AGRIDEMO

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THE ANALYTICAL FRAMEWORK

DEMONSTRATION FARMS AS MULTI-PURPOSE STRUCTURES, PROVIDING MULTI-FUNCTIONAL PROCESSES TO ENHANCE PEER-TO-PEER LEARNING IN THE CONTEXT OF INNOVATION FOR SUSTAINABLE AGRICULTURE

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COLOPHON

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AGRIDEMO

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1 | INTRODUCTION

1.1. CONTEXT

Demonstration farms have a major role to play in the application of scientific findings (science driven research) and the spreading of best practices and innovative farming approaches (innovation driven research) within the farming community.

For agriculture to meet the multiple expectations emerging from society and contribute to tackling the challenges of food security, food safety, quality, sustainability and climate change in Europe, farming systems have to become more knowledge-based. Farmers need to be aware of, have access to, and be able to co-create the best practices available. Currently there are many debates about how to organize the production, accumulation and distribution of knowledge to support innovative agriculture. Knowledge transfer has in the past been conceptualized as a rather linear process of passing on new research-based knowledge to farmers in the form of advice and recommendations for changes in the way they farm and manage their enterprises. However, a changing context with respect to extension, markets and challenges has initiated a more complex system of knowledge exchange. Rather than a linear model of innovation, this is now envisaged as a set of networks, in which innovation is 'co-produced' through interactions between all stakeholders in the food chain called AKIS - Agricultural Knowledge and Innovation System (EU SCAR, 2012). Research on the adoption and diffusion of innovations has consistently confirmed that one of farmers' most commonly cited sources of information and ideas is other farmers (Rogers, 1995). Farmers and small scale foresters tend to be most influenced by proof of successful farming methods by their peers (Kilpatrick and Johns, 2003; Warner, 2007; Schneider et al., 2009; Hamunen et al., 2015). In industrialized countries, however, this collaborative learning has become increasingly marginalized (Hassanein, 1999; Campbell, 1998). Industrialized agriculture has drawn more individual farmers into supply chains where they often act more as competitors, in order to achieve a low-cost strategy. This may have contributed to a weakened collective culture that can sustain such learning through dialogue in certain industrialized countries (Bell, 2004).

Nevertheless, numerous examples of peer-to-peer training movements using on-farm demonstrations have developed worldwide, notably in Latin America where the "campesino-a-campesino" (farmer-to-farmer) movement has promoted agro-ecological techniques over the past 35 years (Holt-Giménez, 2006). Rather than simply using trial and error, this method allows "campesinos" to benefit from the experience of model farmers or "promotores" who teach through participatory workshops and small field experiments. Farmer Field Schools are also an established model for mutual learning in developing countries (Waddington et al., 2014). In Europe farmer discussion groups, study groups have been a central part of the knowledge system in a number of countries, whilst participatory initiatives such as Farmer Field Labs and Monitor Farms in the UK, and EIP-AGRI operational groups within the Rural Development Programmes (RDP) in EU member states, have emerged more recently.

Within these initiatives and networks, demonstration farms have a major role to play in the application of scientific findings (science driven research) and the spreading of best practices and innovative farming approaches (innovation driven research)[1] within the farming community.

1 Science driven research (classical hierarchical flow from science to societal impact) vs. innovation driven research (empowerment of the potential innovators themselves, farmers and small business owners) reflect two main types of motivation for research (EU SCAR, 2012).

Notions of learning rather than simply knowledge transfer recognize that opportunities for observation, interaction and discussion play an important role in farmers' decisions, prompting an interest in both on-farm demonstration activity and monitoring of farm businesses as potentially effective interventions. Efforts are needed to develop their potential and prepare for European connectivity. Effective peer-to-peer learning occurs when the demonstration farm operates under the same conditions as average commercial farms, i.e. subject to normal regulatory constraints, and using the innovative production systems or agricultural practices/technologies in the course of its normal commercial farming activity (Bailey et al., 2006). Developing effective peer-to-peer learning processes is seen as an important strategy to enable policy to support farming systems and facilitate their transition (Iles and Marsh, 2012). Furthermore, an increased understanding of such learning processes will help to develop institutions and programs that can foster innovation dissemination and learning for sustainable practices (Lankester, 2013).

Farmers operate in a complex knowledge landscape or AKIS, drawing in information simultaneously from many different channels (e.g. social media, advisors, regulators, supply chains). Demonstration farms are just one element of this landscape; they are not a substitute for other forms of information but are a valued dimension to farmers' knowledge systems, particularly as they help by intensifying interaction farmers have with other farmers.

1.2. AIM OF THE REPORT

The overall aim of AgriDemo-F2F (H2020 funded n°728061) is to enhance peer-to-peer learning within the commercial farming community. This will be realized through the following general objectives: i) understanding the role of European commercial demonstration farms within this AKIS, ii) building on this understanding, evidence and tools for organizing effective farmer-to-farmer learning approaches will be synthesized and made available to end users and iii) opportunities will be identified and supported for strengthening these activities by the construction of a FarmDemo-Hub community by the project consortium.

Based on an extensive literature review, this report is a first attempt of the AgriDemo-F2F project to structure insights into peer-to-peer learning through focusing on the main characteristics of on-farm demonstrations. Although most literature is currently reporting on the traditional on-farm demonstrations within extension education programs, we aim at including initiatives led by farmers or commercial companies. Furthermore, we aim at capturing the most relevant variables and characteristics of demonstration activities.

These characteristics will be used to build the analytical framework of the H2020 AgriDemo-F2F. This will guide the AgriDemo-F2F project in its next steps, e.g. the development of a geo-referenced inventory and a typology of demonstration farms and activities. This report also provides the theoretical and analytical basis for tasks in WP3 and WP4 in relation to the case study analysis. Here the aim is to provide an in-depth analysis on the structural and functional characteristics of farmer-to-farmer learning approaches, specifically focusing on actors, roles and governance. As well as to describe, analyse and compare the mechanism and tools that are being used by the case study demonstration activities, in terms of recruitment, interaction and learning.

1.3. DEFINITIONS AT STAKE

The core of AgriDemo-F2F is deepening insights on **on-farm demonstration activities to enhance farmer-to-farmer learning**. These demonstration activities can be diverse, ranging from scientific application on commercial farms by research institutes (Nuthall, 2011; BMEL, 2016) and commercial companies (Gros and Oldeweme, n.d.; Syngenta, 2016), to monitor farms where farmers meet regularly to follow a technological or business idea, to facilitated farmer-led groups who experiment in more informal ways (Creaney et al., 2015). They therefore represent both science driven and innovation driven models.

Although not always explicit, farmer-to-farmer learning is central to all of these approaches. We can distinguish four central concepts, viz. 'demonstration activities', 'demonstration farms', 'demonstration networks' and 'farmer-to-farmer learning'. Each of these is briefly elaborated on below.

First of all, there are the **demonstration activities** commissioned and organised by a variety of actors within and outside AKIS. A demonstration activity can be defined as: the diverse means for providing farmers with "*an explanation, display, illustration, or experiment showing how something works*" (Collins English Dictionary[1]) that can be subsequently applied in their own farming practices to bring about positive changes on their farm. In broader terms demonstrations can be seen as an important part of agricultural extension that represents "the function of providing need- and demand-based knowledge in agronomic techniques and skills to rural communities in a systematic, participatory manner, with the objective of improving their production, income and (by implication) quality of life" (Haug, 1999 as cited in La Grange et al., 2010: 261). On-farm demonstrations facilitate an effective learning situation for farmers to "see the crops themselves", "interact with the scientists and extension workers on the field", and "get doubts clarified themselves" (ICAR, n.d.). On-farm demonstrations allow farmers to see a new/innovative technology, practice or system in operation on a working farm not too dissimilar to their own and talk to someone actively engaged in the practice and to whom they can relate (their peers). This is especially true for those technologies that are costly, complex, or require a major shift in the operation (Miller and Cox, 2006; Bailey et al., 2006).

Second, the demonstration activities under study are located on a **"demonstration" farm**, differentiating between commercial farms and farms attached or owned by research institutions, universities, private companies etc., and between farms that host occasional demonstration activities as 'side-activities' or farms that organise demonstration more structurally or even commercially. Demonstration farms can be defined as meeting places where dissemination of knowledge and information is taking place, advice is provided, solutions and tools are designed and implemented as well as controlled, on-the-farm research is conducted (Kiełbasa and Kania, 2015). Educational opportunities come from the application or demonstration of results or methods, training opportunities and the ability to exchange experiences throughout open events and other dissemination actions (Kiełbasa and Kania, 2015; EISA, 2010; Syngenta, 2016).

On-farm demonstrations facilitate an effective learning situation for farmers to "see the crops themselves", "interact with the scientists and extension workers on the field", and "get doubts clarified themselves"

1 https://www.collinsdictionary.com/dictionary/english/demonstration

When an experimental function is present, technologies, innovations tools and methods are trialled, compared or validated (Krah, 1992; Kiełbasa and Kania 2015; ORC, n.d.; EISA, 2010; Gibbons and Schroeder, 1983). Demonstration farms need to show how innovative methods could work in practice in order to convince other farmers to adopt novelties (new technologies as well as new practices) with increasing confidence (Kemp and Michalk, 2011; Oakley and Garforth, 1985). Demonstration farms are important to the creation and dissemination of this knowledge because they are the source of both knowledge and practical solutions (Kiełbasa and Kania, 2015). Demonstration farms vary according to a number of different parameters, including ownership status, goals and objectives, the alternative functions involved, the actors/networks involved in each demonstration function and their roles, the audience, the network structure, its openness etc. They can also differ in terms of their frequency; hosting demonstrations in the long-term (e.g. long-term experiments), short-term (e.g. monitor farms) or annually/seasonally

Third, demonstration farms can operate or collaborate within **a demonstration network (programme or project)**. These are multifunctional entities where different actors with different roles engage in collaborative processes (participatory decision-making, participatory research, evaluation, monitoring, etc.), in most cases (Breetz et al., 2005; Ferranto et al., 2012; Davis and Babu, 2015; PACC, 2015; Mitchell, 2016; Okiror, 2016; Kumar, 2014; Hellin and Dixon, 2008). The network approach is characterised by various formal and informal connections between network participants and the interactions among them. The process of knowledge exchange is complex and multidimensional, and knowledge is created, generated, supplemented and processed on many levels (Kiełbasa and Kania, 2015).

Finally, **farmer-to-farmer learning**, or peer learning in general terms, involves participants learning **from** and **with** each other and can take place anywhere on the scale between informal and formal learning. Peer learning can take place spontaneously and informally, but can be also be prompted. It is a key characteristic of demonstration activities and networks described above. A peer is a person who is equal to another considering a combination of certain abilities, qualifications, age, background, or/and social status, relevant to the learning context. With respect to **learning from others**, farmers tend to be most influenced by proof of successful farming methods by their peers (Kilpatrick and Johns, 2003; Warner, 2007; Schneider et al., 2009; Hamunen et al., 2015). Additionally, according to Franz et al. (2010), based on a study on the learning preferences of farmers, peer teaching and learning, including apprenticeships and work with experienced farmers, are valued by farmers. This interest could therefore be a valuable educational delivery method and a way to enhance adoption of new practices. With respect to **learning with others**, Emerick (2016) states that despite the firm establishment of peer learning in the literature, there is room to build on this by finding ways to make social learning[1] more effective. Simply relying on farmers to share information without any further intervention will limit adoption of agricultural technology. It is important to emphasize though, that peer learning is not a single practice. It covers a wide

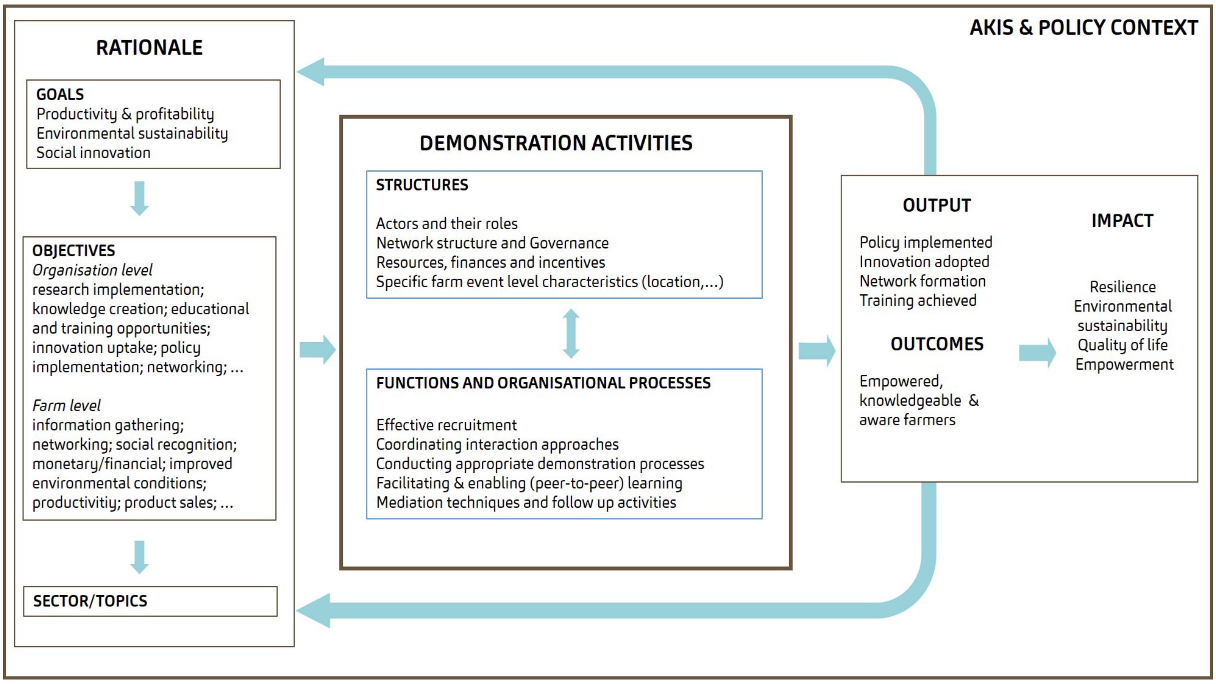
1 See section 3.4.1

range of different activities, each of which can be combined with others in different ways to suit the needs of a particular learning context (Topping, 2005; Boud et al., 2014).

1.4. BUILDING BLOCKS OF THE ANALYTICAL FRAMEWORK

Based on an in-depth literature review (and project practitioner insights), we propose the following main building blocks to study and deepen insights in farmer-to-farmer learning through on-farm demonstration in the context of innovation for sustainable agriculture (Figure 1).

