# ICT and social media as drivers of multi-actor innovation in agriculture

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## ABSTRACT

Innovation occurs as a result of the creativity and interplay between actors combining new and/or existing (tacit) knowledge. As input to a report on agricultural knowledge and innovation systems (EU SCAR, 2013), we analyzed the use of social media and other information and communication technologies (ICT) tools as drivers of innovation in agriculture and other sectors. We found, that there is a great potential for using existing social software tools and platforms for communication, interaction, knowledge sharing, preservation of information and as such stimulate multi-actor innovation. Apart from a few exceptions, our review of social software systems revealed that agriculture as a sector to some extent has adopted the general social software programs as tools for networking and knowledge sharing, but the potential to use it for crowdsourcing and cooperation or as a supplement to face-to-face interactions has not yet been exploited.

**Keywords: Innovation, social media, crowdsourcing, co-production,** Denmark.

## 1. INTRODUCTION

Agriculture today is evolving in an environment of rapid changes in technology, markets, policies, demography and natural environment. The challenges these changes pose to the national agricultural sectors and rural communities in Europe are context specific and complex, and are therefore putting new demands on all actors in and round the agricultural sector to innovate and develop new ways of collaborating to generate knowledge and put it into use at the required pace (Daane, 2010). In the 'European Commission communication, CAP towards 2020' innovation is being highlighted as being indispensable to preparing the agricultural sector in the European Union for the future. The communication from the European Commission on the European Innovation Partnership, 'Agricultural Productivity and Sustainability' also states that increased and sustainable agricultural output will be achievable only with major research and innovation efforts at all levels. Innovation is here defined as the implementation of a new or significantly improved product (good or service) or process, marketing method or a new organizational method in business practices, workplace organization or external relations.

Farmers have a long tradition for sharing of knowledge in cooperatives or farmer learning groups, but there is a gap between the provision of agricultural research results and the application of innovative approaches in practical farming. New knowledge does not or takes too long time to reach the farmers, and the needs of practical farming are not communicated sufficiently to the scientific community. Thus, new ICT supported collaborative methods may be important tools to solve some of these gaps by improving access to results, knowledge exchange and communication as well as preservation and education.

Until recently the conventional concept of agricultural knowledge transfer has been the linear "pipeline" model with clearly distinguished roles between creating, transferring and using knowledge and technologies (Daane, 2010). The linear model has progressively been replaced by a participatory or collaborate social network approach in which innovation is co-produced through interactions between all stakeholders in the food chain (especially for $2^{nd}$ order changes, so called "system innovation" like the introduction of multifunctional agriculture or organic farming (EU SCAR, 2012). In these collaborative networks, 'Agricultural Knowledge and Information Systems' (AKIS), researchers, farmers, agricultural advisors, entrepreneurs, food and feed industries, policy makers etc. involve themselves in creation, diffusion, adaptation and use of knowledge as well as in providing other resources for innovation (Klerkx et al., 2009).

ICT has already been used on many types of platforms for dissemination of agricultural research results, e.g. websites, publication archives, newsletters and other channels of output from research institutions and extension services, and increasingly more advanced forms of ICT are being utilized, e.g. decision support systems (DSS), forecast systems, instructive videos, and text – message information by mobile phone between farmer and advisor. Especially social media play an ever increasing role in society as well as in agriculture. Therefore it is important to identify, how and with which tools ICT may contribute to and speed up innovation processes in agriculture, because innovation is much more than dissemination of research: It occurs as a result of the creativity and interplay between actors combining new and/or existing (tacit) knowledge.

## 2. COMMUNITIES OF PRACTICE

Innovation literature has increasingly posed its attention on the concept of 'communities of practice' (CoP) as a key to improving business performance. CoPs are "groups of people informally bound together by shared expertise and passion for joint enterprise" (Wenger and Snyder, 2000). CoPs magnify the capacity of individuals to learn and innovate, as they provide access to information, frames, memories, validation and legitimization of knowledge. The concept of CoP has been developed before the Internet revolution, but many of its insights are now used to foster virtual communities.

Communities of practice can be seen as knowledge systems wherein components develop specialized functions. The following roles can be identified:
- Facilitation: taking care of network relations, enlarging the network and activating interaction.
- Brokering: procuring relevant information and translating it into appropriate language.
- Memories: storing information.

- Retrieval: making information easily available on request.
- Validation: assessing the relevance of available information to practice.
- Framing: developing criteria to turn information into knowledge.

