcomings, and rely on the potential of agricultural organisations for creating and disseminating innovation, specific "farmer-to-farmer" support and advice schemes have been put in place in recent years especially in the North Mediterranean (El Dahr, 2012).

Peer education allows sharing of information and knowhow or other types of experience in the sphere of technologies, markets. This form of cooperation for sharing "layman's" agricultural knowledge has proved more effective than other forms of support such as extension, often criticised for its top-down and one-way approach (El Dahr, 2012). Producers and their organisations are now placed at the centre of the knowledge triangle which defines the "Agricultural Knowledge and Information Systems for Rural Development" (AKIS/RD) (FAO and World Bank, 2000; FAO, 2005). By making them active partners in these systems, rather than mere beneficiaries, the approach is participatory in that it gives producers a driving role in the process of production and adoption of innovations. Unfortunately, at a time when this form of farmer-to-farmer cooperation is taking off in many geographical zones, supported by European agri-agencies, SEMCs are a long way behind with very few organisations involved in these innovation systems (El Dahr, 2012).

Gender-sensitive approaches in agricultural knowledge, science and technology

Gender, that is, socially constructed relations between men and women, is an organising element of existing farming systems worldwide and a determining factor of ongoing agricultural restructuring. The largest proportion of rural women worldwide continues to face deteriorating health and work conditions, limited access to education and control over natural resources, insecure employment and low income (IAASTD, 2009). Gender inequalities are stronger in rural areas than in cities, despite the great involvement of women for agricultural development and food security. It is therefore essential that employment in agriculture and in rural areas be better considered, services in rural worlds improved and activities diversified.

The elaboration of social and agricultural policies in the Mediterranean should consider more the role of women in agriculture and in all the sectors linked to food security. To achieve food and nutrition security, it is of paramount importance to design and implement gender-sensitive policies that mainstream the role of women in the policy and governance arenas. This should be supported by actions for women's empowerment as only in doing so women will have all the necessary skills to achieve gender equality/equity. Adopting mechanisms that enhance women's skills and knowledge and provide support to forms of women's aggregations, and to the promotion of female entrepreneurship in the agrofood sector, may be effective actions for achieving this goal (Adinolfi *et al.*, 2015).

Enhancing food security in Egypt, Lebanon, and Tunisia through gender mainstreaming: the GEMAISA regional initiative

The regional programme "Enhancing Gender Mainstreaming in sustainable rural development and food Security – GEMAISA" is part of the activities started by the Directorate General for Development Cooperation (DGCS – Italian Ministry of Foreign Affairs and International Cooperation) and implemented by the CIHEAM-Bari, to promote the role of women in rural development and food security actions in three target countries (Egypt, Lebanon and Tunisia) and to foster gender mainstreaming capacity-building of partner institutions. The actions are performed at national level by promoting an institutional recognition of gender mainstreaming for food security through platforms that will involve Ministries of Agriculture as well as representatives of national and local institutions, universities, civil societies, women's associations and the private sector. With the support of the CIHEAM-Bari expertise, the platforms will contribute to the programme's implementation by setting up a grid of analysis and consequently building an approach that could represent a model of multidimensional empowerment of rural women in the Mediterranean region.

Source: Silvia Barbatello and Daniela Palermo, CIHEAM-Bari.

The role of extension and advisory services in agricultural knowledge circulation

The need to increase the efficiency with which scientific knowledge is translated to farmers and other resource managers is well recognised. So, food security is strongly linked to the performance of agricultural and rural extension and advisory services (Ingram, 2011). Easy and timely access to reliable and updated information is crucial for agricultural and rural development and thus for achieving food and nutrition security. Good extension is recognised as a key to agricultural development (USAID, 2012) and can contribute to improving the welfare of farmers and other people living in rural areas (3ie, 2010). Agriculture multifunctionality and rural economy diversification are changing dramatically the classical crop production-centred mission of agricultural extension and advisory services. They need to provide a wider range of services to a more diverse clientele to improve their capacity to access, adapt, and use knowledge, inputs and services (World Bank, 2007b). For extension to be successful, it needs to include credible content, effective delivery and be relevant to and applicable by clients (USAID, 2012). The FAO recognises the important role played by extension in agricultural and rural development processes and therefore, it implemented many initiatives for the improvement of agricultural extension and advisory services in SEMCs with the final aim to develop a pluralistic, decentralised, gender-sensitive, bottom-up and demand-driven extension and advisory service.