Figure 1: Main building blocks of the AgriDemo-F2F analytical framework



In the literature concerning on-farm demonstrations, a wide range of structural characteristics are described. These differ according to the actors/networks involved and their roles, the audience/ attendees, the network structure and its characteristics, resources, finances and incentives, and characteristics related to the farm (geographic location, accessibility, etc.). Next, looking in depth at the functional and organisational processes related to demonstration activities, the literature identifies many different aspects: from coordinating effective recruitment, developing appropriate interaction approaches and conducting appropriate demonstration processes to enable and facilitate learning. Furthermore, we can also observe very diverse mediation techniques, tools and follow up activities. As this is central within the AgriDemo-F2F project, this report starts with defining basic concepts focusing on these structures (Chapter 2) and functions (Chapter 3) of **demonstration activities**.

The long term goals, specific objectives and sector or topic addressed in on-farm demonstration activities provide the rationale for (the choice of) **structural characteristics and functional and organizational processes**. **Goals** relate to long term ambitions and these will tend to prioritise one of the three sustainability pillars (economic, environmental and social). The short-term targets which contribute to the achievement of goals can be thought of as objectives. **Objectives**, in turn, can be applied to different sectors and topics. They originate in organisational or farm level. The former may include research implementation, knowledge creation, development and processing, knowledge transfer, educational and training opportunities, etc. (Appendix 1). Individual demonstration farmers can either directly deliver or mediate these objectives on behalf of an organisation or network, or if they operate alone, will determine their own objectives which are underpinned by their own motivations for hosting a demonstration.

Goals and objectives are also determined according to expected impacts. Impacts can vary between for example, higher quality of life (improved health and safety) or higher resilience level (i.e. improved capacity of the farm to adapt to changes) but should, in principle, all enhance the sustainability of European farming systems and facilitate their transition. However, long-term impact is preceded by immediate/direct outputs (e.g. number of trained farmers) or medium-term outcomes (e.g. increased cooperation, implementation of demonstration practice on participants' farm) which organisers will focus on.

Earlier experiences and results of demonstration activities guide this rationale. As a result, both the rationale and the achieved impacts drive the structures of and organisational processes during the demonstration activities and define the effectiveness of the choices made during the design and implementation of the demonstrations. As such, the effectiveness of on-farm demonstration activities is defined as the degree in which the predefined goals and objectives are reflected in the achieved results (output, outcome and impact).

The effectiveness is addressed in this report as follows. First, in Chapters 2 and 3, the contribution of the structural and functional characteristics to the effectiveness of the demonstration activities is discussed in more detail. Second, in Chapter 4, we discuss the link between the rationale of the demonstration activities, the extent and nature of (peer-to-peer) learning and the dimensions of demonstration activities in relation to the achieved short term outputs, medium term outcomes and long term impacts. Finally, in each Chapter, we describe which data will be gathered in the FarmDemo geo-referenced inventory of demonstration farms and organisations.

2 | DEMONSTRATION FARMS AS MULTI-PURPOSE STRUCTURES

Organisations, programmes and projects have overarching goals and objectives (and strategies) that underpin their demonstration activities (approach, audience, programme approach and management). These are operationalised at network and individual farm demonstration levels where they need to address local issues.
The actors and structural arrangements for delivering demonstration activities sit within, and are not independent of, a wider advisory landscape and AKIS[1]. The demonstration actors will be active in other advisory mechanisms, while demonstration networks and resources will be linked to other advisory and AKIS subsystems.
In the paragraphs below, we describe structural characteristics of on-farm demonstrations and how they are of relevance to addressing objectives and achieving impact.

2.1. ACTORS INVOLVED AND THEIR ROLES.

The literature describes the following parties involved in on-farm demonstrations: 1) the initiator(s), the organizer(s), the funder(s), the specialist: advisors, extension agents and facilitators, 2) the demonstration farm and the demonstrators, and 3) the participants and target audience. Some of these actors may occupy multiple roles.

2.1.1. Initiators, organisers, funders, facilitators and specialists

As far as initiators are concerned, the entities that may initiate an on-farm demonstration can be very diverse. The following can be identified in the literature: a) farmers or farmers' organisations wishing to undertake their own peer-to-peer research and learning, working either independently or in collaboration with other entities (USDA/NRCS, 2013; ORC n.d.); b) private/commercial companies (Syngenta, 2016; Gros and Oldeweme, n.d.); c) NGO and/or other agricultural/ developmental organisations (Qamar, 2013; Okiror, 2016); d) extension services or other advisory services[2] (Penn State Extension, 2017) ;e) research institutes/ universities[3] (Nuthall et al., 2011); and f) ministries or other related national agencies (Smallshire et al., 2004; BMEL, 2016; Kuipers et al., 2005). Usually, it is partnerships between the above-mentioned entities who are involved in initiating on-farm demonstrations and networks (Fisk et al., 1989; Stammen, 2016; USDA/NRCS, 2016; Mitchell, 2016).

Funders comprise, more or less, the same range of actors as initiators. In most cases, according to the literature, demonstration farms operate within a funded project/programme. In many cases the funder is of national (NFSM, n.d.; Kemp and Michalk, 2011, BMEL, 2016), regional, or EU[4] origin or operates within a co-financing scheme[5]. Therefore demonstration programs make use of public funds, deploy private funds or a public-private co-financing scheme. Demonstration activities are therefore funded by one or multiple sources. Moreover, a specific entity may be the funder and at the same time be involved in other demonstration functions such as the programme's coordination or farm management, supervision, etc. (BMEL, 2016). Initiators and funders often coordinate and manage demonstration activities as part of a larger advisory service or programme.

Organisers overlap with initiators but are often representatives of the initiators and deliver the programme at a number of different levels; programme, network or farm. When farmers are the initiators they may wish to enter into projects in collaboration with agencies or organisations to take advantage of support and results/benefits. In many cases, a facilitator (often a local extension agent or advisor) will be the organiser.

Specialist: Advisors/extension agents/experts. These actors have a role both in relation to the local organisation and programme delivery level and as facilitators at demonstration events. They generally facilitate multiple source information sharing and discussion. However, they often also take the role of demonstrator (see below).

1 See: Birner et al. (2009).
2 https://www.leg.state.nv.us/nrs/NRS-553.html
3 http://farms.ag.iastate.edu/
4 http://solmacc.eu/about-us/
5 http://www.balticdeal.eu/advisory/demo-farms/

Agents' characteristics have been found to contribute to effective collaboration and thus to the success of on-farm demonstrations. Generally, the agents or specialists need **deep local orientation**, with key contacts in farmers' networks and **strong interpersonal relationships** with farmers and the community; this allows them to know the audience they are working with and localize the education needs (Franz et al., 2009; Maatoug, 1981; Miller and Cox, 2006). Agents who understand and **respect farmers' lifestyle goals and values** are more likely to have an impact. In addition, it is important for an agent to have good **social skills** (communication and facilitation) as building relationships with farmers and other agencies may require participatory group processes (Franz et al., 2009). Other beneficial attributes include being available for immediate problem-solving and being able to pay individual attention to the farm and farmer, since demonstration farmers need **regular support** (Franz et al., 2009; Morris and Winter, 1999). In this respect, the **resources and facilities available** to the agent (by his/her organisation/service) such as time (including socialization with farmers) and budget, are of crucial importance (Franz et al., 2009). The on-farm demonstration management team or responsible agent must define the **roles/tasks and the number of involved partners** in all of the demonstration stages. It is vital to identify the important tasks and determine each partner's involvement in them to avoid tension or difficulty (Gibbons and Schroeder, 1983).

Generally, the agents or specialists need deep local orientation, with key contacts in farmers' networks and strong interpersonal relationships with farmers and the community; to know the audience they are working with and localize the education needs

CORRESPONDING INVENTORY CHARACTERISTICS

To obtain data about the actors involved in on-farm demonstrations, the inventory will gather data on the primary organizer and the funder of each of the main topics on which demonstration activities are provided. Replies to both questions include the following options: individual farmer, supply chain company, farmers' organisation, NGO/charity or other agricultural development organisation, private/public extension advisory service or research institution.

2.1.2. Demonstration farm and demonstrators

The selection of the demonstration farm is important for effective demonstrations. The farms' biophysical context and farming system are important determinants. The decision process for selecting the demonstration farmer varies between on-farm demonstrations. In some cases the demonstrator is selected through collaboration between external programme partners and the local community (Franzel et al., 2015). In other cases, the responsible agents select the demonstrator (Kittrell, 1974; Rogers and Leuthold, 1962), while elsewhere they may be recruited by the local growers (Kittrell, 1974). The demonstrator can also be a researcher, specialist/extension agent, private sector employee, advisor, or student. Irrespective of who initiates a specific demonstration programme, the field ownership in which a demonstration occurs can vary. The ownership does not always refer to who initiates a demonstration programme or who exactly is running and managing the demonstration activities. Many public or private fields are granted or leased for demonstration activities to several public/private or other legal entities. The most common type of demonstration farms is that of **farmer-owned fields**.

According to the available literature one of the most critical factors for demonstration effectiveness is the **farmer's ownership of the demonstration farm** (Gibbons and Schroeder, 1983; Bailey et al., 2006; Miller and Cox, 2006). Demonstrations and explanations that are **farmer led** (and possibly researcher/advisor supported and facilitated) provide a sense of ownership for both the demonstrator and participants (Miller and Cox, 2006; Kuipers et al., 2005; Oakley and Garforth, 1985; Kumar, 2014). In addition, there is a greater chance of making an impact when a demonstration occurs on an **actual working farm**, at field scale, setting innovations outside of the 'unreal', scientific realm of the research station and placing them firmly within the bounds of a farmer's everyday experience (Gibbons and Schroeder, 1983; Lauer, 2009). During on-farm demonstrations, farmers can see particular technologies or management practices in operation on a working farm not too dissimilar to their own (Miller and Cox, 2006; Bailey et al., 2006). An on-farm demonstration is realised under conditions **similar to those of farmer participants** (soil type, rainfall, equipment, management practices, etc.). For this reason, demonstrations should be carried out on local farms, rather than on an extension plot or research stations (Gibbons and Schroeder, 1983; Miller and Cox, 2006; Oakley and Garforth, 1985; PACC, 2015).

Organisers should be realistic and transparent about **the expected lifetime** of the demonstration farm activity and the requirements from the host farmers. Although demonstration programmes are usually designed to offer a wide variety of incentives and rewards to demonstration farmers, organisers need to avoid host farmers being overexploited. Negative experiences could put them and their peers and potential future hosts off running future demonstrations (Bailey et al., 2006; Bellon, 2001; Gibbons and Schroeder, 1983). It is also important to offer the opportunity for groups to move to other farms for one-off events if they can better demonstrate a particular issue (Bailey et al., 2006).

There is a greater chance of making an impact when a demonstration occurs on an actual working farm, at field scale, setting innovations outside of the 'unreal', scientific realm of the research station and placing them firmly within the bounds of a farmer's everyday experience

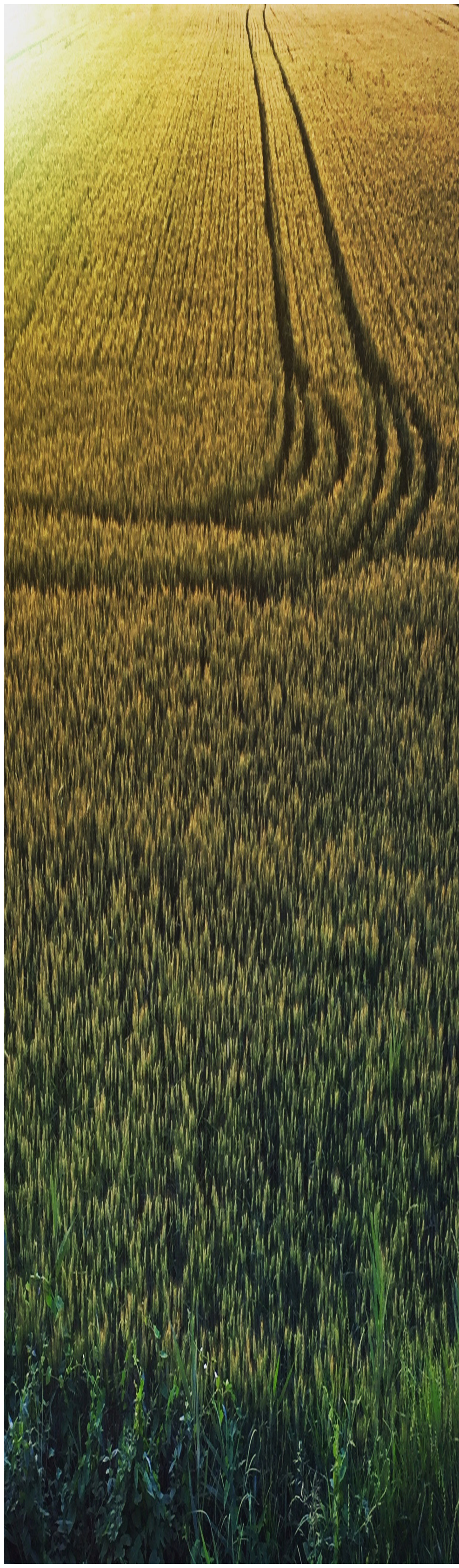
Furthermore, the **demonstrator farmers' characteristics** are identified in the literature as an important factor in effective demonstrations. It is evident that these characteristics influence the adoption and the anchoring of innovations in a certain area. There are several social and human factors affecting the communication quality, the awareness building and adoption processes.

As mentioned earlier, farmer participants will have more confidence and will be more receptive to new innovations, if a new practice is shown by a fellow farmer (Miller and Cox, 2006). Furthermore, farmer demonstrators should be **experienced and continuously involved in commercial farming, with good farming skills in their local context and conditions**.They are **preferably a full-time resident in the community, can communicate in the local language**, enabling them to be sensitive to local cultures, mannerisms, farming practices and needs. They should have **good leadership and communication abilities**, a good reputation and status in their community (Franzel et al., 2015; Kumar, 2014; Kiptot et al., 2006; Cunningham and Simeral, 1977), and **conform to the image of a 'typical' farmer, representing 'typical' conditions**, i.e. 'typical' in the biophysical, farming system and socio-economic sense (Gibbons and Schroeder, 1983). A tendency has been observed for participants to seek information from a demonstrator in a **slightly earlier or similar adopting category** to themselves, but seldom from a demonstrator in a later adopting category. Participants also tend to seek a demonstrator with a slightly higher social status than their own (Rogers and Leuthold, 1962; Gibbons and Schroeder, 1983).

As Leeuwis (2004) suggests, it is wise to recruit or appoint several host farmers to cater for social differentiation of demonstration participants. Additionally, demonstration farmers should be hospitable, willing to show their farm to visiting groups and easily approachable by other farmers and extension workers (Kumar, 2014; Syngenta, 2016; Warren et al., n.d.). Training received by demonstrators increases the demonstration effectiveness. This training can be related to key aspects of the new technology (Kumar, 2014; Bellon, 2001; Franzel et al., 2015; Bailey et al., 2006) and capacity building concerning the use of state of the art tools (content), but also key aspects of didactical and communication skills, i.e. initiate interest and awareness, use farmers' preferred learning methods, communication/people skills and relationship building. The value of 'train the trainer' schemes has been described by several authors (Smallshire et al., 2004; EISA, 2010; Franz, 2009; Fischer and Vasseur, 2002).