ICT can improve these functions in a number of ways:
- It can dramatically improve the access and storage of information, which potentially makes huge amounts of data and information available to everybody.
- Software - often free - can relieve people from the burden of elaborating information and turn information into ready-to-use knowledge. Instrumental operations, once carried out only by experts, for example measuring blood pressure, can now be done by virtually everyone.
- Data-mining technologies allow identification of 'patterns' by processing huge amounts of data, opening the way to better understanding of behavior, and to improve search strategies to accelerate selection of information relevant to one's problems.
- By reducing the cost of interaction to nearly zero, the Internet has multiplied connectivity and interactivity between people, creating the conditions for intense flows of information.
- ICTs also provide trust creation mechanisms, fostering the consolidation of 'virtual communities'.
- Basic principles of virtual communities are 'sharing' and 'co-creation'. Collaborative tools distribute the possibility to contribute to the creation of a common pool of knowledge among people, removing in principle – or shifting ahead - barriers between 'knowledge producers' and 'knowledge users'.
- Interactivity on a mass basis allows processes of continuous review, improving continuously the quality of knowledge produced.
- Used in integration with physical interaction, virtual interaction amplifies the outcome of physical interaction, as it can be used to disseminate, to replicate, to store and to follow up physical encounters.

### 3. SOFTWARE AS INNOVATION BROKERS

Klerkx & Gildemacher (2012) defines 'innovation brokers' as persons or organizations that, from a relatively impartial third-party position, purposefully catalyze innovation through bringing together actors and facilitating their interaction. Innovation brokering expands the role of agricultural extension from that of a one-to-one intermediary between research and farmers to that of an intermediary that creates and facilitates many-to-many relationships.

Just as ICT and especially social media can support virtual communities of practices, so can ICT and social media be seen as virtual innovation brokers who 'catalyze innovation through bringing together actors and facilitating their interaction'. A number of different types of such ICT tools/networks have been identified (see also table 1):

- **Knowledge portals** are ICT tools for providing access to organized web based knowledge. Knowledge portals enable a common platform for delivery of information from diverse sources.

- **Groupware or collaborate software** is software, which helps facilitation of action-oriented teams working together (over geographic distances) by providing tools that aid communication, collaboration and the process of problem solving.

- **Community of practice (CoP)** network serving a group of people who share a craft and/or a profession. The group can evolve naturally because of the members' common interest in a particular domain or area, or it can be created specifically with the goal of gaining knowledge related to their field.

- **Social communities of interest** network serving a community of people who share a common interest or passion. These people exchange ideas and thoughts about the given interest, but may know (or care) little about each other outside of this area.

- **Individual communities of interest** are ICT tools for individuals to manage personal knowledge and networks.

Table 1: Software types, examples of tools and successful examples of application of the tools, mainly in agriculture.

| Software type | Examples of tools | Successful examples |
|---|---|---|
| Knowledge portals | • Digital libraries<br>• Slideshare,<br>• YouTube | • Organic E-prints<br>• VOA3R,<br>• eXtension,<br>• Chil |
| Groupware | • Wikipedia,<br>• Yammer,<br>• Crowdsourcing | • British Farming Forum,<br>• Lego Cuuscoo,<br>• Novozymes COLIN,<br>• Climate CoLab,<br>• P&G Connect+Develop,<br>• Betacup Challenge |
| Community of practice | • ResearchGate,<br>• Erfaland | • Disease surveillance and warning systems,<br>• IDRAMAP |
| Social communities of interest | • Facebook,<br>• LinkedIn,<br>• Google+,<br>• Ning | • Ag Talk+.<br>• Jeunes-agricultuerurs<br>• E-agriculture |
| Individual communities of interest | • Wordpress,<br>• Twitter,<br>• Blogs. | • AG Chat |

**3.1 Successful examples**

Searching on the net revealed the following successful examples of use of the various ICT tool

types in the agricultural sector plus a few very promising examples of crowdsourcing from other sectors:

- **Organic E-prints** is an international open access archive for papers and projects related to research in organic food and farming. The archive presently contains more than 13,000 publications from all around the world and has more than 23,500 registered users and 150.000-210.000 visits per months, www.orgprints.org.

- **VOA$^3$R** is a social platform for researchers, practitioners and students in agriculture and aquaculture integrating open access institutional research repositories. It combines the archive function with the social online communities of interest known from a.o. LinkedIn, voa3r.cc.uah.es.

- **Lego Cuusoo** is an example of crowdsourcing. It was launched worldwide by LEGO and it's Japanese partner CUUSOO in 2011. Lego Cuusoo invites you to submit your ideas to be considered as future LEGO products, and let you vote on and discuss ideas to help the LEGO Group decide what to release next. When a posted idea reaches 10,000 supporters, it is reviewed by LEGOs Cuusoo team who then decide on whether to produce it. So far four Lego sets have been developed/accepted based on users' ideas, and more are under review, lego.cuusoo.com.

