Appendix 3:
Orgware

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This document is an appendix to the report**, ICT and social media as drivers of multi-actor innovation in agriculture – barriers, recommendations and potentials***,* a report under the SCAR CWG AKIS, Lot 2.

3.1 Innovation and relational patterns

Innovation policies in the agricultural sector are inspired by two alternative models. The first one – called the linear model – is based on a clear distinction between knowledge producers and knowledge users. This model was a pillar of the Green Revolution, which aimed at increasing productivity by introducing high yielding varieties and related agricultural technologies. The model works well when the innovation goals are already set – for example, by specific environment regulation or quality standards. It is also adopted when – as in the case of commercial inputs – knowledge is subject to property rights and is paid by users as a component of the price of the product.

The second model – called 'circular model' (Kline and Rosemberg, 1986) – highlights the value of information flows running from knowledge users to knowledge producers. It is based on the principle that, when knowledge users have a say in the process, the resulting output is adopted much faster and gives a better performance when applied. In fact, interaction anticipates problems and barriers to adoption, and takes into account users' needs, experience, knowledge of the local specificities. In this second model, innovation goals are adjusted to users' needs, and it is more difficult to attribute property rights, as both counterparts become knowledge users and knowledge producers. In agriculture, one of the fields where the model has been applied is participatory plant breeding (Ceccarelli et al., 2009).

The second model has gained credit in other industries when analysed in regional firm agglomerations, like the industrial districts of the 'third Italy' in the '80s or the Silicon valley in the '90s. In these cases, it was observed that the large numbers of small firms operating in the same industry and located in the same place generated intense flows of information. Porter (1985) highlighted the role of relations between firms belonging to the same industry but to different stages of the production process: client-supplier exchange turned out to be not only about money and commodities but also about information.

Becattini (1991) and Saxenian Lee (2006) among others have added a new dimension to the circular model, stressing the fact that, being part of the same community, employees could not avoid talking with peers about their work in the many occasions of encounter that a community offers, from the bar to the stadium to the children's schools. In other words, they highlighted the role of interaction between knowledge users. Intense flows of information between peers, together with the mobility of employees across companies, were identified by observers as the reason for the development of an 'industrial atmosphere' beneficial to all firms belonging to the same agglomeration, and explained the higher degree of competitiveness of the firms belonging to these agglomerations in comparison with bigger, isolated firms organized according to hierarchical principles.

Mobilization of social interaction for innovation purposes, however, is not only a characteristic of business agglomerations. Employees of big companies can develop patterns of interaction outside the official flows of communication designed by the firm's organization. The first experiments of exploiting this property were done by the Xerox corporation in Palo Alto (Seely Brown, 1998).
Studying the properties of informal networks, Wenger developed the concept of "communities of practice", "*groups of people informally bound together by shared expertise and passion for joint enterprise*" (Wenger, 1999). Wenger focused on social interaction as a basis for learning. By interacting, people enter into contact with the social world of the others, expose themselves to the unknown and activate processes of exchange of respective knowledge. Interaction, mediated by language, progressively reduces barriers between areas of respective knowledges and develops shared meanings.

Knowledge sharing contributes to the development of shared repertoires, which eventually constitute stocks of knowledge to which all communities will have access. Wenger explains that actors' interaction leads to continuous refinement of 'knowledge objects' until 'reification' occurs, that is consolidation into outputs such as written reports, technical standards, prototypes, routines, or any other things embodying shared knowledge.

On these premises, firms have increasingly adopted this principle of 'open' innovation (Chesbrough 2003), realizing that, in order to keep innovation pace and to maintain their competitiveness, they need to tap knowledge from the outside by systematically exploring the opportunities coming from the connection to the outside environment.

3.2 The organizational evolution of agricultural knowledge and innovation systems

Traditionally, institutional agricultural knowledge systems were built upon the linear model. A clear institutional delimitation was set between universities and research centres (dedicated to research and education), extension services (dedicated to training, advice and general communication), and farmers (as final users). The concept of AKIS, an evolution of the AKS concept, added a fourth set of actors into the model, generically called support systems (for example, input and service providers) (Rivera et al., 2005). Further refinements of the concept have tried to represent the 'ecosystemic' dimension through which farms activate processes of innovation: any agent of the environment where the farm is embedded can contribute to innovation.