CORRESPONDING INVENTORY CHARACTERISTICS

One inventory question asks to what extent demonstrations are organised and led (i.e. topic selection and demonstrations activity) by farmers or by institutions/commercial organisations. Another question asks who the main demonstrators/instructors are in the demonstration activities; possible answers are: farmer, public/private advisors(s), researcher/students, policy maker, funder, supply chain actor or other.



2.1.3. Participants and target audience

Participants are defined as the on-farm demonstration attendees and any other stakeholder/interested party and/or individual.

As far as target audiences are concerned these can be planned and determined at the organisation/programme level and/or at the demonstration farm/event level. An on-farm demonstration provides learning opportunities to many different actors [1,2,3], including local/regional farmers, but also industry/agribusiness personnel, advisors and agricultural professionals, the general public, politicians and administration (legislators, policy makers), university staff, research entities and their partners, environmental and natural resource agencies, other institutions with relevant scopes, consumers, students, etc. and all at different spatial levels (EISA, 2010; Gros and Oldeweme, n.d.; Stammen, 2016).

The target audience and the participants at on-farm demonstrations can be distinguished based on various criteria such as age group, gender, innovativeness (adoption category) and awareness (aware, already interested, already adopted the practice), farm type/production system and sector, socio-economic background, etc.

It is very important during the planning of demonstration activities to **define the type of farmer for whom the intervention is intended** and ensure it is appropriate and relevant. For example, a low cost improvement is designed for low-resource-based and smallholder farmers while a state-of-the-art on precision farming demonstration may be more relevant for commercial, large-scale farms (Krah, 1992).

Furthermore, the number of **people involved and reached by the activities** will influence effectiveness. In the case of repeated demonstration events with similar goals, **the increase or decrease of the amount of people** involved could be an indicator of their effectiveness. When planning a demonstration event, **targeting both men and women** can have a positive influence by possibly adding different gender-related viewpoints to the discussion. Women and men have different roles, responsibilities and priorities, as well as different skills and experiences to contribute to finding solutions. In developing countries women have a significant role to play in ensuring household food security. In Europe, women play a number of roles from main decision maker to business partner and business support (PACC, 2015). There is also value in organizing demonstrations for clusters of peer farmers (Janvry et al., 2016; Franzel et al., 2015; Rogers and Leuthold, 1962).

The presence and participation during a demonstration event of multiple stakeholders, in addition to farmers, i.e. industry representatives and/or specialists, government agencies and any related local entity, can contribute to the overall events' effectiveness (Bailey et al., 2006; Kiełbasa and Kania, 2015; Franzel et al., 2015; Nuthall et al., 2011).

CORRESPONDING INVENTORY CHARACTERISTICS

Different inventory questions collect information about the target audience and participants. The typical group of participants (farmers, farm employees, public or private advisors, consumers, supply chain actors, researchers, students, policy makers, funders and other) as well as the typical distribution of age and gender are asked for. The geographical coverage (local, regional, national, EU-level, global) and the experience of farmer participants (new entrants, experienced farmers, innovative/farm leaders) are characteristics also covered by the inventory questions.

1 http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=SOLMACC-leaflet-web-EN.pdf

2 http://farms.ag.iastate.edu/

3 http://www.lincoln.ac.nz/Lincoln-Home/About-Lincoln/Lincoln-University-Farms/

2.2. NETWORKS

Demonstration farm networks are formed from either bottom up approaches (initiated by farmers themselves in an informal way), or top down approaches (created by organisations as formal and coordinated programmes and projects). A network of farmer-owned demonstrations allows for greater geographic distribution of demonstration activities (Warren et al., n.d.). Collaborators may be selected from pre-existing local initiatives, groups and networks in the farming community and their representative farmers or they may be totally new, according to the demonstration programme's objectives (Franzel et al., 2015; Kiptot et al., 2006; Bailey et al., 2006). There are several parameters to be taken into account when developing a demonstration network such as the overall size of the network (i.e. the number of farmers and demonstration sites), the homogeneity of the network (i.e. whether it will be sector-specific or multi-sectoral), geographic coverage, and the intensity of the links within the network, etc.

Moreover, many demonstration networks consist of multiple entities and/or stakeholders in addition to demonstration farmers, i.e. multiple retailers, processors and manufacturers, financial services, farm input suppliers, universities, innovation and/or research centres, ,subject matter specialists, field advisors/extensionists and facilitators (Nuthall et al., 2011; BMEL, 2016; Business Wales-Farming Connect, n.d.; Stammen, 2016; USDA/NRCS, 2016; Mitchell, 2016).

Demonstration networks are usually open structures accommodating new farmers, as well as newly associated partners and stakeholders outside the existing network (Bailey et al., 2006; Creaney et al., 2015; Franzel et al., 2015).

Working with pre-existing locally based initiatives, groups and networks in the farming community adds to the effectiveness of demonstration activities (Franzel et al., 2015; Kiptot et al., 2006; Bailey et al., 2006). For example, NGOs usually have advantages over research organisations because of their long-term presence in the community, their ability to establish trust with local farmers and their emphasis on social and community processes (Hellin and Dixon, 2008). Networks containing informal social networks were also found to be more effective in delivering demonstrations (Creaney et al., 2015; Kiptot et al., 2006). Furthermore, the effectiveness of demonstration activities can be enhanced if participants are part of a larger network. As farmers benefit from the availability of multiple sources of information during demonstration events (i.e. peers, advisors and others), access to a variety of network participants aids the adoption of what is being demonstrated; this is because both local knowledge and external technical expertise are valid sources of information that can be used to address problems and seek solutions (Bailey et al., 2006; EISA, 2010; Kiełbasa and Kania, 2015; Franzel et al., 2015; Business Wales-Farming Connect, n.d.; Kuipers et al., 2005; CCCA, 2013; Okiror, 2016; Nuthall et al., 2011; Gros and Oldeweme, n.d.). However, the need for involvement of multiple stakeholder groups may also give rise to coordination difficulties.

As farmers benefit from the availability of multiple sources of information during demonstration events (i.e. peers, advisors and others), access to a variety of network participants aids the adoption of what is being demonstrated

CORRESPONDING INVENTORY CHARACTERISTICS

The inventory questionnaire explores if the on-farm demonstration activities are part of a network or programme. If so, details about the name and the size of the network, and whether it is part of the EIP network (Local Action Group, Operational group, National Rural Network or other) are collected..

2.3 RESOURCES, FINANCES AND INCENTIVES

The overall strategy for resources is mostly determined at organisational/programme level and translated to individual demonstration farms. Budget and resources need to be planned according to the rationale (objectives, topic) and the selected approach.

With respect to **finances**, on-farm demonstration activities can be fully or partially funded. Ideally, the budget should cover all expensesas, for example, inputs, transportation costs, organisationexpenses, publicity expenses as well asguarantee of any shortfall in yields or direct payments to farm owners/demonstration farmers [1](BMEL, 2016; Bailey et al., 2006; Braga et al., 2001; Franzel, 2015).

According to the international literature, participation in demonstration events is usually free of charge, however, relevant references are rather scarce and many of our project partners (practitioners) have indicated that fees can apply to both participants and initiators/organisers (i.e. companies wishing to carry out an on-farm demonstration).

With regard to **human resources and capacity building** many on-farm demonstration programmes offer/require the training of the agent and/or the demonstration farmer. Therefore, professional training/mentoring sessions designed for advisors are offered, in order to successfully accomplish their duties (Smallshire et al., 2004; EISA, 2010; Franz, 2009; Fischer and Vasseur, 2002). Such training can be related to key aspects of the new technology, communication skills and relationship building i.e. learning group processes, participatory educational tools/methods, facilitation skills. Additionally, helping farmers to improve their own performance through the provision of some basic training and guidelines is also considered necessary. Depending on farmers' skills and innovation properties such training may include both technical and communicational skills (Franz, 2009; Kumar, 2014; Bellon, 2001; Franzel et al., 2015; Bailey et al., 2006).

CORRESPONDING INVENTORY CHARACTERISTICS

The inventory gathers information about the main funder and asks whether a fee is charged..

2.4. MULTI-LEVEL GOVERNANCE

Governance is a broad concept and refers to all the processes of governing, whether undertaken by a government, network or farm, whether through the laws, norms, power or language of an organized society. It relates to "the processes of interaction and decision-making among the actors involved in a collective problem that lead to the creation, reinforcement, or reproduction of social norms and institutions" (Hufty, 2011).

1 http://www.mssagnet.net/wp-content/uploads/2013/04/MSAN-Demonstration-Farm-Application1.pdf

Practitioner partners agree there are many models to organize the governance of demonstration programmes, networks and activities and related policies. Participatory, collaborative, multi-level and co-governance models that aim to empower farmers' engagement, may contribute definitively to effective demonstration programs (Breetz et al., 2005; Ferranto et al., 2012).

Effective governance is pertinent to many levels of the organisation, network, demonstration programme or set of activities, and to the Agricultural Knowledge and Innovation System (AKIS) at regional, national or EU level. However, literature on the most relevant levels, existing models and their effectiveness is limited.

At demonstration programme (and network) level, one of the most crucial duties of the coordination team, according to the literature, is to ensure an overall **collaborating process across the demonstration programme**. The governance of demonstration activities will thus affect many functions and organisational processes. When relevant, the latter will be addressed in Chapter 3. Evaluation, monitoring and record keeping are central to governance. Whilst a number of demonstration programmes and projects are subject to evaluation, these are largely ex-post. There is limited evidence of ongoing evaluation and reflection as part of a governance process.

Furthermore, the actors at the programme level also interact with, influence and are influenced **by policy and AKIS actors**. In almost all countries the information and knowledge system has been composed of research, extension and educational organisations, structured and governed by the government through a sectoral agricultural policy (EU SCAR, 2012). The structure of this system, its organisation and governance (e.g. under a public or private structure) differs greatly between countries, as does the level of centralisation or decentralisation (Knierim et al., 2015). Diversity can also be found within different regions and federal states in the same country (e.g. Germany). In general the systems are highly fragmented and subject to a dynamic process of emerging new structures and actors (Hermans et al., 2015). For instance, with regard to agricultural extension/advisory services, several different models can be identified according to the level of fragmentation and sources of funding – whether central or regional administration or other sources and funding (Laurent et al., 2006). Generally, the governance of innovation systems is changing as a result of an increasing move towards pluralistic configurations (see, inter alia, Birner et al., 2009), such as public-private partnerships, along with the tendency for research or innovation agendas to not only be defined by the government and universities, but increasingly by private and public stakeholders. At the same time, government, universities and research institutes maintain a strong influence over AKIS, including its innovation systems, although the degree to which they do so differs between countries (EU-SCAR, 2012). Whatever the arrangement in most European countries, the AKIS are pluralistic and diverse often characterized by fragmentation and coordination issues (EU SCAR, 2012). The provision and governance of demonstration activities needs to be considered against this background. Specifically the implications of AKIS evolution for peer-to-peer learning in demonstration activities will be addressed in the inventory and in the AgriDemo-F2F case study analysis.

Participatory, collaborative, multi-level and co-governance models that aim to empower farmers' engagement, may contribute definitively to effective demonstration programs

2.5. STRUCTURAL CHARACTERISTICS - FARM (EVENT) LEVEL

2.5.1. Practice/technology demonstrated

In planning and designing on-farm demonstrations, different **types of technologies and practices** can be demonstrated, varying from experimentation (on-farm research designs; see Appendix 2) and/or exemplary demonstration designs (notably method or result demonstrations; see Appendix 2) or just the showcasing of existing experience.

Two types of demonstration projects are described: (1) experimental projects for testing the workability/feasibility of a practice/innovation under operational conditions, and (2) exemplary projects which demonstrate the utility of the innovation/practice to potential adopters and provide supporting evidence (that is, to diffuse the innovation) (Myers, 1978). In terms of a technology, the following types are distinguished: a) single practice or single component or elementary technology demonstration with the aim of proving the worth of a specific practice; b) package technology consisting of several independent components; and c) composite technology which is composed of several elements which cannot be applied separately or requires changes of the existing farming pattern/system (Krah, 1992; Mutsaers et al., 1997). A further categorization of on-farm demonstration can thus be made according to the adjustments of the existing system as follows: a) single intervention or one practice demonstrations and b) package or complete or all-practice demonstrations or a whole farm approach (DAE, 1999; Hancock, 1997; Kittrell, 1974).

A further categorization of on-farm demonstration can be made according to the adjustments that are made to the existing system. We can discern between single intervention or one practice demonstrations and package, complete or all-practice demonstrations (whole farm approach)

CORRESPONDING INVENTORY CHARACTERISTICS

The inventory gathers data on whether the demonstration activities focus on a single practice or on a whole farm approach.

2.5.2. Location and layout

A demonstration activity may be established at a fixed **site** to serve as a demonstration farm or at a temporary site for one-off demonstrations. Any farm can, if suitable, be used for one-off demonstration by simply showcasing its crops/animals, infrastructure and/or farm operations (ZLTO, 2017).

The **location** of the on-farm demonstration can be a university/research center/extension site (on or out of campus/station) (Nuthall et al., 2011; Dirimanova and Radev, 2014); private or public owned field, granted or leased to the aforementioned organisations; demonstration farms owned by a commercial farmer or by farming organisations, NGO's[1], etc.; and industry owned demonstration farms. It can also be real or virtual.

1 http://www.siddc.org.nz/sthld-demo-farm/sthld-demo-farm/

Furthermore, demonstration sites can be distinguished according to the **agroecosystem** within which they operate, the farming system they represent as well as their location vis-à-vis urban centers. The location may be remote or in areas with a high population density with or without many peers in the neighbourhood. The **accessibility** of demonstration sites is an important consideration. Also related to accessibility, the on-farm demonstration event may be closed, i.e. accessible only to invited individuals or to a certain network, study group, etc. members-farmers, or open (non-restricted); in the latter case it may concern local, regional, etc. farmers or combinations.

The **type of comparisons and location(s)** involved in on-farm demonstrations can be distinguished as follows: a) Proof of Concept is the simplest form of on-farm demonstrations referring to how to implement an alternative management practice or how it will perform in a production environment; b) Test strips or plots where alternative management practices are imposed in strips within the same field; c) Strip Trials in multiple fields i.e. the same management practices are imposed in multiple fields in order to obtain more reliable results; d) Replicated plot/strip trials in one field in which a management alternative is imposed in multiple–random locations within a field; and e) Replicated strip/plot trials to multiple fields which allows observations of treatment effects under varying environments (NFSM, n.d.; Havlin et al., 1990; Hancock, 1997; Warren et al., n.d.; Herendeen et al., n.d.). Additionally, a demonstration can involve paired comparisons i.e. two treatments within a field – usually the new and the standard practice, or operate randomized complete blocks, i.e. multiple treatments – three or more – per field with a number of different test strips/plots (Lauer, 2009).