- **P&G Connect+Develop** was launched more than 10 years ago and has developed more than 2,000 global partnerships, delivered dozens of global game-changer products to consumers, accelerated innovation development and increased productivity, both for P&G and its partners. The website has served as P&G's 'open front door to the world', allowing any innovator anywhere to share their innovations with the company. The site receives about 20 submissions every weekday – or more than 4,000 a year – from all over the world, www.pgconnectdevelop.com.

- In the **Betacup Challenge** in 2010, the goal was to find ways to reduce the use of cups that cannot be recycled. There were more than 430 entries in the challenge. First place, with a $10,000 prize, went to a group from Boston, which proposed what it calls the 'Karma Cup' - a new way to encourage customers to bring reusable cups to their local Starbucks shop, www.thebetacup.com.

- **AgTalk+** is a platform purely run on voluntary basis and on donations. It has forums, blog, wikis and (sharing innovations) workshop creations and very active forums - e.g. on machinery and equipment, stock, crops, IT, market and precision tools, agtalkplus.com.

- The French **Jeunes Agriculteurs** (JA) Syndicat is an organisation for young people working in agriculture. It counts more than 50,000 members and has an active Facebookpage with more than 5,000 followers, www.jeunes-agriculteurs.fr.

- US based **AgChat** Foundation started AgChat in 2009, using Twitter. It has more than 30,000 followers, and its mission is to "Empower farmers and ranchers to connect communities through social media platforms. The concept has now spread to Australia, New Zealand & UK, twitter.com/agchat.

When looking at the success stories described above, it is not possible to point at one type of software tool as being more successful than another in relation to networking, knowledge

exchange and innovation in the agricultural sector – nor as regards the number of users, the activity in the network or the longevity of the network. Twitter based AgChat is with +30.000 users one of the most succesful examples of social media use in agriculture although Twitter's honeycomb (figure 1 below) scores zero in half of the communication functions evaluated. This shows that the success of a social software tool as regards communication, knowledge sharing and innovation depends on many other factors than the ICT tool itself.

Kärkkäinen et al. (2012) investigated the use of crowdsourcing, especially from business-to-business companies' innovation perspective, with the aim to create a more comprehensive picture of the possibilities of crowdsourcing for companies operating in business-to-business markets. They performed a systematic literature review and found 19 cases, in which evidence of innovation as a result of crowdsourcing activities were found in 12 cases. Use of crowdsourcing was identified in three innovation process phases: front-end, product development, and commercialization. Furthermore, evidence was found for crowdsourcing to be used in innovation mainly in the manner of crowd creation, crowd wisdom and crowd funding. They concluded, that the role of social media was quite essential in all the analysed B2B crowdsourcing examples.

**3.2 Strengths of various social software tools in relation to innovation**
Figure 1 shows a honeycomb presentation of the strength of 15 selected tools in relation to their subjectively judged functionalities for the six social network functions, which are considered to be most important for innovation networks:

- **Networking** - ways for one person to meet up with other persons on the net.
- **Cooperating** - working or acting together towards a common end or purpose.
- **Co-producing** - using each other's assets, resources and contributions to achieve better outcomes.
- **Crowdsourcing** - obtaining needed services, ideas, or content by soliciting contributions from a large group of people.
- **Discussing** – exchanging viewpoints about topics in open and informal debate.
- **Engaging** – making users share, connect and contribute.

The honeycomb presentation uses ten colour grades from white (not supported) to dark green (strong functionality of the tool) to describe each of the social network functions in the diagrams in figure 1.

