Innovation for Sustainable Food Systems: Drivers and Challenges

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1 Sustainable Development as a "Wicked Problem"

Since the publication of "Our Common Future" in 1987 by the World Commission on Environment and Development (WCED), there has been a growing interest in the conceptualisation and application of sustainability: several initiatives at global and local levels carried out by governments, civil societies, business leaders, common people, are described and analysed by thousands of academic publications.[1] Nevertheless, achieving a sustainable development is a very difficult task. According to Pryshlakivsky and Searcy (2013, p. 109), one of the reasons of this shortage of results is related to the concept of "wicked problem": "like all wicked problems, Sustainable Development issues are often characterized by a lack of clarity, uncertainty, ambiguity, high risk, and limited understanding. Among other challenges, these characteristics make establishing appropriate analytical boundaries problematic". In 2008, Sandra Batie, in her milestone article in the American Journal of Agricultural Economics (Batie 2008), addressed the main characteristics of a wicked problem. In general, no agreement exists about the real nature of the problem and every attempt to create solutions (that cannot be "true or false", they can only be "better or worse") changes the same problem over time. Thus, in light of the high uncertainty in terms of system components and outcomes, different stakeholders can have different ideas about the "real" problem and its causes, and it is difficult

[1] The search for these keywords "Our Common Future" on scholasr.google.com retrieves 77.900 results (beginning of January 2017)

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to find share values with respect to societal goals. She gives a clear illustration of this lack of shared values, common solutions and joint points of view about sustainability.

> "*For example, with respect to sustainability of ecosystems, environmental ethicists may focus on the intrinsic value of nature; applied economists may focus on the instrumental value of nature; and non-academics may bring tacit knowledge garnered from practical experiences and personal values associated with nature and resource use. Also, management agencies might consider natural resources from the viewpoint of wildlife survival, whereas project agencies might consider natural resources as commodities. Even when dialog occurs and includes all of the actors, clear solutions rarely emerge; rather, via negotiation processes are identified which are judged as better or worse (not right or wrong) in addressing the wicked problem*".

Similarly, Dentoni et al. (2018) highlight that sustainability issues cannot be easily framed in "linear cause–symptom–effect relationships (*knowledge uncertainty*), evolve unpredictably over time (*dynamic complexity*) and involve conflicts of values among stakeholders (*value conflict*)". As a consequence, wicked problems such as sustainable development and the implementation of Agenda 2030 call for different and innovative approaches, able to activate deeper and broader systemic change (Ferraro et al. 2015).

Mediterranean food systems, in particular, are under strong pressure due to climate change, unsustainable agricultural practices, changes in dietary habits and a huge coastal urbanisation. To deal with such crisis, technological innovation is crucial. Precision farming, new water management techniques, drones, blockchains, Decision Support Systems are only a few of the tools which are becoming available. However, the technological side is not sufficient to tackle challenges of sustainable food systems. The social dimension of change is relevant as well. Farmers and producers who want to behave in a sustainable way need also more entrepreneurship, access to new markets, capacity of answering to new dietary needs, new professional figures, more modern extension services, and sharing of experiences. Furthermore, sustainable food systems need a better political and policy coherence, alignment, coordination and cooperation among agriculture, health, water, energy and other related sectors, such as tourism and economic development (Réquier-Desjardins and Navarro 2016).

In this perspective, identification of solutions becomes as much a social and political process as it is a scientific endeavour (Kreuter et al. 2004). Furthermore, multi-stakeholder engagement and global partnerships become extremely relevant in order to balance different stakeholders and their respective objectives. This is particularly true with reference to food systems. Such systems include complex and interconnected activities going from the field to the fork, with many actors and often within a very large geographical area. They also present clear and intertwined economic, social, cultural, environmental dimensions. As a consequence, it is impossible to tackle sustainability issues of such systems without the contribution of different and coordinated actors, ranging from farmers to producers, regulators, policymakers, innovators, academics, NGOs and customers. Too many objectives

and interests are at stake. Without a good balance among them, any solution will leave discontent and open issues.