A further distinction can be made according to the **number of farmers engaged and the plot's location** as follows: i) Single Farmer Demonstrations; ii) Block demonstrations which are planned and implemented with a group of farmers who operate land next to one another; iii) Clustered sites demonstrations which are located in a 'pilot research location', consisting of one or several adjoining villages/sites which are representative of a major target zone; and iv) Scattered farms with sites being located across the target zone (DAE, 1999; Mutsaers et al., 1997).

The demonstration site characteristics are mentioned in the literature as key factors determining the success of a demonstration effort. First of all demonstration sites must have **good and easy access** (Okiror, 2016; Mbure, n.d.). For example, farmer-to-farmer learning has been reported not to work well in areas of low population density where transportation is limited (Franzel et al., 2015). The site should also be **centrally located and visible**, in order to attract maximum attention of potential audience/farmers (NFSM, n.d.; Cunningham and Simeral, 1977; Gibbons and Schroeder, 1983). Furthermore the sites have to be representative/typical of surrounding lands and must be managed in a representative fashion. The existence of appropriate farm infrastructures and welfare facilities (toilets, rest area, shelter from rain and wind, etc.) is also required[1] (Gibbons and Schroeder, 1983).

CORRESPONDING INVENTORY CHARACTERISTICS

The inventory gathers data on the geographical location, the farm type (specialist vs. mixed), the farm management type (commercial, research/experimental/knowledge transfer farm, charitable farm, public farm or other). Furthermore, data on the geographical coverage of the typical participant groups are requested.

2.5.3. Frequency, duration and timing.

With regard to the **frequency of farm demonstrations**, it is important to distinguish between single and repeated events, i.e. when the activity is repeated per cultivation period/year and/or in subsequent years. There are one-off events (i.e. single open day events) per year at demonstration sites, as well as on farms which are not intended to serve as demonstration farms but are used for a single demonstration (ZLTO, 2017). On the other hand, the **frequency of repeated**

1 http://www.balticdeal.eu/advisory/demo-farms/

demonstration events may vary according to the site setup and the purposes of the demonstration programme.

A series of field days[1], especially in cases in which the demonstration is available for a season/year and showcases a cropping pattern, provide an ideal opportunity for farmers to meet again (DAE, 1999). Furthermore, a demonstration site may repeat the same or different demonstration topics throughout the year. Monitor farms typically are run for 3-4 years, however in an evaluation of the Scottish monitor farm programme some participants complained that the short timeframe (three years) limited the programmes' effectiveness, whilst others thought that it had an appropriate duration, linking to the natural life span of the programme (Watson Consulting, 2014). The duration of technology management on demonstration farms can be distinguished as follows: single season demonstrations which last for only one season and cropping/production pattern demonstrations which are operational for more than one season (DAE, 1999; Mbure, n.d.). **Repetition of demonstration events** concerning the same topic may add to the effectiveness according to literature (Hancock, 1997). With respect to the design of demonstrations, demonstrating one practice at a time (Hancock, 1997) and keeping the demonstration simple in character, direct, and limited to a few fundamental things (Knapp, 1916) have also been found to be important.

With regard to the **duration** of a demonstration event, this may vary from half or one full day, to several consecutive days. However, there are cases in which the demonstration may last for a week, and in exceptional cases a full month. The **timing** of a demonstration is another important factor for characterising demonstration events. In general, demonstration events are arranged when particular management activities are implemented or when the benefits of the demonstration would be most beneficial. A key period to organise a (result) demonstration event is harvest time (Harvesting Demonstration). A field day during this time, when yields, costs and benefits can be compared, is considered the optimum time to achieve the greatest impact (DAE, 1999).

CORRESPONDING INVENTORY CHARACTERISTICS

Indications of the usual frequencies and duration of the demonstration activities are requested in the inventory questionnaire.

1 Field/open days is a term used for a group extension event conducted at the demonstration site. More specifically, a field day is an organized event, initiated when there is something important to be done in the field or a clear visible benefit from the technology being shown. Field days are usually opportunities to hold mainly method or result demonstrations on a slightly larger scale. In most cases field days as open events are organized to introduce a new idea and to stimulate the interest and the awareness of as many farmers as possible. They aim at encouraging an open and informal atmosphere in which visiting farmers can inspect, inquire, question, etc. The learning environment of field days is thus more informal; a field day may also include non-educational events like music, awards, ceremonies, prizes, invitation of special guests, meals and refreshments. Open days can thus be organized several times per year and have specific themes (Dirimanova and Radev, 2014; Oakley and Garforth, 1985; Gibbons and Schroeder, 1983; Hancock, 1997; DAE, 1999).

3 | DEMONSTRATION FUNCTIONS AND ORGANISATIONAL PROCESSES

Demonstration programmes and activities have functions, i.e. they are performing or achieving something. The functions are:

- **Coordinating effective recruitment of host farmers and participants**
- **Developing and coordinating appropriate interaction approaches**
- **Planning, designing and conducting appropriate demonstration processes**
- **Enabling learning appropriate to purpose, audience, context**
- **Designing and implementing appropriate learning, mediation techniques and communication tools**
- **Providing effective follow up activities**

This review aims to draw out the factors, or functional characteristics, that influence these functions and processes. These are considered in the sections 3.2-3.7 below.

Demonstration farmers are mainly motivated by the expectation of economic gains (windfall profits by being the first to apply/exploit an innovation) as well as the opportunity for pride and social status by being the first farmers to try something new

3.1. COORDINATING EFFECTIVE RECRUITMENT

3.1.1. Host farmers recruitment[1]

Whilst financial incentives may be quite effective in recruiting host farmers, they may not always be tenable. Beyond this, effective recruitment is likely to involve targeting key members of the farming community who are accustomed to being involved in such practices and promoting the individual and community-wide benefits of the demonstration activities to them.

With respect to incentives for hosting a demonstration, according to our project partners (practitioners) demonstration farmers are mainly motivated by the expectation of economic gains (windfall profits by being the first to apply/exploit an innovation) (ORC, n.d.) as well as the opportunity for pride and social status by being the first farmers to try something new[2] (Smallshire et al., 2004). The passion/entrepreneurial spirit, especially of new-entrants, as well as social pressure from non-farming stakeholders, were also identified as incentives for hosting demonstrations. Furthermore, in the case of on-farm demonstrations staged through the collective efforts of a group of farmers, the chief function is to generate interest within the community, but it can also work to raise the status of innovative farmers in the area (Franzel et al., 2015; Krah, 1992). If an event moves beyond a single village/area to neighbouring ones, the secondary benefit extends to the entire host community. Finally, in case government officials are invited/attending, then there is the opportunity for local farmers to gain more recognition, or to lobby with officials for additional services[3] (Gibbons and Schroeder, 1983).

1 This section builds on information in 2.1.2 Demonstration farms and demonstrators.
2 http://www.balticdeal.eu/advisory/demo-farms/
3 http://www.britishgrassland.com/page/demo-farms-research-practice

According to our partners (practitioners) other actors may be motivated by commercial interests and for the opportunity to increase their visibility amongst the farming community. In the case of extension services (whether public, private or third-sector ones) the motivation is linked to the organisations' mandate/policy and thus the promotion of innovations/advice/recommendations.

There is debate in the literature about whether, or not, which and to what extent various incentives/rewards must be offered (Franzel et al., 2015; Gibbons and Schroeder, 1983). With specific reference to farmer-communication workers (but certainly also extendable to the situation of farm demonstration hosts), Leeuwis (2004) describes the need to financially incentivise or reward volunteers as a 'sticky issue', with significant implications for who are willing and eventually appointed as demonstrators. There are many ways of delivering benefits to collaborating demonstrators which depend on each demonstration programmes' budget and planning. Although different arrangements and their associated benefits are cited, there is **a lack of assessment in relation to their effectiveness**. It also seems that the effectiveness of these different arrangements **depends on regional factors and circumstances**. It has to be noted that besides/instead of economic incentives, some demonstration programs offer some extra benefits for the collaborating demonstration-farmers, such as a food label/certification for the products associated with the network[1] or training certification (Franz et al., 2009).

3.1.2. Participants recruitment[2]

It is critical that demonstration activities are sufficiently targeted **to recruit a variety of participants** (e.g. both male and female, different ages, different levels of prior learning). Furthermore, it is necessary to **recognise different levels of interest in and enthusiasm towards participating in learning activities such as demonstrations**. According to La Grange et al. (2010: 262) "extension programs and activities need to cater for the challenges that this variation presents". Leeuwis (2004) suggests that understanding extension activities, such as demonstrations, as 'multi-actor problematic situations' can help target different types of farmer or members of the farm household, and account for inherent social differentiation. Specifically, Leeuwis notes how different actors will have different understandings of what the problem is and place different values on different interventions and their potential outcomes. **Background characteristics such as training and experience of the participants** are likely to impact the level of effectiveness of on-farm demonstrations. Recognising farm demonstrations from this multi-actor perspective, allows recruitment to be more targeted.

La Grange et al. (2010) identify **motivation** as a key element in farmers' participation in demonstration activities. To this end, various commentators have highlighted the need for demonstration activities to provide a solution to a perceived 'problem' (Kiełbasa and Kania, 2015). Leeuwis cites Hayami and

To recruit effectively, the demonstration activities must be seen to address a specific problem. In some cases, this may require raising awareness and consciousness of said problems amongst the farming community

1 http://www.leafuk.org/leaf/farmers/demofarm.eb
2 This section builds on information in 2.1.3 Participants and target audience

Ruttan's (1985) theory of induced innovation which stipulates, for example, that technology development relates to which production factors, i.e. labour, land or capital, are deemed most problematic. Motivation to participate in a demonstration activity therefore requires prospective participants to have experienced a problem. Therefore, to recruit effectively, the demonstration activities must be seen to address a specific problem. In some cases, this may require raising awareness and consciousness of said problems amongst the farming community.

"Active learning pre-assumes awareness of, and interest in, a problematic situation. Frequently, therefore, communication for innovation efforts are geared towards encouraging farmers and /or other stakeholders to problematize their current situation and become conscious of individual or collective problems and solutions that they were not aware of or interested in before" (Leeuwis, 2004: 220; Rice Knowledge Bank, n.d.; Kiełbasa and Kania, 2015).

Leeuwis (2004) recognises the following ways of raising awareness of problems:

- Mass media campaigns
- Entertainment - education
- Visualising what is difficult to see
- Demonstrating the results of particular practices

To ensure demonstrations are targeting relevant problems, it is also necessary to gain insight into what problems farmers are experiencing. Leeuwis (2004) identifies a number of ways to identify problems experienced by farmers, including analysis of everyday talk (including matters discussed at farmers markets, community meetings etc.), as well as more formal techniques including in-depth purposeful interviewing and visual diagramming and mapping.

Not only is the identification of problems that farmers genuinely want to resolve/improve critical to the recruitment of participants to demonstration activities, but also means participants are more invested and motivated to learn from the activities. For example, in their study of demonstration farms and anthropogenic impact on the Baltic Sea, Elmquist and Krysztoforski (2015) note that when participants are personally motivated to learn (as opposed to the process being imposed on them), it is much more likely to lead to behavioural change. Gonczi (2004) also highlights the importance of the setting/environment of learning activities; the farm provides much of the motivation for farmers, therefore the demonstration activity should link to/match this setting/context as much as possible.

Motivation in this context can be split up in motivation of the specific actors to contribute to demonstration activities. All active contributors' **(personal) goals and reasons to participate** in some way can have a relevant (indirect) impact on the nature of learning. **Trusting the demonstrations' knowledge sources** and the above mentioned perceived autonomy and ownership are also connected with motivation.

Although demonstration events should be intellectually accessible, it is also **important for demonstrations, and associated learning to be informed by and aligned with scientific understanding**. This will add credibility to learning (see Ingram et al., 2016). It is important to situate the demonstration recruitment 'campaign' in the wider advisory (and regulatory) landscape and avoid risk of overload, duplication or conflicting information.

As a result, incentivising farmers' participation in demonstration activities can take many forms. Financial or tangible rewards are perceived as most effective, but are not always possible because of the costs involved. Typically farmers will be incentivised by less tangible rewards, such as getting solutions to their problems (as above), gaining an understanding of the latest science/technology (Smallshire et al., 2004), networking opportunities (with other farmers and industry experts; Bailey et al., 2006; EISA, 2010) and contributing to the general advancement of the industry. It is important to **match incentives to relevant audiences** for them to be most effective in terms of recruitment.

CORRESPONDING INVENTORY CHARACTERISTICS

Within the inventory, information on host farmers' motivations for running demonstrations on his/her farm is requested. Additionally, data on the means to promote the demonstration activities are gathered.

3.2. DEVELOPING AND COORDINATING APPROPRIATE INTERACTION APPROACHES

Two broad knowledge exchange approaches are described in the literature.The first a top- -down, institution-driven and more formalised approach, is underpinned by a linear model of knowledge transfer where scientific knowledge (as the authorised and only source of knowledge), technology or innovations are transferred to farmers. The second, less formal, bottom-up, farmer-driven approach, is based on a perspective that integrates knowledge from multiple actors through participation and emphasises facilitation of learning in a social context. This latter 'human development' model is based on the principles of empowerment and ownership of the problem and more inclusive methods of generating knowledge (Black, 2000; Jiggins and Röling, 2002). In line with this, many extensionists argue that traditional modes of communication between farmers and scientists need to be reconceptualised from transmitting information in a linear, depersonalised, top-down fashion (e.g. field days, seminars, newsletters), to joint participation models where new ideas can be discussed, co-constructed and challenged (Sewell et al., 2014).

However whilst there has been an evolution in theory and a shift in practice towards more bottom-up approaches (as manifested in the increase in participatory initiatives such as operational groups, farmer field labs, etc.), top-down approaches are still valid/appropriate where information about a scientific innovation or technology needs to be communicated. Both these approaches correspond to different structures and are operationalised in the demonstration activity as mediation techniques.

Analysing the nature of interaction in demonstration activity functions should be seen against this backdrop, both at an organisational level and a demonstration farm/event level. A programme (network) or organisation may operate according to one particular approach, or make use of combinations of them. Ultimately the approach used needs to suit the purpose (and topic) of the demonstration and the intended audience, this provides the rationale for the choice of approach. Discussing the rationale for different approaches, Leeuwis (2004: 29) notes "communication for innovation can take many forms, not just in terms of the methods and techniques used, but also with regard to the wider intervention purpose, which relates closely to the assumed nature of the problematic". He identified different communication strategies (e.g. collective action bottom up) referring to the way in which communicative intervention is supposed to contribute to problem solving. He also outlines

Involving farmers in the learning process, and making them accountable for their own learning, not forcing them to learn something, will foster a sense of ownership and autonomy.

general communication functions which may be relevant within each of the strategies; functions like 'information provision', for example, can be relevant to all strategies mentioned.