The honeycomb evaluation of figure 1 mainly demonstrates that there exists a large variety of social software programmes with different strengths, capabilities and focuses. It is not evident which tools or platforms to choose to ensure a successful, i.e. active and vibrating community. Instead of focusing too much on the tools, it is worth paying attention to Hafkesbrink & Schroll's (2011) concept of 'Embedded Innovation' (Innovation 3.0), which they define as the fundamental ability of a firm to synchronize organizational structures, processes and culture with open collaborative learning processes in surrounding communities, networks and stakeholder groups so as to ensure the integration of different external and internal knowledge, i.e. competences or technological capabilities, and to exploit this knowledge to commercial ends.
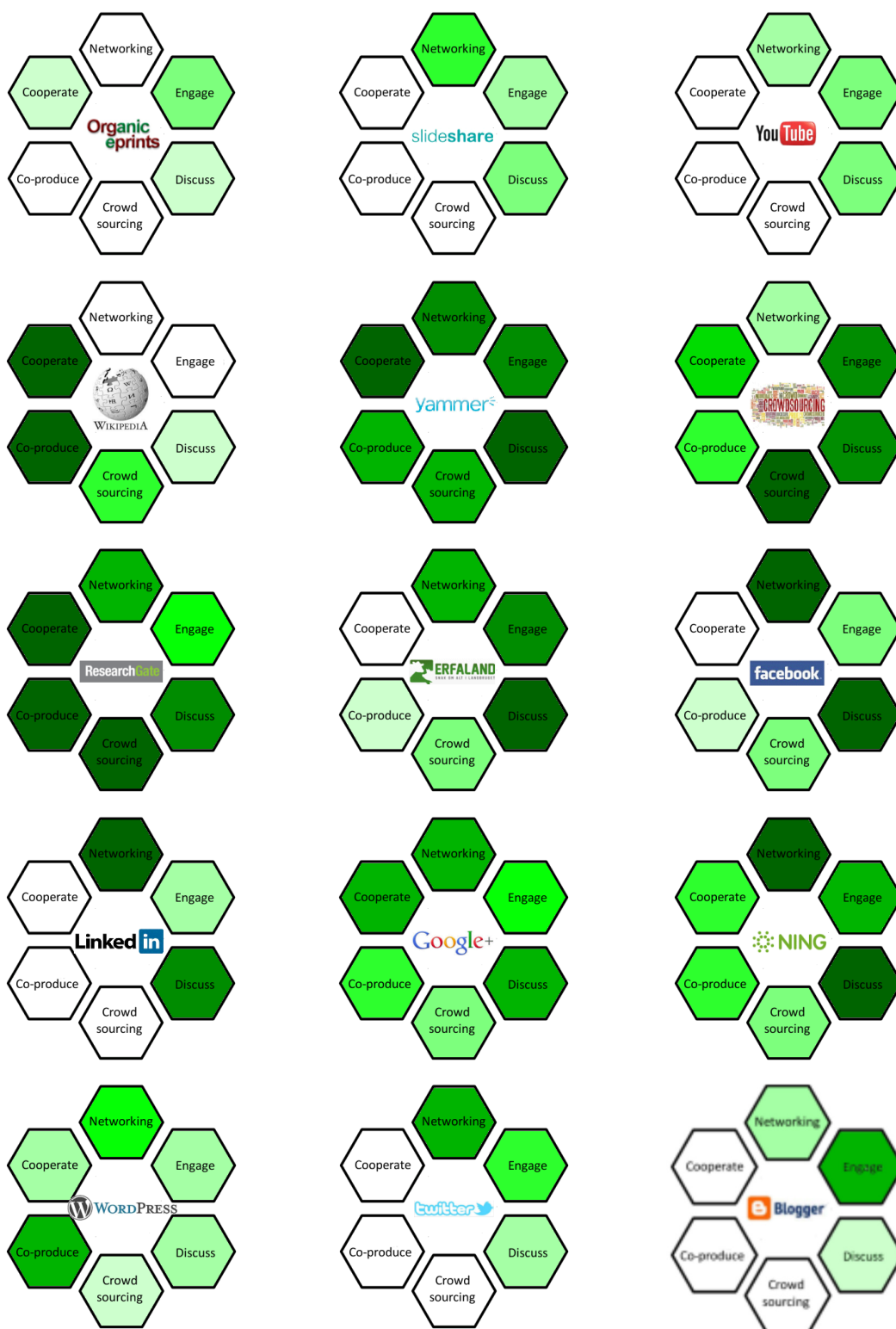
Figure 1. Honeycomb evaluation of selected tools in relation to six social media functions

## 4. CONCLUSION

Despite the lack of identification innovation as a direct result of activities in any of the mentioned successful agricultural examples of virtual communities, it is evident, when judged by the variety in capabilities of the reviewed tools and successful examples from other sectors, that there is a potential for using social software tools and platforms much more to communicate, interact, create, share and organize information and as such stimulate multi-actor innovation in agriculture. Furthermore, instead of inventing new tools it is recommended to consider which of already existing tools and platforms, are best suited for the purpose and the cooperation of the stakeholders to be involved. However it is not possible to predict which ICT tools should be used in a given situation, but focus should be on how you can help your target group(s) to do what they want to do, taking into account the target groups' pattern of ICT usage. Maintaining the platform, selecting first movers, ambassadors etc. may also play an important role for the success. Moreover, a redesign of the organizational model from top-down to network and embedded innovation (Hafkesbrink & Schroll, 2011) will also improve the knowledge sharing and mutual learning, which are prerequisites for innovation.

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