The VERCON initiatives of the FAO

Knowledge and information are essential to improve the agricultural sector, but in order to be useful, they must be effectively communicated to farmers. In collaboration with the World Agricultural Information Centre, the FAO developed the VERCON network (Virtual Extension, Research and Communication Network), which is a powerful tool based on ICT and whose objectives are to improve communication between research, extension and farmers (two-way communication), reinforce linkages within agricultural research and extension institutions and close the gap between researchers and extension specialists by improving the generation, flow, sharing and collaborative use of agricultural knowledge and information. Concretely, when a farmer detects a problem causing damage to his production, he/she shares this information with the extension office, the extension worker will identify the problem by consulting the VERCON database and discuss its control with researchers connected to the network. Relevant information is compiled and shared with all extension officers in the region that would communicate it to concerned farmers directly, during awareness meetings or in farmer field schools.

Source: Mohammed Bengoumi, Subregional Office for North Africa (SNE), FAO.

Agricultural extension services in the Mediterranean have evolved towards pluralistic supply models, where the public component is increasingly giving way to private agents and NGOs. An assessment in this regard has been carried out during the Feeding Knowledge initiative: representatives of eight Mediterranean countries have been invited to draw the National Extension Services (NES) features (see Table 3).

Table 3 - National Extension Services (NES): some indicators

Country	No. of Officers: Central Level	No. of Officers: Regional Level	District/Caza/ Municipality Levels	Type of NES	Other Key Actors in NES	Food Security	Trends
Albania	4	60	220	Partially decentralised	Universities, NGOs	Approach for main commodities	– Top-Down with feedback – Setting up more specific financial support – ICT Development
Bosnia	8		61	Partially decentralised	Ministry of Agriculture, Water and Forestry	Market oriented	Interactive Participatory Research and Extension involving private sector
Lebanon	3	15	96	Partially decentralised	University (American University of Beirut), NGOs	– VC approach – Promotion of local products – Market oriented (export) – PPP Approach	– ICT Development – Reinforcing farmer organisations
FYROM*	24	20	80	Partially decentralised	Private Sector Traders	– Strongly market oriented to enhance export and fulfil traders' needs – Rural development approach	– Interactive Participatory Research and Extension with active involvement of private sector – ICT Development

Table 3 - National Extension Services (NES): some indicators (continued)

Country	No. of Officers: Central Level	No. of Officers: Regional Level	District/Caza/ Municipality Levels	Type of NES	Other Key Actors in NES	Food Security	Trends
Morocco	50	200		Partially decentralised	–	Value Chain Approach	Stronger ICT tools usage
Serbia	8	15	247	Partially decentralised	Top-Down	Specific Law on Extension	Interactive Participatory Research and Extension involving private sector
Tunisia	30	50	550 (40% of their time for extension)	Participatory Partially decentralised	– Interactive Participatory Research and Extension (79%) – Active involvement of private sector (21%)	Aiming for self-sufficiency in strategic commodities (wheat)	– Reinforcing link with research – Decentralisation
Turkey	55	918	10,000	Partially decentralised	Interactive Participatory Research and Extension involving private sector	Market oriented	Local and national "Extension Projects"

FYROM*: Former Yugoslav Republic of Macedonia.
Source: Virginia Belsanti, William Critchley, Alberto Dragotta, National Extension Services (NES) orientation paper, Feeding Knowledge programme.

The changes in modern agri-food systems, as well as issues regarding food safety, climate change, the role of multi-functional agriculture and the development of rural areas, are redrawing the boundaries of knowledge information in agriculture, fuelling the complexity of the governance of extension services. However, as highlighted on the occasion of an intensive workshop organised at the CIHEAM-Bari in 2014 in the framework of the Feeding Knowledge programme and attended by representatives of the agricultural extension services of several Euro-Mediterranean countries, there are other constraints which negatively affect the effectiveness of extension process, such as weak relations and coordination among researchers, extension staff and farmers; limited budget allocation; low acceptance of changes in some farming systems; no tradition of on-farm experimentation. Surprisingly, according to the extensionists interviewed, there is little articulated connection between extension and food security (Adinolfi *et al.*, 2015; Feeding Knowledge, 2015). The use of ICT tools can help to overcome many of these obstacles.