In order to analyse the importance of multi-stakeholder partnerships, Dentoni et al. (2018) recently discussed the interesting concept of "Harnessing wickedness," i.e., the approach of taking into account and responding to the different dimensions of wicked problems. This approach requires a governance process that enables networked action carried out by different actors such as business, NGOs, governments and academia, to stimulate collective processes and deal with complex dynamics to achieve small wins. In this context, Higher Education Institutions can have a crucial role. According to Dentoni and Bitzer (2015), academics in multi-stakeholder initiatives in the agrifood sector can play five key roles:

(a) knowledge experts,
(b) agenda-setting advisors
(c) facilitators,
(d) providers of new knowledge on multi-stakeholder initiatives by theorizing from their observation and reflection,
(e) creators of international bridges between students and multi-stakeholder initiatives.

In short, many studies (see also Rinaldi et al. 2018) provide empirical evidence that, to address the challenges of sustainability, universities need to play new functions and missions, going beyond the traditional economic focus of the third mission and conventional technology transfer practices.

To find innovative approaches and pathways of sustainable development, new modes of interaction with stakeholders are needed. This brings to a switch and expansion of the traditional model of the "triple helix" (Amaral et al. 2011) to a "quadruple helix", being the community the new subject of this model together with Universities, Public bodies and Business actors. Within such model, universities are called to new forms of networking and co-working, within living labs shared with the communities of their territory and beyond. As stated by Van Winden and Carvalho (2015, p. 10): "The quadruple helix opens up issues around the nature of demand and may also move innovation from having a narrow technological orientation towards a more societal focus". These transformations and transition towards a new concept of Universities' missions are happening in different higher institutions throughout the world, to varying degrees (Rinaldi et al. 2018). Sometimes such "co-creation for sustainability" (Trencher et al. 2013) is recognized as a fourth Universities' mission, even though this function is still new, not established yet in the academic literature like the third mission and could also be embedded in an expanded version of the third mission.

In parallel to the rise of such third/fourth mission, an increased role is given to universities in the development and capacity building within their local economies (Kempton 2015). According to Goddard et al. (2012), the functions of what they call "civic university" should be the following:

(a) Provide opportunities for the society of which it is part (individual learners, businesses, public institutions).
(b) Engage as a whole not piecemeal with its surroundings
(c) Partner with other local universities and colleges.
(d) Be managed in a way that facilitates institutional wide engagement with the city and region of which it forms part.
(e) Operate on a global scale but use its location to form its identity.

Such new roles of Universities were highlighted by policy strategies such as Europe 2020 (European Commission 2010) and are taken into consideration in the definition of the new Horizon Europe Research programme. As Mazzucato (2018) underlines, societal missions are much more complex because they are less clearly defined and indeed must be co-defined by many stakeholders. Higher Education Institutions can be crucial to mediate between sectoral, regional and national ecosystems of innovation, linking them, in a dynamic way, to different public and private actors and to international institutions. New challenges arise for Universities, called to reconsider their role in society and their contribution to regional, economic, social and cultural development (Cavicchi et al. 2013). Also because globalisation is being accompanied by a regionalisation process and Universities are expected to contribute to the development of the territory where they are embedded. They can do it putting themselves at the center of local and regional learning and innovating partnerships, bridging different partners, creating a sustainable learning organisation and developing on-going leadership capacity in the region (Rinaldi et al. 2018). In short, addressing sustainability challenges means for Universities to be engaged in place-based, multi-stakeholder partnerships to solve real-world issues. "Co-creation for sustainability" should become a new function (fourth mission) of Universities, switching from entrepreneurial to transformative university, conceived as "a multi-stakeholder platform engaged with society in a continual and mutual process of creation and transformation" (Trencher et al. 2014, pp. 7–8).