In line with adult learning theories (Knowles, 1984), adults need to be involved throughout the whole process of their instruction/learning. Involving farmers in the learning process, and making them accountable for their own learning, not forcing them to learn something, will foster a sense of ownership and autonomy. This proves very effective in adult education theory and links with motivation of the learner. In practice this means that the more the local farmers and institutions can be involved in the whole process of a demonstration, the greater will be their self-confidence and readiness to participate and learn.

Furthermore, as discussed below with respect to learning, many of the principles of bottom up approaches can benefit all forms of demonstrations, for example ensuring a degree of user involvement at every stage of the demonstration, including facilitating interaction with farmers during the design of demonstration, identifying co-designing experiments, etc. (Macey and Brown, 1990: 234[1]; Leeuwis, 2004). Thus, a crucial duty of the coordination team, according to the literature, is to ensure an overall collaborating process across the demonstration programme (Breetz et al., 2005; Ferranto et al., 2012; Davis and Babu, 2015; PACC, 2015; Mitchell, 2016; Okiror, 2016; Kumar, 2014). Close and regular cooperation and communication between different actors, e.g. in the form of a permanent cooperation calendar (meetings, seminars, etc.), aids the overall programme effectiveness (BMEL, 2016; Kiełbasa and Kania, 2015). Interaction approaches also determine the form of interaction and the actors involved (who designs and delivers the demonstration and who learns?), e.g.:

- Advisor-to-farmer
- Researcher-to-farmer
- Farmer-to-farmer (F2F) /peer-to-peer
- Farmer-to-researcher/advisor

CORRESPONDING INVENTORY CHARACTERISTICS

The inventory will gather data on the typical demonstration methods used (seminar/expert led, field trials, demonstration displays, farm-field walks, exhibition, videos, on-line tutorial, workshops and other). Furthermore, through analysis of the data, we will be able to determine the form of interaction and the actors involved, since we ask the profile of the demonstrator and the audience (advisor-to-farmer, researcher-to-farmer, farmer-to-farmer/ F2F, farmer-to-researcher/advisor).

A crucial duty of the coordination team is to ensure an overall collaborating process across the demonstration programme

1 Macey and Brown (1990) referring to demonstration of energy technologies support this and list the following reasons for success or failure of demonstration projects: (1) user involvement is crucial at all stages of demonstration projects to facilitate information and learning, (2) project design should not be rigid to allow user input and modifications to improve effectiveness, (3) careful planning to take account of market readiness and user participation, (4) dissemination of results and evaluation information should be included in the project design

3.3. PLANNING, DESIGNING, AND COMMUNICATING APPROPRIATE DEMONSTRATION PROCESSES

These functions (largely covered in Section 2.5) relate to the underlying rationale, the objectives, the topic, the audience and the context, all of which influence the nature and the timing of the demonstration process. They will differ according to whether, for example, the demonstration aims to raise awareness and consciousness of pre-defined issues, provide information, train or educate and so on.

With respect to design, it is important whether the demonstration is experimental or exemplary as these two types have different functional characteristics and processes.

According to Hancock (1997), a single disciplinary demonstration programme involves a single subject matter or relationships within a single discipline. This form has the advantage of being usually the easiest and most straightforward to understand. Commentators argue that an effective demonstration design characteristic is to **keep the content as simple and manageable as possible** (Krah, 1992; Hancock, 1997; Lauer, 2009; Bellon, 2001). However this depends on the goal and the topic, in other circumstances multi- or inter-disciplinary programmes are undertaken (Hancock, 1997).

A multidisciplinary demonstration programme involves individuals from two or more different disciplines working on a common problem. Each discipline individually plans, implements, and evaluates with little or no consideration of the other disciplinary approaches to the problem; results are compiled at the end of the project. Interdisciplinary demonstration programs imply a team approach, with individuals from different disciplines working together in an effort that is mutually planned, implemented and evaluated. This form takes into account most of the possible cause and effect relationships that might be experienced taking a comprehensive view ('whole farm') of the enterprise. Hancock (1997) argues that **the most effective demonstrations are interdisciplinary**.

Another characteristic relevant to the planning phase is the size of the groups. Farmers get more out of smaller groups and **ideally not more than 20 farmers should attend**, otherwise it is difficult for everybody to see and hear or even more difficult for everybody to get opportunity for 'hands on' practice (DAE, 1999; Bailey et al., 2006). When fewer farmers participate, it is easier to obtain a more in-depth discussion in which every attendant can participate (Bellon, 2001). The nature of learning can be influenced by the quality of the communicated content about the demonstration. It is imperative that the community understands what the demonstration is about, why it is being conducted, and what it intends to accomplish (Franzel et al., 2015; PACC, 2015).

Extensive mass media coverage of the demonstration event is important for its success (Cunningham and Simeral, 1977). The extent of the publicity campaign, e.g. through meetings, letters, posters, newspaper articles, and radio and television promotions can determine the outreach (Hancock, 1997).

Furthermore, materials or inputs necessary for the demonstration should be locally available and accessible as, for example, audio-visual aids (Oakley and Garforth, 1985).

CORRESPONDING INVENTORY CHARACTERISTICS

The inventory explores whether the demonstration activities focus on a single practice or a whole farm approach.

3.4. ENABLING LEARNING APPROPRIATE TO OBJECTIVES, AUDIENCE & CONTEXT

3.4.1. Theoretical insights

Currently, there is no one theory or concept of learning which covers all the potential learning processes in a demonstration project. Some of the core concepts that are relevant to the learning functions and processes on demonstration farms are described here.

There is a large body of literature on knowledge and learning that is relevant to demonstration from different contexts, including agriculture (Lankester, 2013), technology and innovation (Hoogma et al., 2002), natural resource management (Keen et al., 2005), education (Kolb, 1984; Percy, 2005), learning economy (Lundvall and Johnson, 1994), and organisations (Argyris and Schön, 1978).

Although theories are often modelled on **individual learning**[1] with individuals as the primary learner, learning is regarded as a social process (Lankester 2013; Koutsouris and Papadopoulos, 2003). Individuals can develop shared understandings of a problem which is characteristic of social learning. Social learning can involve different perspectives of a situation that move to shared perspectives, which are then used to address a problem (Röling, 2002). Social learning advocates an interactive (participatory) style of problem solving with outside intervention taking the form of facilitation (Leeuwis and Pyburn, 2002).

Perspectives that relate to social, collaborative and inter-personal learning are particularly relevant since demonstration projects are practiced in an interactive setting. **Collaborative and participatory learning** experiences that develop trust, encourage dialogue, and prompt individuals to critically reflect on assumptions of the world, are an important part of learning, and in particular learning that enhances sustainability (Darnhofer et al., 2010). **Interactive learning** also helps understanding of the combination of scientific knowledge and practical experience and is often necessary for success in a demonstration project.

In agriculture, multiple elements contribute to the process of learning and acquiring knowledge (Coudel et al., 2011; Lankester, 2013; Leeuwis, 2004). One important element is the subject/topic of learning (or demonstration). This can be a new technology, innovation, novelty or artefact (e.g. a machine, a seed, a database) or a strategy (the ways an agent responds to its surroundings and pursues its goals), or a combination of both (Douthwaite et al., 2009). Furthermore, learning about concepts such as sustainability, as opposed to technologies and innovations, requires changes in values, representations (Keen et al., 2005), goals (Lankester, 2013), and skills. Each of these changes involves different learning mechanisms, and therefore different mediation and demonstration approaches.

1 Koutsouris and Papadopoulos (2003) describe learning as an individualised-social process.

From the point of view of functions provided by demonstrations we need to examine and understand different dimensions of learning. From one perspective learning is fundamentally about change, specifically the "act or process by which behavioural change, knowledge, skills, and attitudes are acquired" (Knowles et al., 1998). This is linked to improving farming and management practices – increase productivity and profitability. From other perspectives learning is more about building capacity, putting in place the capacities for learning such as formulating networks, providing triggers for change, exposing participants to debate and new ideas, and improving analytical skills, critical thinking, the ability to make better decisions, and familiarity with practices (Waddington et al., 2014). This capacity building strengthens confidence and farmers' self-reliance, builds community conscience, activates social life, and builds social capital. At this deeper level, empowerment and enhanced capacity to learn are seen as indicative of improved and more transformative learning (Duveskog et al., 2011; Percy, 2005). Aligned to this are notions of learning as a continual and integrated psychological and social process of knowledge creation rather than a fixed process focused on outcomes (Lankester, 2013). The challenge of sustainability (and relevant innovations) is seen as requiring at least this sort of second-order social learning (Röling, 2002).

Learning about concepts such as sustainability, as opposed to technologies and innovations, requires changes in values, representations, goals, and skills

Argyris and Schön (1978) described these different forms of learning as: **single loop learning** which generates knowledge from doing, and **double loop learning** which explores the underlying values and assumptions behind knowledge and learning, and allows reflection on the processes by which learning takes place. An additional level of **triple loop learning** has been added which emphasises reflection and 'learning to learn' and is aligned to transformative learning impacts which entails a deep-seated shift in perspective (King and Jiggins, 2002)[1]. In practice these types of learning operate together and are often intertwined, as shown in the following subsections. Also double and triple loop learning may be an indirect long-term outcome of repeated single loop learning interactions. Providing the demonstration participants with both the information/knowledge and the capacity to change are important, particularly as "an individual's decision about an innovation is not an instantaneous act. Rather, it is a process that occurs over time and consists of a series of different actions" (Rogers, 2003: 169). These forms of learning (loops) are relevant to the following subsection functions.

3.4.2. Providing a space for interactive learning

The extent to which demonstration activities enable peer-to-peer interaction, is seen as an important factor affecting demonstration functions. The significance of learning from other farmers has been demonstrated in a number of studies. A meta-analysis of 46 studies on best management practice adoption highlighted the importance of being connected to local networks of farmers (Baumgart-

1 In the transition/innovation literature Hoogma et al. (2000:58) distinguishes between first and second order learning: "First-order learning refers to learning about the effectiveness of a certain technology to achieve a specific goal. First-order learning aims to verify pre-defined goals, to reach goals within a given set of norms and rules. Second-order learning refers to learning about underlying norms and assumptions and is about questioning these norms or changing the rules" (cited in Raven, 2005:42).

Getz et al., 2012). Isaac et al. (2007) discuss the importance of maintaining both farmer-organisation ties and farmer-farmer ties. This importance of the peer-to-peer advice networks has also been found in the context of private forest management (Knoot and Rickenbach, 2011) as well as countryside stakeholders in the United Kingdom (Prell et al., 2009). Watson Consulting (2014) found that for monitor farms in Scotland, the social nature of the meetings has contributed to participants becoming more likely to engage in networks, taking up leadership or representative roles, becoming more confident at speaking in public, being more willing to adopt new farming methods, and being more willing to share learning, information and practices with others.

An important element of interaction is learning through dialogue, debate, questioning and reflection

Participatory approaches are used to foster interaction and learning. Those that allow iteration and continuous reflection through progressive processes (e.g. creating awareness of new opportunities; deciding to adopt; adapting and changing practice; and learning and selecting) are described as effective both for learning about topics and capacity building (learning how to learn) (Douthwaite et al., 2009).

An important element of interaction is learning through dialogue, debate, questioning and reflection. Learning through negotiation and dialogue are concepts that are relevant to demonstration and peer-to-peer learning. According to Keen et al. (2005) effective learning dialogues need to be processes that create the space and time for a range of different types of dialogue, in particular: a) disciplined debate b) interpersonal exchanges: smaller group meetings to build trust and a learning environment and c) creative dialogues: regular meetings with open agendas to nurture relationships.

Aligned with this is the view that interaction should trigger reflections upon current circumstances, and an important feature of learning groups concerns the engagement and dialogue among holders of different forms of knowledge allowing, in turn, for transformative learning; engaging in dialogue (and reflection). Therefore, "creating a purposefully designed 'space' or 'platform' which brings together different views allows for the creation of synergies (Hubert et al., 2012: 180).

These interactive processes provide both immediate learning opportunities (single loop) but also allow reflection and help to build competences and capacity over time (double/triple loop).

3.4.3. Providing a space for learning from experience and learning by doing (active learning)

Fundamentally, demonstrations are about providing information and evidence (thereby reducing uncertainty) about new practices and technologies, whether through experiment or example. A core part of this process is about providing practical experience to solve problems. Hoogma et al. (2002) point out that practical experience is necessary to generate knowledge required to accommodate introduction of new technologies – such knowledge needs to be tested in practice. With respect to learning theories this aligns to the notion of active learning, learning-by-doing (know-how, tacit knowledge) (Lundvall and Johnson, 1994), although demonstration farms provide this learning by proxy (through observation of others doing). The adoption literature also identifies the importance of observability and trialability which are relevant as on-farm demonstrations can provide this opportunity (Rogers, 2003; Bailey et al., 2006).

Aligned to this 'learning by doing', Kolb developed the notion of experiential learning and defined learning as: "the transformation of experience into knowledge" (Kolb, 1984: 47). This sees reflection and the handling of information as explicit components of a learning cycle. Kolb focused on individual adult cognitive processes while situated learning theories (Wenger, 1998) stress the importance of activity as well as of the appreciation of the local understanding of practitioners. They offer an understanding of learning as a collective experience (Lave and Wenger, 1991) with activity (not the individual) being the unit of analysis. Collective learning, often as Communities of Practice, relies on the ability of people to share their concepts of activity. These processes of collective problem solving are described by Leeuwis (2004) as active learning.

Again these processes provide both immediate learning opportunities (single loop) but also allow reflection and help to build capacity over time (double/triple loop).

3.4.4. Taking account of the variation in farmers' learning capacities and contexts

Long (2004) recognises there is no such thing as a 'stereotypical' adult learner. Taking account of the variation in learning capacities and learning styles of individual farmers and their diversity of knowledge and skills (Millar and Curtis, 1997; La Grange et al., 2010) is an important part of enabling learning.

In developing the idea of a learning regime, Toillier et al. (2014) consider 1) the trigger factors: why is the farmer learning?; 2) The manner of learning or the learning style (Kilpatrick and Johns, 2003): how is he learning? (encompasses both the nature of the source of the knowledge and over what time period); and 3) the outcome of the learning. They identify three types of changes as an outcome of the learning. The first is a change in agricultural practices, without impact on the overall functioning of the farm. The second is a systemic change corresponding to a change in the farmer's objectives and his routines of organizing his productive activities. The third change is of the farmer's 'frame of reference' itself, i.e., of all his representations and assumptions resulting from acquired experience and which orient his perception of experiences to come. This is what Mezirow (1991) calls **transformative learning**. This corresponds to single and double loop learning, as described above.

Consideration of what influences farmers to learn and ultimately change is also important when designing demonstrations. Farmers have different goals and values which are influenced by a range of personal, social, cultural, physical and economic factors and capacities (Pannell et al., 2006). Furthermore knowledge is constructed within social relationships and situated in terms of the 'life-worlds' of those involved (Arce and Long, 1992). **Demonstration activities should understand/allow for the multiplicity of life worlds, interests and many frames of meaning** in the farming community. Furthermore, farmers have different competences, education, skills and literacies which need to be accommodated.