The evolution of the concept of AKS and its application to innovation policies has progressively taken into consideration bidirectional communication. In general, this has led to market-driven approaches to innovation, that postulate the creation of 'markets of innovation', with interaction between innovation demand and innovation supply. In order to implement this approach, innovation policies have fostered privatization of extension services, funding under competitive bids, and farmers' participation to costs. As a consequence, a plurality of actors operating in the field of innovation has emerged, each of them trying to respond to an increasing variety of demand for innovation, including the one emerging within society. Agricultural knowledge systems have thus fragmented and developed more flexible organizational patterns, based on network configurations rather than on hierarchical structures. We can now list the following typologies:

- **input-based** networks, commanded by the agribusiness and aiming at ensuring correct use of the input by farmers and at creating brand fidelity;
- **product-based** networks – putting together actors belonging to different segments of the product chains and aiming at aligning farmers around quality standards;
- **place-based** networks – as in the case of LEADER local action groups, linking together local actors of different natures (public, private, civil society) around objectives of local development – and
- **value-based** networks – as in the case of so called 'alternative food networks' (Renting et al., 2003), that link together producers, consumers and civil society organizations around transformative goals. The key of these new organizational patterns is hybridity, that is the cooperation among actors with different goals, interests, languages, and regulatory fields.

What is evident in this evolution is that specific networks are built around specific problems, and their life-cycles are related to the life-cycle of the problem. Generic knowledge systems tend to be replaced by object-specific knowledge systems which are much more flexible and transient than the previous ones. In the new model, it is the problem that generates research for appropriate knowledge and not the reverse (Knickel et al. 2009).

Another characteristic of this evolution is the progressive involvement of different sets of actors, first of all civil society organizations (CSOs), local administrations and consumers, who try to respond to problems emerging in society and to which the private system is not able to respond, such as sustainability and ethical problems. The network approach also fosters a much more intense involvement of experts who, albeit belonging to specific institutions, participate in the networks with their own ideas and positions, which sometimes may be different from the official rules of their respective organizations.

As the key of innovation is the integration between diverse actors, tasks such as aligning actors around strategic goals, stimulating the emergence of research needs, facilitating access to funds, liaising between

experts and research centers have become central and specialized bodies in relation to is (Klerks et al. 2009).

3.3 The role of the Internet

Network models of innovation pre-exist in relation to the recent developments of the Internet. The first communities of practice are face-to-face communities, of which informal social relations are the most important media. The internet allows the model of informal social interaction to expand in time and space. Face-to-face communication (characterised by co-presence) is indeed complemented by remote interaction, both synchronous (for example, skype conversations) and delayed (for example, e-mail). Progressively, the Internet expands the possibilities to broadcast information (one to many) while receiving feedback (contrary to traditional media which have very rudimentary feedback channels such as 'letters to the editor'). Moreover, they progressively expand the amount and type of information exchanged (sounds, texts and images). The Internet also allows the storage of growing amounts of information in remote repositories, making shared repertoires available without direct social interaction.

When we look at the role of the Internet in communication and collaboration processes, we can say that:

- The Internet adds human-to-machine interaction to human-to-human interaction. A lot of information can now be accessed without any human mediation.
- The Internet makes operations possible that once were possible only in co-presence.
- The Internet reduces the time necessary to perform activities that can be slow and complicated when done in a face-to-face setting.

Social media take a step further. They provide platforms for the development of virtual communities, giving users tools to develop 'social' skills (profile description, asking connections, exploring other members' connections, publishing posts, commenting on others' posts, 'like' buttons, reputation generators - as in the case of amazon book reviews - , social bookmarking, etc.). Social media provide platforms for collaborative working, such as collaborative text writing and collaborative maps, not to speak of the 'open source' software projects.

3.4 The integration between offline and online

The developments offered by ICTs do not imply, however, that physical interaction is obsolete. Rather, the Internet forces us to reconsider the respective roles of offline and online, face-to-face and remote, and to redesign processess accordingly. As the cost of physical interaction increases its relative cost compared to remote interaction – due to scarcity of time and energy costs due to transportation – it is important to identify the features that still give physical interaction an advantage compared to remote interaction, thus mobilizing it when it really adds value. The following could be criteria to identify the roles of different types of interaction:

- **Human-to-machine** interaction will replace all standardized knowledge transactions, as in the case of search for information stored into databases. The area of application of this type of interaction is constantly expanding, as the progress in automatic translation, automatic text summarization and the so called 'semantic web' – where data are accompanied by metadata which make data machine-readable – develops.
- **Remote human interaction** replaces face-to-face interaction whenever unproblematic communication is involved: for example, agreeing on dates for a meeting, responding to specific questions, writing collaborative short reports, polling on alternative options, discussing routine issues among people who already know each other. The possibility of exchanging images and voice, together with experienced use of these media, progressively shifts the range of issues that can be addressed through remote interaction.
- **Physical interaction** is still not replaceable when information is too complex to be codified in a digital way (for example, involving taste, touch, smell, body language). It is still essential to foster motivation, to mobilize emotions, to capture background information and tacit knowledge, or to interpret complex natural phenomena. Rather than mere replacement of physical interaction with remote or machine interaction, innovation systems will enjoy an integration of online-offline interaction.