2 Multi-Stakeholders Partnerships for Innovation in Mediterranean Food Systems

After the approval of the Agenda 2030, the contracting parties to the Convention for the Protection of Marine Environment and the Coastal Region of the Mediterranean, commonly called "Barcelona Convention" (participated by 21 Mediterranean Countries and the European Union), adopted the revised Mediterranean Strategy for Sustainable Development 2016–2025. Such strategy provides a strategic policy framework built upon a broad consultation process for securing a sustainable future for the Mediterranean region, consistent with Sustainable Development Goals: "It aims to harmonize the interactions between socioeconomic and environmental goals, adopt international commitments to regional conditions, guide national strategies for sustainable development and stimulate the regional cooperation between stakeholders in the implementation of sustainable development" (UNEP/MAP 2016, p. 7).

The European Union is also playing an important role in enacting Agenda 2030. Since its Agenda for Change,[2] the EU declared its will to play a leading role into the implementation of an ambitious, transformative, and universal agenda that delivers poverty eradication and sustainable development for all, increasing the impact and effectiveness of EU development policy. Among the principles of the Agenda, coordination seems to be a relevant one. In fact, to avoid fragmentation of aid and further increase the impact, the EU and its member states highlight the centrality of joint programming among different actors and Countries. The EU also defined a broad European Neighborhood Policy (Dannreuther 2006), within which the Union for the Mediterranean was boosted. This is an intergovernmental organization bringing together the 28 European Union member states and 15 countries from the southern and eastern shores of the Mediterranean. It provides a unique forum to enhance regional cooperation and dialogue in the Euro-Mediterranean region. A major policy approach that the EU implemented to boost sustainable development through Multi-stakeholders Partnerships is the Smart Specialization Strategy. The core idea of such strategy is that a limited number of promising priorities has to be selected to stimulate regional growth, job creation and collaboration among research and knowledge institutions, businesses, and the investors (Stančová and Cavicchi 2018).

Regions and Countries enhance their R&I systems by looking beyond their national/regional administrative borders for opportunities, and by supporting transregional and international R&I activities. As a consequence, trans-regional cooperation in R&I becomes an essential element of Smart Specialisation. Radosevic and Ciampi Stancova (2015) argued that the transformative power of Smart Specialisation can be seen in the capacity of the regions to combine locally accumulated knowledge and technologies with international knowledge and production networks. Internationalisation within Smart Specialisation includes not only export and foreign direct investments (FDI) but also 'strategic alliances, joint research, co-development, outsourcing, relocation, mergers and acquisitions, licensing intellectual property rights (IPR), soft landing, and technology showcase' (Foray et al. 2012, p. 94). Smart Specialisation matches research strengths with business needs in an international environment. Internationalisation and Smart Specialisation should create a context within which regions are able to identify domains for (present and future) competitive advantage, and relevant linkages and flows of goods, services and knowledge that reveal opportunities for collaboration with other regions. Rakhmatullin et al. (2016, p. 78) suggested that regions should consider opening up their smart specialisation strategies to gain access to wider business and knowledge networks; get necessary research capacity; reach out to other markets; expand business opportunities; combine complementary strengths; and join global

[2] The Agenda for Change, adopted in 2011, is the basis for the EU's development policy. The primary objective of the Agenda for Change is to significantly **increase the impact and effectiveness of EU development policy** and, to this end, a series of key changes in the way assistance is delivered have been introduced. These key orientations have changed EU development policy significantly and have informed the programming process for the current 2014–2020 period (https://ec.europa.eu/europeaid/policies/european-development-policy/agenda-change_en)

value chains. Smart Specialisation is by definition an on-going, evolutionary process based on continuous exploration and exploitation of research and business potential and opportunities. A novelty is represented by the role given to regional entrepreneurs to identify business opportunities, as they are positioned close to the market, in the best position to collect information on economic trends, competitors, market gaps, industrial trends and new markets. It should be noticed that one in five priorities reported by EU countries and regions focus on agro-food technologies, the others being key enabling technologies, health, energy, and the digital agenda.