3.4.5. Facilitating interaction and learning

Outside intervention taking the form of facilitation is at the core of collaborative learning and problem solving (Leeuwis and Pyburn, 2002). Ensuring effective mediation in the process of demonstration is important (Gandhi et al., 2009). Facilitation aims to help make groups perform more effectively, and so improves the function of demonstration events. Facilitation formalises and organises the learning environment and learning processes. It manages critical discussion among participants with the view that over time, deeper levels of understanding, inquiry, and innovation can be created; it thus enables effective learning. Compared to other actors (opinion leaders, champions, linking agents and change agents), a facilitators' overarching role is to assist (individuals or groups) through the process of implementing a change in practice. Facilitators can play different roles, and as such require different skills, competencies (and support and training). Leeuwis (2004) summarises the facilitator's tasks as a) to facilitate the group process, b) to teach and c) to be an expert on technical aspects of farming.Facilitators should foster active listening, learning and questioning by providing (confrontational) feedback, raising questions, stimulating people to talk, as well as translating and structuring information, and educating/training, depending on their remit (Leeuwis, 2004).

Overall, they should be good communicators, trusted, respected and credible, have local connections, understanding, and experience. If facilitators act also as expert advisors during demonstrations, a high level of specialist knowledge and progressiveness of the advisor is required (Elmquist and Krysztoforski, 2015); they need to possess both experience and expertise (knowledgeable in the relevant field) (La Grange et al., 2010).

3.4.6. Designing and implementing appropriate mediation techniques and communication tools

Demonstration programmes and activities also serve to design and organise appropriate learning/mediation techniques and communication tools (see also the subsequent discussion on the 'Effectiveness of farmer-to-farmer learning approaches during demonstration activities').

A key function of a demonstration activity will be to provide a positive and open learning environment, where farmers are able to ask questions, engage in discussion and talk openly (DAE, 1999; Oakley and Garforth, 1985). Based on Heymann (1999), Leeuwis (2004) identifies some key characteristics of extension activities that enable active learning:

- Time/space for questions and probing (see also Millar and Curtis, 1997)
- Opportunity for participants to come up with their own conclusions and have opportunity to guide the learning agenda (this fulfils the principles of experiential learning)
- Appropriately structured with a clear beginning, middle and end

Another key function of a demonstration activity is to offer the opportunity to engage observers in the demonstration process. The pedagogical benefits of hands-on activities have been widely recognised elsewhere; it is the function of a farm demonstration to offer the time and space to be involved in such activities that is important here (Franz et al., 2009, DAE, 1999). With specific reference to farmer demonstrations, Millar and Curtis (1997) recognised how interactions between participants were most significant when practical activities were deployed. Hancock (1997) identifies a key function of extension activities as providing the opportunity for farmers to apply practices – the opportunity to do so enhances learning and understanding; "seeing is believing". La Grange et al. (2010) suggest opportunities for farmers to be involved as what they describe as 'co-contributors' to the activities, reinforced learning outcomes.

Leeuwis (2004) also advocates the inclusion of visualisation techniques – particularly concerning issues that cannot easily be seen, e.g. pollution of ground water, to raise farmers' awareness of certain issues. In these instances, demonstration activities should look to methods that allow the visualisation of the problem, such as in field simulations (although Leeuwis recognises these can be expensive and labour intensive). A cheaper and less demanding approach might be the use of diagrams or mapping. However, Leeuwis (2004) cautions that visual tools should not be regarded as an end in and of themselves. Visual tools can help to put issues on the agenda for further discussion and debate, however without further discussion and debate visual diagrams are not likely to lead anywhere (Leeuwis, 2004: 229).

The design of mediation and communication tools, such as farmer-presented instructional videos or farmer-written blogs can amplify the effectiveness of extension activities and confer a number of benefits. For example, Gandhi et al. (2009) recognize how the 'excitement' of appearing in participatory instructional videos motivated local farmers and their communities and reduced the 'distance' between farmers and the 'experts'. Sewell et al. (2014) describe the value of designing multi-sensorial experiences in farmer learning events including walking, talking, listening, observing, tasting, smelling.

3.5. PROVIDING EFFECTIVE FOLLOW UP ACTIVITIES

A well designed event will encourage conversations to continue amongst the participants after the event, for example on the drive home (Sewell et al., 2014). Circulating participant lists is another way of encouraging exchange after the event.

Follow up activities can take the form of newsletters sent to the farmers between events to provide updates on demonstration results or details of arrangements for the next event; fact sheets or handouts about the day and the demonstration topic with links to supporting material online.

Allowing farmers to appreciate that the event or farm is not a one-off but part of an ongoing programme or network of activities will increase 'buy in'.

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CORRESPONDING INVENTORY CHARACTERISTICS

The questionnaire asks if outputs or further information is made available after the event as well as if evaluation feedback is requested from participants and if it is available for analysis.

4. EFFECTIVENESS: FROM OVERALL GOALS TO REACHING IMPACT

Effectiveness of a demonstration activity (or programme) can be determined by assessing the extent to which it reaches its predefined goals and objectives. Effectiveness can be judged in terms of the outputs, outcomes and impacts reached in relation to the goals and objectives set. AgriDemo-F2F focuses on peer-to-peer learning, in which both the extent and nature of learning are important outcomes. In this Chapter, we provide insights on these concepts related to on-farm demonstration in the context of innovation for sustainable agriculture.

4.1. UNRAVELLING WHAT CONSTITUTES THE OVERALL RATIONALE OF DEMONSTRATION ACTIVITIES

The overall goals of organizing or providing demonstration activities are often defined in the context of innovation for sustainable agriculture. However, defining sustainability is challenging and normative; numerous literature sources start from the Brundtland definition "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (World Commission, 1987) but this results in many different implementations and interpretations at practice level. Sustainability is thus a contested and evolving concept with uncertainty about values, interests and methodological approaches due to the difficult cause-effect relationships and interrelationships with other factors (Hermans, 2011; Hubeau et al. 2017; Jahn et al., 2012). Furthermore, measuring sustainability is extremely difficult and often contested (Coteur et al., 2016; De Olde et al., 2016). In the case of demonstration activities, effects and impact on sustainability is even harder to determine, since sustainability is mostly interpreted and measured at farm level or food system level, while the demonstration is often focused on one or more single practices. Furthermore, a single practice focused on a more efficient production is not per definition "not sustainable", it is dependent on how and in which farming system it is applied. However the three sustainability pillars economic, environmental and social provide a good framework for situating the demonstration goals, which are: Productivity and profitability (economic competitiveness), Environmental Sustainability and Social Innovation (strengthening the community, including farmers).

The means to achieve such overall goals can be thought of as the (short-term) objectives of on-farm demonstration activities. The level at which such goals and objectives are set is also important to consider. Organisational (and therefore programme and network) objectives may reflect national/regional policies (and regulatory or voluntary measures) as well as own organisational goals (public or private). As aforementioned these can include research implementation, knowledge creation, development and processing, knowledge transfer, educational and training opportunities; demonstration of new technologies or innovation uptake, policy implementation, networking, locally oriented implementation, participatory processes enhancement and feedback opportunities (elaborated in Appendix 1). These are translated to address local contexts with objectives having to be relevant to farmers' challenges (or opportunities).

The organisational level objectives are thus translated to individual on-farm demonstration objectives. At this level objectives must be clear and appropriate for the topic and the audience. Therefore, a manageable demonstration topic has to be chosen, that is, a testable topic or problem statement which is neither trivial nor complex and unmanageable (Hancock, 1997).

Objectives can be applied to different sectors and topics; thus, in practice, the objectives are numerous covering all aspects of farming technology and practice (hardware, software and orgware), alternative production systems, environmental issues and climate change, energy efficiency, etc. They can be **incremental or radical** (Chandy and Tellis, 1998; OECD, 2005), in need of a **disciplinary, multidisciplinary** (Hancock, 1997) or **transdisciplinary** approach, and the technologies shown **low or high-tech** (Krah, 1992). A demonstration may be multifunctional and multipurpose with broad-interrelated features incorporating a farming system approach (El Bassam, 2001) or less complex focusing on a single practice and individual farm components (DAE, 1999) (see Appendix 3). Furthermore, the **area** a demonstration event targets can range from a purely local level to much wider (regional, national[1] or cross-border[2]).

According to some commentators **diagnostic processes** are crucial, during planning, in formulating the objectives to ensure that conducted research, on-farm demonstration and the proposed solutions are directly relevant and **focused on farmers' identified needs**; it is important to identify regional conditions and practices, needs/problems and their root causes, and farmer acceptable options, etc. (Franzel, 2015; Franz et al., 2009; Kiełbasa and Kania, 2015). Ideally a more **demand-driven, participatory model** should be thus followed, which in turn amplifies the subsequent acceptability of the innovation by farmers (Okiror, 2016; Kumar, 2014; Hellin and Dixon, 2008). In parallel, rapport with farmers is established, building farmers' awareness on topics that they are not aware of and that correspond to their needs (Kiełbasa and Kania, 2015).

Initially it is fundamental for the demonstration management team/responsible agent to set **clear goals and objectives** which are relevant to the stakeholders (potential participants) and which can be **communicated clearly** (Bailey et al., 2006). The clarity of declared objectives is crucial since it determines important decisions to be taken further (Mbure, n.d.). Additionally, clear goals and objectives help in communication and awareness raising about agriculture among key national and international institutions, regulatory authorities, ministries and consumers/the public to improve their understanding of the needs, the problems and the challenges faced by farmers as well as the role which agriculture plays in society (EISA, 2010; Syngenta, 2016).

A demonstration may be multifunctional and multipurpose with broad-interrelated features incorporating a farming system approach or less complex focusing on a single practice and individual farm components

1 http://www.leafuk.org/leaf/farmers/demofarm.eb
2 http://www.balticdeal.eu/advisory/demo-farms/

Furthermore, clear objectives help the assessment of the effectiveness of the on-farm demonstration approaches.

CORRESPONDING INVENTORY CHARACTERISTICS

The inventory assesses the goals and objectives of organisations and host farmers by asking them to rank their 5 most relevant motivations for organising demonstration activities. The overall goals related to innovation for sustainable agriculture are assessed with reference to the following sustainability dimensions, related to the three pillars:

- Strengthen the farming community (social pillar)
- Assist farm families (social pillar)
- Local economic development (economic pillar)
- Monetary/Financial (economic pillar)
- Improved environmental conditions (environmental pillar)
- Nature conservation (environmental pillar)
- Competitiveness/Productivity (economic pillar)

Additionally, the (short-term) objectives are assessed using the following options:

- Research implementation
- Knowledge creation
- Educational and training opportunities
- Innovation uptake
- Regulatory compliance/Policy implementation
- Networking
- Information gathering/sharing
- Social recognition
- Innovation development
- Technology promotion/Product sales

Furthermore, the inventory is also gathering information on the crops, the animals and the topic(s) on which the demonstration activities are undertaken. Both farm diversification and farm management topics are addressed.

4.2. PEER-TO-PEER LEARNING: THE EXTENT AND NATURE OF LEARNING

For evaluating learning and the effectiveness of the approaches applied, both the 'extent' and the 'nature' of learning will be considered within the AgriDemo-F2F case-studies. The 'extent' as defined in this project does not provide clear information on what has actually been learned by whom, but assesses learning in terms of numbers at events (how many farmers are being reached?), geographic coverage (are only local farmers reached, or does it range further?) and stakeholders involved (are only farmers reached, or are also researchers, policy makers, etc. involved during demonstration activities?). Assessing the 'extent' is mostly covered by structural design characteristics outlined in Chapter 2. The 'nature' of learning seeks to find out which types of learning are induced by the demonstration activity (e.g. experiential learning, collaborative learning, and transformative learning). Learning approaches, methods, tools, demonstrator and participant background, and follow-up activities all include characteristics that possibly influence learning, and thus the learning type. Changes in the 'nature' of learning can influence the long term impact of a demonstration activity, although assessing this is far more challenging than assessing the 'extent'. Assessing the 'nature' of learning is mostly covered by functional and organizational characteristics discussed in Chapter 3. Although a distinction is made between 'extent' and 'nature' of learning, both concepts closely relate to each other, which means some characteristics mentioned can influence both.

Changes in the 'nature' of learning can influence the long term impact of a demonstration activity, although assessing this is far more challenging than assessing the 'extent'.

4.3. FIVE DIMENSIONS REACHING OUTPUT, OUTCOME & IMPACT

At present, we focus on a subset of five dimensions in the process from the instigation of a demonstration up to its (indirect) impact on the agricultural system at large. Each dimension is focusing on certain parts of the analytical framework and addresses certain outputs (short-term), outcomes (medium-term) and impacts (long-term).

The planning dimension is about what precedes a demonstration, i.e. before learning starts taking place. This is a stage where some initiator(s) start by either taking a 'problem' or an 'opportunity' as an inspiration to organise a demonstration. This dimension asks for analysis of the rationale and setting out the objectives for organising a demonstration and how it comes to be undertaken. In this phase recruitment plans and audience targets are set and effectiveness can be judged in the conducting phase in terms of short term outputs (i.e. whether the targets are achieved).

The conducting dimension is about how the demonstration is carried out, what demonstration activities and farms look like, who plays an active role in the demonstration and who are the visitors (farmers and possibly others). Analysis of this dimension will focus on short term outputs and characteristics such as the timing and structure of the events, numbers, stakeholders involved, ages and gender of participants, 'quality' and suitability of demonstration farms and mediation techniques.

The learning dimension is about how and what participants learn during the on-farm demonstration activities, the nature of learning and the dynamics during the demonstration. Assessment of effectiveness can focus on short term outputs (e.g. interest generated and/or intentions among attendees) or medium term outcomes related to single, double or triple loop learning (e.g. empowered, knowledgeable and aware farmers).

The application (or anchoring) dimension is about how (and if) farmers translate what they have learned into changes on their own farm. This can be assessed by gauging the extent of (non-)implementation. Furthermore, this dimension also contains the learning that may continue afterwards and is thus not confined to what happens at the demonstration itself. Moreover, lessons from the demonstration itself acquire a more specific meaning in view of new experiences. For this dimension, assessment is focused on more medium-term outcomes such as level of implementation, empowered, knowledgeable and aware farmers. This might also be thought of as scaling up, or embedding the practice in the farming community.

The diffusion (or scaling out) dimension analyses the wider adoption and impacts of demonstrated novelties. This concerns the extent of learning, the size of adoption, a breakthrough phase where visible structural changes take place through an accumulation of socio-cultural, economic, ecological and institutional novelties that, through (positive or negative) feedback, lead the system to (in-)stability and may result in emergent properties. This phase generates impacts, i.e. broader (long-term) changes affecting direct beneficiaries of a demonstration activity or a wider community/ institutions/ environment that become evident several years after the activity has taken place. It is about reaching impact on the following components: i) resilience (e.g. improved capacity to adapt to changes); ii) environmental sustainability (e.g. improvement of environmental resources); iii) quality of life (e.g. improved material/ working/ health/ safety/ leisure conditions).