These aspects will have implications on the activities carried out in the Agricultural Knowledge Systems.

Research

Social media dramatically change the way research is organized. Social media allow the creation of communities of practice among researchers and students to exchange ideas, expertise, bibliographies. Some specialistic media have grown in the last years, such as Mendeley (www.mendeley.com), Academia.edu, ResearchGate, LinkedIn. Possibilities of exchanging and sharing large amounts of data and processing capacity allow the connection of laboratories in places distant from each other. The winning pattern of organization of research is now based on large consortia of laboratories and on networks of researchers. Collaboration possibilities foster interdisciplinarity. Open access journals allow access to scientific outputs to everybody.

As Brossard and Scheufele (2013) state, social media will provide a much faster and effective dissemination of research output. Feedback to researchers will be much more consistent. Peer review, which at present is the key to scientific quality of research output, will be possible at a much larger scale and will become a continuous process. Civil society will have the possibility to provide feedback on the relevance of research output, on the possible impact and on potential risks.

According to Ballantyne et al. (2010), research in agriculture can benefit from the possibility of sourcing data from farmers through mobile digital devices. This will reduce the costs of data collection and will allow the development of locally specific solutions. The implication of these developments is a progressive involvement of farmers in research, provided that social media allow them to give not only data but also input on research problems, feedback on research output and direct use of it.

As said above, **off-line interaction** will play an important role also in the new research organizational models. They will be employed to establish first contacts, to strengthen already existing contacts, to be exposed to new ideas and tips, to develop strategic issues and new concepts, to gain expertise on specific techniques where tacit knowledge is heavily implied, to set shared priorities and align network members around them.

Education and training

Tapscott claims that, as access to information is no longer a problem, teachers will lose their role as 'content providers', and will have to concentrate on methods: thinking, finding relevant information, synthetize, contextualize, critically evaluate. With the increasing availability of online courses, students will have the possibility of following lectures of 'teaching popstars' from home, and will have access to reading lists, assignments, online forums, as already provided by the MIT among others (ocw.mit.edu).

Downes (2005) claims that ICTs transform e-learning tools from 'medium' to 'platforms', in which content is created, shared, remixed, repurposed, and passed along. As Downes states, '*the control of learning will be placed in the hands of the learner'*, and learning will be linked to specific goals. The teacher, in this context, will become a facilitator, a resource person, and the class will be transformed into an environment in which creative discussion and stimulating collaborative work is developed. In the new context, students will view learning as the process of joining a community of practice.

When it comes to farmers, training will concentrate on **face-to-face activities** in relation to problem-solving activities and will increase group building, knowledge sharing, and collective problem definition. Brokerage methods such as transect walks, focus groups, Venn diagrams, world café, card games etc. will make the meetings more effective as they will stimulate participation, discipline of interaction, curiosity, and group identity. Offline encounters will be followed up by post-event social interaction, which will strengthen and disseminate learning output.

Technical advice

Repeated interaction among multiple actors allows a reduction of the distance between expert advice and lay knowledge. The role of the Internet in this context has been analysed in depth in the field of health care. As Loader et al. (2002) state, '*increasingly netters will arrive at a doctor's surgery having already accessed to the Internet, and may be more informed about their medical condition and its potential remedies than the medical practitioner*'. Social media also allow the integration of expert advice with lay knowledge through peer-to-peer interaction: '*the advice provided through face-to-face medical consultation can be checked, verified and discussed within a virtual forum*'. As in the case of research and education, also with technical advice all the tasks that can be standardized and digitalized will be progressively performed through human-to-machine relationships; remote advice will have a much more relevant role, especially for frequently asked questions, and peer-to-peer interaction will complement expert advice (see eXtension example).

No fruit Strawberries

I have strawberry plants that bloom very nicely. After the blooms die off, the fruit starts as a small fruit and that is where it stops. This has happened for two or three years. Not sure what is causing the problem. They are in direct sun. Can you help?

Answered

Fillmore County Minnesota horticulture fruits and vegetables about 17 hours ago

(from: ask.extension.org)

Physical interaction will be concentrated on the discussion of complex issues or on problems that require direct observation of the object of knowledge. Imaging and recording will allow the sharing of information gained with physical interaction and contribute to shared repertoires.

Within the project FOODLINKS (foodlinkscommunity.net) a group of researchers, local administrators and civil society organizations went to Rennes and visited a cooperative farm shop. They made questions to the people in the farm shop, took pictures, discussed among them the relevant issues. After the visit, a short report of the visit was written by the coordinator and posted on the wiki of the project. All the others contributed by integrating the report with their own notes and added pictures, and people of the community of practice who did not participate in the visit could make questions and comments.