Agro-food is probably one of the most transversal domains, intersecting, besides bioeconomy and agriculture, the fields of technology, tourism, health and well-being, services, sustainable innovation, cultural and creative industries. This means, in practice, that Regions and EU member States are now called to increase their international collaboration in Agri-food research and innovation as a prerequisite (*ex-ante conditionality*) to get European Structural Funds (Stančová and Cavicchi 2018). Such place-based policies can be defined as policies that take into account the special dimensions and the specific context where economic activities are embedded. For instance, developing labor markets or innovation in a city may not entail the same type of instruments and may require a different sort of approach than in a rural area. This means that "one size fits all solutions" do not exist and participatory approaches, stakeholders' engagement activities and a constant problem-based research are crucial elements to implement diversification strategies (Cavicchi and Stancova 2016).

In line with this orientation, many universities are rethinking their roles and responsibilities, exchanging knowledge with actors outside academia and collaborating with stakeholders. A European Commission report states: "There is a growing recognition between universities and local/regional leaders of the potential for mutually beneficial relationships, and the active role of universities in terms of their contribution to local and regional development, and innovation has gained a new salience in the context of smart specialisation as a future focus for European regional policy" (Kempton et al. 2013). Also the Joint Research Center of the European Commission recently analysed the role that universities might play in local development, showing that HEIs can build innovation capabilities in Regions and play a much broader role than usually considered.[3] The debate is open and extremely alive, also because, given public funding constrains, universities are called by governments to show that their activities are worth to be funded. Being able to contribute, through an effective multistakeholder engagement, to economic and social growth in key sectors such as the agrifood can be a good answer to such request.

[3] Launched in March 2016, the HESS project focuses on how higher education and HEIs can contribute to the successful implementation of S3. It has two broad aims: (a) To help build innovation capabilities by strengthening the role of HEIs in regional partnerships, (b) To promote the integration of higher education with research, innovation and regional development in S3 policy mixes, particularly in the use of European Structural and Investment Funds (http://s3platform.jrc.ec.europa.eu/hess)

3 Major Institutional Multistakeholder Initiatives for Sustainable Mediterranean Food Systems

Besides the Union for the Mediterranean, cited above, other institutional partnerships are deeply involved in promoting more sustainable Euro-Mediterranean food systems.

CIHEAM, International Center for Advanced Mediterranean Agronomic Studies, founded in 1962, is a Mediterranean intergovernmental organisation devoted to the sustainable development of agriculture and fisheries, food and nutrition security and rural and coastal areas. Participated by 13 member states, and based in Paris, its collaboration, research and education activities are performed in four Institutes in Italy, Greece, France and Spain. According to the aim of this Center, all its activities are based on a bottom-up collaboration approach and pursue problem-solving approaches, in relation with the specific needs of the countries and in line with Agenda 2030 in the Mediterranean in some specific fields.

Another important initiative is represented by **UNIMED**, the Mediterranean Universities Union, founded in 1991. It counts 113 Universities coming from 23 countries of both shores of Mediterranean (data updated to November 2018) and its aim is to develop research and education in the Euro-Mediterranean area in order to contribute to scientific, cultural, social and economic cooperation. Through the many initiatives carried out over the two decades, UNIMED has promoted the collaboration between universities of the Mediterranean, becoming a point of reference of the international university cooperation. Particularly relevant for the aim of this work, is the establishment of agri-food UNIMED sub-network. Such sub-network allows an intensive exchange of information among the participating actors of the two Mediterranean shores for the creation of partnerships, collaborations and projects. The aim of these projects is to strengthen the economic and social cohesion, in order to promote cross-border, transnational and interregional cooperation in the field of food systems and local sustainable development.