Morocco: The National Internet Portal of the Ministry of Agriculture to support farmers as good practice ICT application

The National Office of Agricultural Advice (ONCA) has been created in 2012 in Morocco to implement the new government strategy on agricultural advice. It also ensures monitoring, coaching and professional advice to farmers in technical and management aspects, which are important tasks especially for small-scale agriculture. The new strategy of the ONCA also takes into account the institutionalisation and organisation of the private segment of agricultural extension. More generally, this new strategy highlights the importance of development and modernisation of extension, training and technology transfer for the benefit of various stakeholders in the agricultural sector, particularly farmers. With the aim to support the implementation of its action plan (training, information, awareness and communication), the ONCA has set up broadcasting emissions as well as agricultural ads using its website, radio and TV. In addition Farmer Field schools are developed in close collaboration with professional organisations and private extension experts.

Source: ONCA (www.onca.gov.ma).

Conclusion

The need to support research revolving around food security is nowadays widely admitted as well as the urgency to improve the interface between science and policy as a means to reduce knowledge waste and to move towards more sustainable food systems. The real challenge for science-policy initiatives dealing with food and nutrition security is to resist the narrowing of the analytical lens, and to overcome the fragmentation of food governance and policy spaces (as shown by the prominent role of agriculture ministries and dichotomy between food and health policies) by adopting a systemic, inclusive and holistic approach. In order to contribute to food systems reform, a critical mass of evidence must be gathered and transposed into policy recommendations. Furthermore, this emerging concept of sustainable food systems must take into consideration the voices of academic experts and social innovators and be informed by the knowledge of practitioners, and appropriated by those to whom it seeks to be useful.

Many of the challenges regarding the food system are common to all Mediterranean countries. Therefore it is of paramount importance to set up a joint research agenda to address them in a collaborative way. Cooperation and dialogue on research and innovation, if carried out through the involvement of all actors concerned – from farmers to officers – might contribute to building-up long-term initiatives, tailored to the needs and specificities of each country. In addition, it is of paramount importance to design a sound strategy for reducing knowledge waste in the Mediterranean, building up on the unique features and potentials of this region. After years of intense activities, the Feeding Knowledge programme called for the creation of a permanent Euro-Mediterranean Centre for knowledge development and sharing on food security, able to intervene at all levels of the short knowledge chain, from assessment of needs to the development of solutions and transfer of research results.

To better match the knowledge needs and offer – which is a prerequisite for avoiding knowledge waste – it is necessary to act on both the demand and supply sides of the knowledge system. As for the demand side, research priorities should be better defined in a concerted way and with the active participation of the representatives of the food system (i.e. producers, processors, retailers, consumers as well as policy makers). As for the supply side, the research system should be endowed with the necessary human and financial resources to act on the defined priorities. Resources should not only be dedicated to knowledge generation but also to communication and dissemination. For that, the capacity of bridging actors and knowledge brokers (e.g. extension services, media) should be strengthened along the knowledge chain. Moving towards a circular knowledge system seems to be the best option although it encompasses many challenges.

Agricultural extension and advisory services are widely recognised as critical to agricultural development. More attention should be paid to supporting extension and advisory services to allow them to fully assume their role in achieving food security. It is necessary to develop a pluralistic, participatory, bottom-up, decentralised, farmer-led and market-driven advisory system. The involvement of other actors in the rural extension work is then crucial if the system is to meet the expectations and needs of rural people.

The multiple threats and risks to food insecurity and malnutrition in the region call for strengthened regional collaboration and agricultural and food diplomacy. Countries must develop and implement comprehensive and consultative food security agendas and put food and nutrition security at the top of their policy agenda. In this sense, the CIHEAM and the FAO can play a key role: they offer a privileged arena for exchanges and analyses aimed at developing cooperation between the countries and can, in collaboration with other regional and international organisations, play a lead role in identifying and catalysing partnerships with other intergovernmental organisations, national governments, UN and EU agencies, private sectors and NGOs, to achieve sustainable food and nutrition security. Facing huge and increasing challenges, this is strategic for the future of the Mediterranean countries, underlying the strong necessity to share experiences, adopt collective behaviour and draw a more convergent approach to enhance food security in the region.

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