We want to emphasise that these dimensions are based on the literature review and insights from both scientific and practitioner partners. However, this dimension approach or attributes of these dimensions can change during the course of the AgriDemo-F2F project when empirical case-studies results provide new insights.

5. APPENDICES

APPENDIX 1: ON-FARM DEMONSTRATIONS OBJECTIVES

1 Research implementation

Demonstration farms are used to conduct and test new practices as well as to implement solutions at farm level (Syngenta, 2016; Kiełbasa and Kania, 2015). Demonstrations are designed to take innovations out of the 'unreal', scientific realm of the research station and place them firmly within the boundaries of a farmer's everyday experience (Gibbons and Schroeder, 1983). Thus, a consistent system of knowledge and information exchange between science and practice occurs, helping farmers to become directly engaged in research activities, including funded projects or any other research set up (ORC, n.d.).

In some cases, demonstration projects are established to create an opportunity for producers and other businesses to engage directly in research implementation and the conducting of experiments (ORC, n.d.; Kiełbasa and Kania, 2015). On demonstration farms, common research is implemented, under the supervision of agricultural advisory centers or research institutes, as well as field tests/trials by researchers from research institutes, universities, or the companies supplying the means of production (Kiełbasa and Kania, 2015). A field demonstration is usually established by researchers and/or extension workers - in collaboration with farmers, to validate and demonstrate new technologies (integration of new technology and/or new approaches to management, raising standards of on-farm efficiency, decreasing inputs, increasing outputs and profitability etc.) (Business Wales-Farming Connect, n.d.; Rice knowledge Bank, n.d.).

2 Knowledge creation, development and processing on demonstration farms

Demonstration farms are becoming the source of knowledge for other farmers and regions' inhabitants. New knowledge in both science and agricultural practice is created on demonstration farms (field tests and/or experiments) as a result of the cooperation of farms' owners, specialists, researchers, field advisors, etc. The knowledge generated is also processed (modified, tested, improved) on demonstration farms in order to meet the specific goals of the demonstration program (Kiełbasa and Kania, 2015).

3 Knowledge transfer, educational and training opportunities

Farmers engaged in demonstration activities get advice, information and knowledge about innovative practices and/or regional, national or EU agricultural policies (EISA, 2010; ORC, n.d.). Farmers get support to improve the way crops or livestock are established and managed, including means/methods, measures and tools which will improve the way they manage their landscape (Syngenta, 2016). Farmers engaged in demonstration activities have an early access to new research results and ideas that help in the development of better farming systems (ORC, n.d.). During demonstration processes, activities to exchange knowledge are taking place, as for example training sessions for farmers and any interested stakeholder (Syngenta, 2016). It is clear that demonstration activities' obvious impact concerns making farmers aware of new possibilities. On-farm demonstrations are an effective way to raise farmer awareness about new options. In turn, farmers may then seek more information about a technology if they wish to try it (EISA, 2010; Rice Knowledge Bank, n.d.; Bailey et al., 2006). Building the demonstration farm's management on science and working with many partners helps to deliver research into practice and sometimes to bring into a region the state of the art gleaned from a particular knowledge field (EISA, 2010; Fisk et al., 1989). In addition, the demonstration farms provide also educational opportunities and training sessions for agricultural advisors, agricultural specialists and researchers so that they can notice the methods and results of innovative activities or experiments at first hand (Kiełbasa and Kania, 2015).

4 Demonstrating new technologies – innovation uptake

As aforementioned, on-farm demonstrations are needed to show how (technical) innovations work in practice (Kemp and Michalk, 2011). A demonstration farm can be viewed as a catalyst for better communicating innovative practices implemented by experienced and commercial producers who are willing to show their farm to visiting groups (Fisk et al., 1989; Padel et al., 1999). Demonstration farms are used to display the results of conducted trials, showcasing the stakes in adopting a new practice and then to give the farmer an opportunity to practice new technologies/methods. All types of demonstrations serve to make clear to a farmer exactly what is entailed in opting for a new farming innovation (Gibbons and Schroeder, 1983).

5 Policy implementation

Demonstration farms provide the opportunity for growers to comply with EU and national regulations and supply chain standards and lead the dialogue on Sustainable Productive Agriculture (Syngenta, 2016; BMEL, 2016). On national and on community level as well, participation in educational, advisory and training events, including train-the-trainer schemes and demonstration activities (for farmers and for the public), are useful indicators towards achieving the targets of sustainable agriculture, food security, efficient resource use and maintaining agriculture in remote areas (territorial balance) (EISA, 2010). Setting up and strengthening structures to share skills and expertise both on academic-research basis and through practical approaches allows for showing the progress towards achieving the EU objectives (Kiełbasa and Kania, 2015).

6 Networking

On-farm demonstrations enable faster change and help to foster discussions among local producers (Kemp and Michalk, 2011). Demonstrations are also designed to illustrate the benefits of strengthening the links between producers and their markets, the food chain industry, local communities, local authorities, consultants and national agencies (Bailey et al., 2006; EISA, 2010). Further, demonstration networks allow for greater geographic distribution of demonstrations compared to the use of university research farms (Warren et al., no date).
The importance of the role of on-farm demonstration networks is defined by and reflects on the density and strength of the linkages and interactions between the network's participants. In a demonstration network trials are usually conducted, solutions and tools are designed and implemented; discussions and educational meetings are organized, along with training courses, workshops and advice provision (Kiełbasa and Kania, 2015). The network approach contributes to the strengthening and development of collaboration based on partnership for cooperative problem solutions, the implementation of innovative results and the dissemination of knowledge and information (Kiełbasa and Kania, 2015). The demonstration farms are the "meeting place" for all network participants, (farmers, advisors, researchers) as well as for further stakeholder engagement. Thus, the discussion to achieve practical, realistic solutions is facilitated (EISA, 2010; Kiełbasa and Kania, 2015). Networks also enable the public involvement, engaging consumers and contributors thought events and visits (EISA, 2010). Opportunities to spread information by word-of-mouth, or talk to others in the business (their peers), are first on the list of farmers' preferences (Miller and Cox, 2006).

7 Locally oriented implementation, participating processes enhancement and feedback opportunities

A key element of demonstration projects is the opportunity of linking extension education provision with the needs of local farmers, with regard to innovative knowledge, i.e. to validate new technologies under local conditions. This reinforces bottom-up processes and ensures that the conducted research and proposed solutions are directly relevant and focused on farmers' needs and the problems individual businesses are facing (Bailey et al., 2006; Smallshire et al., 2004; Rice Knowledge Bank, n.d.; Franz et al., 2009; ORC, n.d.).

APPENDIX 2: ON-FARM RESEARCH AND DEMONSTRATIONS

Research, in order to be classified as on-farm research, has to be carried out on a plot of land belonging to a farmer and within the farming environment of the farmer. Off-station research is, therefore, not synonymous with on-farm research, though all on-farm research is by definition 'off-station' (Krah, 1992).

The objective of applied agricultural research is to identify new practices and materials which have the potential to improve farmers' production system, productivity, well-being, etc. Traditionally, such research was conducted in research stations, while extension and development organizations were expected to transfer the results to the farmers. The low effectiveness and adoption rates of this model in many cases have caused agricultural scientists to adopt on-farm research (OFR) as an effective means to transfer appropriate technology (Mutsaers et al., 1997). On-farm researchers often fear that leaving the management of a trial to farmers, introduces too much variability making it thus impossible to analyse the results and draw solid conclusions. However, the way farmers manage their fields, with all the resulting variation among farmers, is an essential part of real farmer conditions. Trials conducted under maximum farmer management are the only valid way of testing technology, provided that farmers treat the trial fields in the same way as their other (non-experimental) fields. Variability should thus be analysed and explained, rather than artificially controlled by researchers (Mutsaers et al., 1997). On-farm research with farmers as active collaborators has been shown to expedite the transfer of technology to producers (Rzewnicki, 1991). OFR enhances the relevance of research by taking direct cognizance of farmers' conditions and needs and by choosing new technologies in cooperation with farmers and testing them under their local conditions (ORC, n.d.; Kiełbasa and Kania, 2015; Smallshire et al., 2004; ICAR, n.d.). **The OFR approach is simple: conducting an important part of applied research together with farmers in their own environment, with the aim of finding adoptable and sustainable solutions with regard to their production constraints** (Mutsaers et al., 1997).

More specifically, on-farm research plays a crucial role in the following areas:

- Testing and validating farming technologies under local farmers' conditions
- Development and adaptation of farming technologies to local farmers' conditions
- Demonstration and extension of farming technologies in local farming communities (Krah, 1992).

The OFR process has three components:

- Developing a clear understanding of the farm and its environment as well as of farmers' goals, constraints and opportunities (the diagnostic component
- Choosing or designing appropriate innovations, in close co-operation with farmers, and testing them under real farming conditions (the experimental component)
- Evaluating the performance of innovations and monitoring their adoption, or analysing the causes for non-adoption (the evaluation component) (Mutsaers et al., 1997).

On - Farm research typology

There are two basic types of OFR according to Krah (1992):

a) Experimental OFR

Experimental OFR is performed for the physical, technical, and economic assessment of alternative systems or treatments within the framework of standard experimental designs. The structure and design are very similar to those used on-station. However, on-farm experimentation is kept as simple as possible to ensure effective farmer understanding of issues and her/his meaningful involvement and contribution. Bio-physical assessment is related to the determination of the system's biological and physical yield and productivity. On the other hand, economic assessment concerns the availability of labour, cash, and other resources for meeting the projected needs of the alternative system, the level and dependability of profit, etc.

b) Developmental OFR

Developmental OFR involves: (1) the introduction of particular systems within the farmer environment, and (2) the assessment of the workability of the system and its acceptability by farmers.

Developmental OFR main purposes comprise:

- The extrapolation of the tested results to the target area
- The fine-tuning of technology
- Determination of the required support structures prior to wide-scale extension of the technology.

Through the developmental OFR process, farmers of the targeted area are gradually exposed to a new technology, and their management of the system is monitored in order to identify problem areas and researchable issues. Developmental OFR operates within a framework of research-extension collaboration. Developmental OFR makes use of extension techniques and methodologies for the introduction of the concept or system and the development of farmers' awareness. For this reason, developmental OFR requires the joint involvement of researchers, farmers and extension agents. For such development-oriented research, the performance parameters are not necessarily crop yield or other biological or technical indicators, but the farmer's level of interest and adoption (Krah, 1992). In reality this type aims at getting information on both biophysical and farmers' assessment of the technology (Venkatasubramanian et al., 2009).

Phases of Developmental OFR

There are three phases in the developmental OFR process, namely:

- The exploratory phase,
- The intermediate phase,
- The pilot project phase.

The **exploratory phase** is the stage when a new system or concept is introduced into a community allowing farmers to gain a precise image and a practical understanding of the system. This exploratory phase thus has a demonstration objective. It begins with the identification of individual farmers within the community with whom the researchers work closely to put the system on the ground. When a technology is not sufficiently mature to be exposed to farmer management researchers should conduct trials at this initial stage under their own management. As a result, during this phase, researchers' involvement is very high since farmers' perception of the system is almost zero. Usually only a small number of farmers (1-5) are selected for these trials (Krah, 1992). Exploratory trials are no different from conventional station or multi-locational trials although they are conducted in farmers' fields. The same applies to trials relating solely to physical conditions. If, for instance, nothing is known about crop response to fertilizer in the soils of the target-area, there is no point in conducting farmer-managed trials until the response curves have been established in a more researcher-managed trials context (Mutsaers et al., 1997).

The **intermediate phase** begins after the exploratory trials are established and the management of the system has commenced. This phase, like the exploratory phase, is also targeted at individual farmers, but requires greater involvement of the farmer in the establishment and management of the experiment. Farmers participating in the intermediate trials will have a clearer perception of the system because of the existence of the exploratory - demonstration units which provide a visual dimension for discussions on the system's structure and potential. The number of farmers used in this stage can be 3-5 times the number of the exploratory trials. The exact number is usually determined by resource availability (Krah, 1992).

The **pilot project phase** takes off after the intermediate trials have been conducted and farmers' understanding and capability in management have been sufficiently established. At this point, direct involvement of researchers in the management and other farm operations is withdrawn and farmer involvement is greatly increased. The main objective of the pilot project is to place the technology within the target-community framework and to enable assessment of its relevance, workability, and acceptability by local farmers.

More specifically, a pilot project aims at:

- Evaluating benefits to farmers and their community from the adoption of the new technology
- Assessing institutional and social requirements for the accelerated adoption of the technology
- Identifying constraints and researchable problems pertaining the adoption of the technology by individual farmers and the community
- Redesigning the production program as necessary for wide-scale implementation.

During the pilot project stage, the focus is on the community rather than on individual farmers. Participating farmers are responsible for all farm activities and for the management of the experimental plots. The involvement of extension agents, which is required to a lesser degree in the earlier stages, also reaches its peak during the pilot project phase. The extension officer becomes the key link between the farmer and the researcher (Krah, 1992).

A draft presentation of the OFR process is shown in Figure 1.

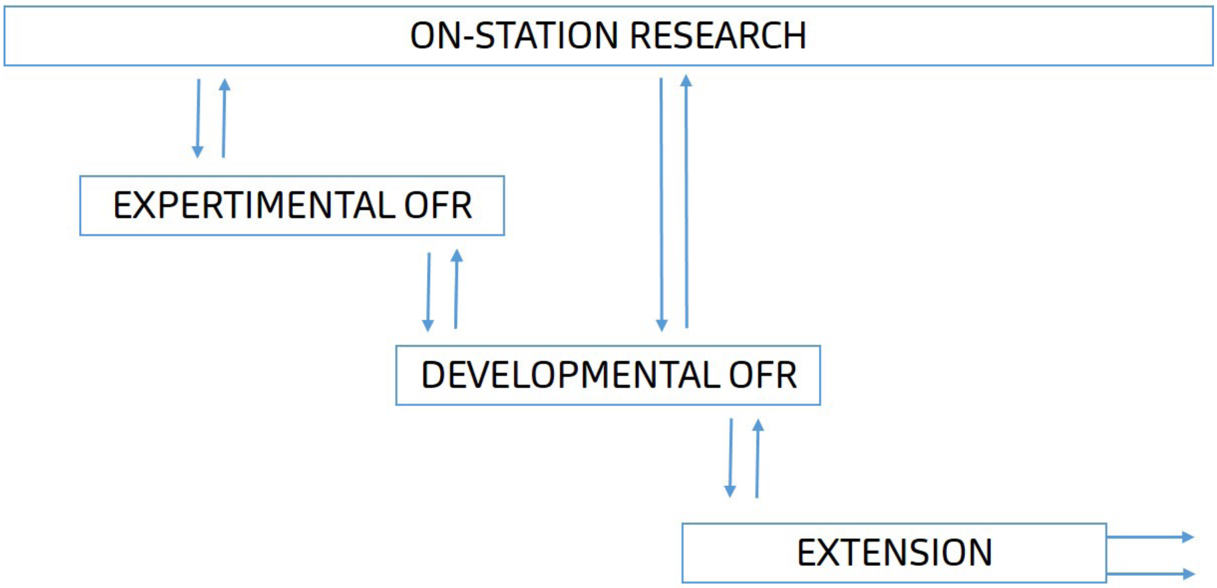

Figure 1: Relationship between OFR and other stages of research and extension
Source: Krah (1992)

The multiple stages occurring before a demonstration is realised are shown in Figure 2.