A recent policy initiative pursued by the European Union in the field of food systems is boosting the collaboration between Higher Education Institutions and enterprises on both shores of the Mediterranean. With the Decision 2017/1324 of the European Parliament and of the Council of 4 July 2017 on the participation of the Union in the Partnership for Research and Innovation in the Mediterranean Area, a new initiative, **PRIMA**, was adopted by the EU. The aim of this partnership is to develop much-needed solutions for a more sustainable management of water and agro-food systems. The main objective of the 10-year initiative (2018–2028) is to devise new R&I approaches to improve water availability and sustainable agriculture production in a region heavily distressed by climate change, urbanisation and population growth. The partnership currently consists of 19 participating countries,[4] and it is financed through a combination of funding from participating

[4] Algeria, Croatia, Cyprus, Egypt, France, Germany, Greece, Israel, Italy, Jordan, Lebanon, Luxembourg, Malta, Morocco, Portugal, Slovenia, Spain, Tunisia and Turkey (http://ec.europa.eu/research/environment/index.cfm?pg=prima)

Countries (currently €274 million), and a €220 million contribution from the EU through Horizon 2020, its research and innovation funding programme (2014–2020). In line with the priorities of Horizon 2020, the general objectives of PRIMA are to build research and innovation capacities and to develop knowledge and common innovative solutions for agro-food systems, to make them sustainable, and for integrated water provision and management in the Mediterranean area, to make those systems and that provision and management more climate resilient, efficient, cost-effective and environmentally and socially sustainable, and to contribute to solving water scarcity, food security, nutrition, health, well-being and migration problems upstream. The involvement of all relevant public and private sector actors in implementing the strategic agenda by pooling knowledge and financial resources to achieve the necessary critical mass, is one of the specific objectives of PRIMA. Particularly, the Strategic Research and Innovation Agenda of the Programme, outlines the importance of promoting local (country based) and Euro-Mediterranean multi-level stakeholder/actor networks to improve governance-related capacity in agricultural water and agro-food systems, integrating and bridging different (and opposite) interests and stakes.

4 Some Preliminary Evidence and Challenges for the Future

In order to implement more sustainable food systems some universities are reconsidering their role in society, promoting multistakeholder involvement and the establishment of innovation working labs based on principles of co-creation and co-working. Such labs allow universities to better interact with their multiple local stakeholders, allowing the definition of more effective sustainable development paths. They act as physical locations to guarantee an "initial hearing" for ideas and business projects, supporting university spin-off projects, without becoming incubators. Such labs represent concrete places for hybridization among different scientific and operating perspectives, offering valuable opportunities for dialogue among stakeholders and concrete support to joint creativity and innovation. Researchers, teachers and experts meet with farmers, entrepreneurs, students, technicians, discussing common issues, sharing experiences, proposing new partnerships and testing solutions. Experts contribute from different fields, including agronomy, engineering, digital, economy, business, law, natural sciences, marketing, and sociology.

This new approach is not simple to follow. Difficulties depend upon some conservatosm in the academic field and mis-aligned incentives. It is not easy to convince researchers from different scientific fields to share experiences, tools and networking and to co-work with business. Even more problematic is that incentives to make academics dialogue with local partners and stakeholders are weak. If the sole incentive for university careers is the number of publications on impacted journals, everything else will fall into second place. Therefore, regulatory institutions, governments, the academic community and the public opinion should define incentives for researchers coherent with the promotion of innovation and sustainable develop-

ment. New careers paths giving attention to multistakeholder engagement could be devised and positive outcomes from joint activities between academic and business should be taken into consideration by Universities to assess individual careers. Furthermore, more investments should be dedicated to professional figures and innovation centers to support researchers in their connection with business. This is particularly important in the field of food systems, where a wide range of expertise is required to deal with technological changes and social and environmental challenges in front of the sector.

In short, implementation of Agenda 2030 and dealing with issues of Mediterranean food systems represent a breeding ground for policy innovation and for a reflection on the role of Higher Education Institution. In particular, they require more and more international, North-South and regional cooperation and multi-stakeholder partnerships, crucial to facilitate knowledge sharing, capacity creation and adoption of sustainable solution. In this way, different kinds of expertise, advanced technologies and financial resources could be mobilized and processes of sustainable co-innovation activated. Within such scenario, Universities can play a pivotal role, promoting effective public-private partnerships, contributing to the empowerment of key local community stakeholders and creating conditions to boost more sustainable food systems and local economic growth.

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