In Wengers' terminology, the farm shop is a *knowledge object*. Participants in the visit have the opportunity to get a lot of information from physical interaction among themselves and with the situation they have observed. They shared their knowledge in relation to the object, developed a shared view through interaction. This view is '*reified*' into a report that eventually constitutes a resource for all the people belonging to the community of practice.

3.5 The emerging brokerage function

Instead of the hierarchical and institutionalized Agricultural Knowledge Systems we have experienced in the past, the new Agricultural Knowledge Systems will develop around specific innovation objectives and will turn into something else when the objectives are achieved. Social media and social technologies accelerate the cycle of development for communities of practice. Extension services will increasingly dedicate themselves to the creation of communities of practice, specializing in bridging worlds characterized by different languages, bodies of knowledge, goals, to align actors around specific innovation objectives and to facilitate the access to financial resources.

The increasing demand for food quality has encouraged farmers and small and medium enterprises to develop specific, local products which are based on local raw materials, local breeds or varieties and traditional production and processing techniques. These products are branded under collective labels, which can be used by producers who adhere to specific codes of practice. The process of product development and of the relative code of practice, often ending in EU recognition under the regulation 1151/2012, implies an intense work of brokering performed by local actors at different stages of the production process: farmers, processors, health authorities, local administrations.

Brokering skills, both online and offline, rather than technical specialization, will become key tools in the new Extension services. As far as face-to-face interaction is concerned, brokerage tools will be increasingly employed to increase their effectiveness. Cf the following examples.

System Analysis Matrix has been experimented in the Netherlands to make project participants reflect on barriers to the achievement of project goals. It is based on the building of a matrix of relevant stakeholders, X relevant system characteristics, and the broker encourages stakeholders to discuss the barriers in each cell of the matrix (van mierlo et al 2010).

The **World Café** is a method for fostering a creative process for collaborative dialogue and the sharing of knowledge and ideas, particularly in large groups. World Cafe is set around a collection of tables. Each table discusses one topic, theme, or question. A facilitator or moderator introduces the host at each table. After 15 to 30 minutes participants leave the table and visit another one while the hosts stay at their respective stand. The host sums up briefly the content of preceding discussions and start a new discussion. The World Café concludes with a reflection phase.

Participatory video making is a method to build a group around a knowledge object. The principle is that participants create their own film. This process can enable a group to take action to solve their own problems, to communicate their needs and ideas to decision-makers (http://en.wikipedia.org/wiki/Participatory_video). The process is generally organized by a broker who facilitates the agreement over the script, the use the camera and editing of the video. Given the decreasing cost and easiness of using imaging tools, this method can be easily applied in many situations. The limit of the method is that it is time consuming.

Peer-to-peer interaction will increasingly integrate technical advice, and extension services will have to design their activities in a way as to foster and monitor social learning. All actors in the system will dedicate a higher share of resources to online instruments to increase their productivity. Mailing lists, content management systems, and collaborative working tools will become tools of daily usage.

Social media have the potential of turning any project into a community of practice. Development projects – such as those funded by Rural Development policies - will increasingly mix different activities (research+training+extension) and diverse actors, including consumers, linked together by flows of information across the Internet and finalized to specific innovation objectives (see IDRAMAP example).

Increased use of social media and involvement of civil society and consumers will broaden the field of learning. Consumers can interact directly with farmers and develop new quality criteria. Producers increase the possibility of managing reputation building among consumers and to create their own consumer market. Participation in civil society activities will expose farmers to new ideas and will tune them up with societal values, and at the same time it will give them a 'voice' in the policy process.

3.6 Conclusions

In today's information society, information is one of the cheapest available resources. This encourages a restructuring of economic processes in a way to replace, when possible, processes that imply exchange of materials with exchange of information, physical interaction with remote interaction or even human-to-machine interaction. The intensity of information flows depends on connectivity – the number of people

each actor can communicate with – and interactivity – frequency and direction of interaction. In this chapter we have highlighted how social interaction can be the engine for learning and innovation, and how the Internet and available software allows us to support the creation and the management of communities of practice and collaborative work.

Agricultural Knowledge Systems, so far designed around a model of face-to-face interaction between knowledge producers, knowledge brokers and knowledge users, will benefit immensely from a redesign of the organizational model based on a network approach and heavy use of social networks. As shown above, the available Internet tools encourage a change of innovation models: from top-down models to network models, from generalist extension structures (for example, 'crop management' departments) to problem-specific structures (for example, 'participatory plant breeding' networks), and will allow direct interaction between farmers, researchers, extension workers, consumers, and civil society organizations. Innovation policies can support the restructuring process by raising the level of digital literacy, encouraging collective development projects with explicit internet-based experiments, and introducing methods of monitoring and evaluation of learning processes.

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