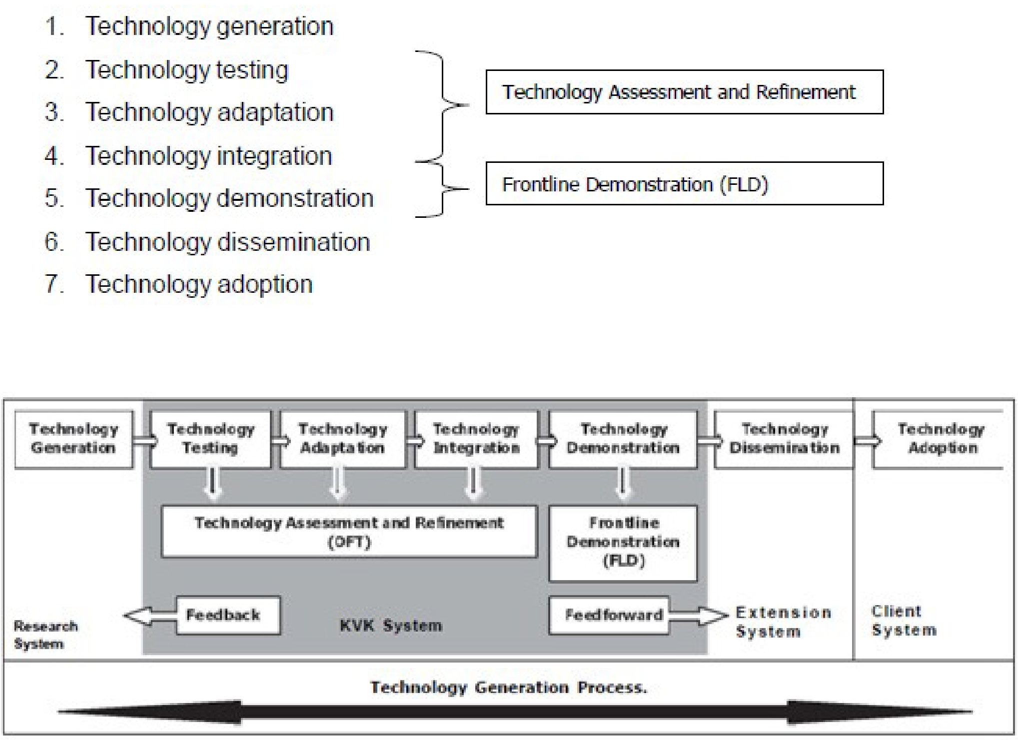

Figure 2: Conceptual model of technology generation process
Source: Venkatasubramanian et al. (2009)

'Types of farms' in the context of developmental OFR

With regard to developmental OFR, some quite usual 'types of farms' are referred to in the international literature. These types relate to the trials of new practices in an extension context, aiming at on-farm testing and validation of new solutions and their further dissemination.

i) Pilot farm

According to Maatoug (1981) a pilot farm is the first farm established in an area or region for trying new ideas or practices under the local conditions. In other words, a pilot farm is the first locally-oriented test and implementation of new ideas[1]. For Hruschka and Rheinwald (1965) pilot farms are defined as units operated by farmers who were asked by extension agents to introduce new farm-practices earlier than their neighbours, and the whole effort is conducted in cooperation with the change agent. The new practices are embedded in the whole setting with which farmers are familiar. At the same time, the author notices that the term 'pilot farm' has generally been interchangeably used with

1 http://www.ble.de/EN/03_ResearchFunding/05_MaDProjects/MaDProjectsPlantProtection_node.html

many other terms, such as demonstration farms, empirical farms, experimental farms, etc. Nevertheless, their purposes differ, even if slightly, according to Penders' (1954) as follows:

"… an experimental farm, is where several experiments are carried on separately";
"… on empirical farms, a single productivity scheme is applied on the farm as a whole for several years consequently";
"… pilot farms show farmers how …".

Despite the abovementioned differences[1], the overall-purpose is to give concrete examples of the implemented practices to farmers (Hruschka and Rheinwald, 1965). Additionally the intense involvement of the extensionist and the local implementation of new ideas are common traits in available definitions of pilot farms.

ii) The On-Farm Trial/Test

An on-farm trial (OFT) aims at testing a new technology or idea in farmers' fields, under farmers' conditions and management, using farmers' own practice as control (Venkatasubramanian et al., 2009).
On-field trials meet the basic criteria with respect to statistical validity (Herendeen et al., n.d.). They are thus a more sophisticated approach to the demonstration technique; it uses the fundamental principles of the demonstration method but the results are more reliable. This type of demonstration uses a scientific experimental design so that results can be statistically analyzed. OFTs, according to the literature, help to develop innovations consistent with farmers' circumstances, compatible with the actual farming system and corresponding to farmers' goals and preferences (Venkatasubramanian et al., 2009). The on-farm test is usually conducted when a practice recommended by the research stations and extension system is not being followed in the district. Tests are also run when practices recommended by the research stations and extension system are being followed, but yields/results remain low in the district. On farm trials are also useful when a district has locations that have special attributes which do not fit the general pattern or/ and particular micro locations within a region which are less productive despite farmers' efforts (Extension Education Institute (NE Region), n.d.). According to Kittrell (1974), these types of demonstrations are kept simple by only using a limited number of treatments in the test design. Then, local growers are able to visit the demonstration and observe the treatments throughout the growing season; among several different treatments the grower usually chooses the treatment that will give him the highest net returns under his farm conditions. Therefore, OFT gives an opportunity, under controlled conditions, to try new ideas before they are available for grower use. Thus, growers have a chance to evaluate these new ideas under their conditions prior to trying them on their farms. This approach also provides an excellent opportunity for growers, agribusiness personnel and extension personnel to work together and better serve the grower through the newly developed knowledge. The main procedures concerning OFT is diagnosis and planning (identification of problems and their causes and possible solutions) as well as implementation, assessment and dissemination of the most efficient ones (Extension Education Institute (NE Region), n.d.).

In this respect, the so-called "mother-baby" trials approach can be used, offering an interesting way to combining farmers' and scientists' trials (CIMMYT, 1988; Snapp, 1999). In such a case, a research managed trial is established in a central location, where all of the technological options are tested and appropriate controls and replications according to scientific standards (the "mother" part of the trial) take place. Nearby, within easy access to farmers a set of farmers' trials is established (the "babies"). These experiments include a subset of the technological options of the mother trial which follow a simpler design and are established and managed by farmers. The conditions and management of the baby trials should reflect farmers' circumstances and interests. This experimental layout yields results that are of interest and have credibility for both scientists and farmers (Bellon, 2001).

1 Another term found in the literature is that of discovery farms. According to Kuipers et al. (2005) "…the research results of experimental research farms are developed and demonstrated in the field at a limited number of discovery farms. At this stage, emphasis is placed on innovation development and gathering on farm experience…".

iii) On-farm Demonstrations

On-farm demonstrations is an educational activity conducted in a systematic manner in farmers' fields to show the worth of a new practice/technology. In this case the teaching of farm management principles is emphasized and the adoption and efficient use of improved technology is encouraged. Only proven technologies are selected for on-farm demonstrations. On-farm demonstrations educate farmers through results obtained as for example in terms of varieties resistant to disease and pests, quality of the grains and overall higher yields, etc. (Extension Education Institute (NE Region), n.d.). In this respect, Venkatasubramanian et al. (2009) state that a demonstration plot, is not identical to OFT, since a demonstration aims at showing farmers a technology of which researchers and extension agents are sure that it works in the area.

Demonstration event types

Demonstrations typically falls into two categories: result or method. The distinctions between the two types are not always clear, since many demonstrations incorporate aspects of both, applied either consecutively as subsequent events or within the same demonstration event. The purpose for which the demonstration is conceived, executed, and carried through is the real test of its classification. Although various qualifications have been suggested as ways of differentiating between method and result demonstrations, only the purpose really matters (Hancock, 1997). Both method and result demonstrations are extension activities that require a lot of thought, careful planning and efficient execution (Oakley and Garforth, 1985).

i) Method demonstration

A method demonstration is a teaching method which involves the verbal and visual explanation of a process, fact or idea (Maatoug, 1981). Method demonstrations basically show farmers how to do something, allowing farmers to learn by doing, i.e. to demonstrate and practice a specific skill, step by step. Method demonstrations, include: a) events aiming at showing to farmer attendees how to complete a task step by step, i.e. how, for example, to plant seeds in line; use a mechanical duster to control insects; operate a tractor; apply fertilizers in the field; prepare a nursery-bed; treat seed with pesticides; sow; perform soil sampling, etc. (Oakley and Garforth, 1985; Gibbons and Schroeder, 1983) as well as b) equipment demonstrations and similar commercial purpose events in which, usually, companies play a leading role (Dirimanova and Radev, 2014). The latter offer the opportunity to agricultural experts, farmers, students or any interested entity to become acquainted with the most modern equipment available in the market (Dirimanova and Radev, 2014). The method demonstration assumes that the observers wish to learn the process and focuses on teaching skills or techniques to show "how to" (Hancock, 1997; Oakley and Garforth, 1985). Thus, in general, in method demonstrations concern is with farmers who have already accepted the particular practice being demonstrated, but who now want to know how to do it themselves (Oakley and Garforth,1985).

ii) Result demonstration

A result demonstration is the active promotion of innovations in farming practices by showing the advantages of a recommended practice or a combination of practices (Maatoug, 1981; Gibbons and Schroeder, 1983). They are conducted in farmers' own fields to show to local farmers that research-experimental findings can be reproduced locally and to what extent. Comparison is the important element in a result demonstration as, for example, comparison between compost and no compost, between poor seed and selected seed, or between use of fertilizer and no fertilizer. A result demonstration thus concerns side by side comparisons of new and traditional techniques and results of both practices are shown (Oakley and Garforth, 1985). This process always includes keeping analytical records for comparisons in order to show the superiority of recommended practices (Hancock, 1997; Khandelwal, n.d.).

iii) Monitor farms

Monitor farms provide and develop economic and environmental benchmarking through on-farm events and the establishment of 'business clubs'. They can therefore demonstrate the application of a specific technology or combination of technologies over time, which allows monitoring and comparison within a specific context[1]. Although monitor farms are not typical demonstration farms they share some common characteristics with some demonstration farms. Moreover, monitor farms include demonstration events as part of their educational activities.

More specifically, monitor farm always refer to networks comprising the monitor farmer, the facilitator and the community of participating farmers as well as invited experts, enterprises and scientists (Creaney et al., 2015). The social aspect of participating is the key characteristic of monitor farms programs. Monitor farms appear to be based a lot on informal networks; the formal network is complemented with informal networks that each of the participating farmers brings with her/him as well as the networks of the facilitator and other actors (such as representatives of fertilizer or machinery companies) (Creaney et al., 2015). As a result, many links are initiated between the formal monitor farm network, advisory services and a wider network including invited specialists, industry representatives and student/ researcher attendees.

- Monitor Farms are 'owned and operated' by the group of local farmers – 'for farmers, by farmers'. Different farmer types participate in the monitor farm network, representing the range of enterprises in the geographical area of the monitor farm. The selection of topics covered in the community group meetings is mainly farmer-, community-led.
- 'Monitor farms' are based on the premise of ongoing interaction with and within a defined group of like-minded farmers. Monitor farms are structured by sector (livestock, arable, dairy, pig, organic, agri-tourism) although they are open to any farmer (and indeed any interested person) (Creaney et al., 2015).
  With regard to spatial relations, monitor farms have a clearly defined spatial extent/ 'catchment' areas (Creaney et al., 2015).
- At monitor farms the focus is on the improvement of the farm's financial performance (efficiency), i.e. increasing the productivity and profitability of the farms involved, through discussing issues and demonstrating business improvement. Hence, the objective of a monitor farm network is the improvement of farming practices, the adoption of new technology or adjusting the existing one, coupled with the acquisition of new skills to manage the innovation process. In order to achieve efficiency (and becoming able to assess it), attention is paid to the regular record keeping and monitoring of financial data in order to benchmark the performance of networks (Bailey et al., 2006).
- It is important to highlight that monitor farms are distinguished from other similar activities with regard to their focus on knowledge exchange; monitor farms programmes are focused on communication, knowledge exchange and co-creation through the sharing of ideas and experience between monitor farm participants (Creaney et al., 2015). Therefore, the network encourages participating entities to share critical performance information/data which are discussed and evaluated by the group, thus facilitating business improvements. Monitor farm networks engage in several activities such as regular meetings and visits to farms inside or outside the network, often incorporating a visiting external speaker or specialist, as well as practical on-farm demonstrations (Creaney et al., 2015).

1 https://cereals.ahdb.org.uk/get-involved/monitor-farms.aspx,http://www.qmscotland.co.uk/monitor-farms-2016-2020

APPENDIX 3: TYPES OF TECHNOLOGY DEMONSTRATED

Below, some types of the technologies, referred to by the available literature, being implemented at demonstration farms are listed.

i) Single practice or single component or elementary technology demonstration

This type of innovations cannot be broken down into separate elements. Single practice demonstrations aim at proving the worth of a single practice such as the effect of an improved/new variety, fertilizer, irrigation scheme/technology or pesticide, etc. applied to one crop (ICAR, n.d.; Mutsaers et al., 1997; Krah, 1992). Single component technologies are the least complex and can be easily managed (Krah, 1992).

ii) Package technology

A package technology consists of several independent components (e.g. improved seed, fertilizer and herbicides) and fall in between single component and composite technologies (Krah, 1992). In reality a package technology is a combination of several technologies, where the total effect on yield of the package is expected to be greater than the sum of the effects of the individual application of each element (Mutsaers et al., 1997).

iii) Composite technology demonstration

A composite technology consists of several interacting components (Krah, 1992). More specifically, a composite technology is composed of several elements which cannot be applied separately or which requires changes in the farmers' cropping/production pattern. One example is alley cropping, which means planting hedgerows, maintaining them and growing crops continuously in the alleys (Mutsaers et al., 1997). In this respect, a composite demonstration can be a combination of field-based result demonstrations and a chain of skill-oriented method demonstrations. In this case, the effect of one practice in harnessing the effect of other practices is also demonstrated and studied (ICAR, n.d). Composite technologies are thus more complex because they involve several interacting components. They usually concern long-term operations and may have a rather long waiting period before benefits can be seen (Krah, 1992).

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