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STRUCTURAL ASPECTS OF ON-FARM DEMONSTRATIONS: KEY CONSIDERATIONS IN THE PLANNING AND DESIGN PROCESS

[a]Eleni Pappa, [a]Alex Koutsouris*, [b]Julie Ingram, [c]Lies Debruyne, [c]Hanne Cooreman, [c]Fleur Marchand
[a] Département of Agricultural Economics & Rural Development, Agricultural University of Athens, Greece.
[b] University of Gloucestershire LBG (CCRI), United Kingdom.
[c] Flanders Research Institute for Agriculture, Fisheries and Food (EV ILVO), Belgium.

A B S T R A C T

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. Demonstrations concern the practical exhibition (and explanation) of how something works and have for long been one of the most important extension techniques. 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". 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.). The current paper will elaborate on such structural characteristics and will thus contribute to building a provisional model of the linkages between rationale (goals, objectives, topics), structural factors, functions and results (output, outcomes and impact).

Keywords: On-farm demonstrations, structural characteristics, actors, networks, resources, event characteristics.

INTRODUCTION

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, 2003). Farmers and small scale foresters tend to be most influenced by proof of successful farming methods by their peers (Kilpatrick & Johns, 2003; Warner, 2007; Schneider *et al.,* 2009; Hamunen *et al*., 2015). Such farmer to farmer learning, or peer learning in general terms, involves participants learning from and with each other and is possible anywhere on the scale between informal and formal learning.

According to the Oxford Dictionary a demonstration is defined as a) "The action or process of showing the existence or truth of something by giving proof or evidence", and b) "A practical exhibition and explanation of how something works or is performed" while Collins English Dictionary refers to "an explanation, display, illustration, or experiment showing how something works". In the same vein, 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". "Seeing is believing" is the basic philosophy of (extension concerning) field demonstrations; 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 – i.e. peers (Miller & Cox, 2006, Bailey *et al.,* 2006). Demonstration farms thus allow for the creation of practical knowledge that can be used directly on farms. This way, the possibility of farmers to observe the results of on-farm trials at demonstration farms, allows them to make a decision to introduce the innovations much faster; this is especially true for those technologies that are costly, complex, or require a major shift in the operation (Miller & Cox, 2006). The farms on which on-farm demonstrations are held are a meeting place where on-

* Corresponding Author:
Email: koutsouris@aua.gr
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the-farm trials are conducted, solutions and tools are designed and implemented, advice is provided as well as the dissemination of knowledge and information is taking place. In the experimental part of the demonstration farm's functions, if there is any, technologies, innovative tools and methods are tried, compared or validated. In the educational part, the results or methods applied are demonstrated, training opportunities are provided to farmers and experience exchange is taking place throughout open events and other dissemination actions throughout an area (Kiełbasa & Kania, 2015; Gros & Oldeweme, 2013; Syngenta, 2016; Madureira *et al.,* 2015).

If appropriately planned and structured, on-farm demonstrations can be a very powerful and efficient mechanism for innovation showing, providing an environment where active learning can take place through visualisation and discussion (Bailey *et al.,* 2006; Smallshire *et al.,* 2004). Indeed, on-farm demonstrations serve as one of the most effective extension education tools ever developed in order to speed up the technology transfer process (Leeuwis, 2004; Hancock, 1997; Rogers, 2003; Kittrell, 1974).

MATERIALS AND METHODS

Following the results of a review of the international literature on the topic on-farm demonstrations, with emphasis on structural characteristics, is presented. The review concerned both academic/research and practitioners' documentation. In this respect the basic keyword 'demonstration farm' and its derivatives were used both in Scholar Google and Science Direct as well as in Google, respectively. The result was around 120 scientific papers and reports, the latter mainly from extension services and relevant to the topic projects. Since the aim is a comprehensive overview of the topic qualitative analysis of the documents followed (exploratory analysis, see Sarantakos, 2005). Therefore axes and categories were constructed to accommodate the variety of findings on the topic, the synthesis of which is presented below.

The point reached (i.e. 120 documents) proved to be the data saturation point in the sense that further documents did not add any new information/data (or, codes) to the ones already obtained (Saunders *et al.*, 2017).

RESULTS AND DISCUSSION

On-farm demonstrations aims: According to the international literature on-farm demonstrations aim at one or more of the following:

Research implementation: Demonstration farms are used to conduct and test new practices as well as to implement solutions at farm level (Syngenta, 2016; Kiełbasa & 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 & Schroeder, 1983). Such a demonstration is usually established by researchers and/or extension workers - in collaboration with farmers, to validate and demonstrate new technologies

Knowledge creation: development and processing on demonstration farms. New knowledge in terms of both science and agricultural practice is created on demonstration farms 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 & Kania, 2015).

Demonstrating new technologies – innovation uptake: As aforementioned, on-farm demonstrations are needed to show how (technical) innovations work in practice (Kemp & 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). All types of demonstrations serve to make clear to a farmer exactly what is entailed in opting for a new farming innovation (Gibbons & Schroeder, 1983). In turn, farmers may then seek more information about a technology if they wish to try it (Bailey *et al.,* 2006).

Knowledge transfer, educational and training opportunities: Farmers engaged in demonstration activities have the chance to get advice, information and knowledge on a wide variety of topics from advisers, specialists, etc. In this respect, on-farm demonstrations are an effective way to raise farmer awareness about new options.

Policy implementation: Demonstration farms provide the opportunity for growers to become aware of EU and national regulations and supply chain standards and lead the dialogue on sustainable agriculture (Syngenta, 2016; BMEL, 2016).

Networking: 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). The network approach contributes to the strengthening and development of collaboration for concerted problem solutions, the implementation of innovative results and the dissemination of knowledge and information (Kiełbasa & Kania, 2015). The demonstration farms are the "meeting place" for all concerned actors; thus, the discussion to achieve practical, realistic solutions is facilitated (Kiełbasa & Kania, 2015).

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; Franz *et al.*, 2009).

Demonstrations typically fall into two categories: result or method. 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. A result demonstration aims at showing the advantages of a recommended practice or a combination of practices (Maatoug, 1981; Gibbons & Schroeder, 1983). A result demonstration thus concerns side by side comparisons of the results of new and traditional techniques (Oakley & Garforth, 1985).

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 & Garforth, 1985).

In the paragraphs below, we describe structural characteristics of on farm demonstrations.

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

At this point it is important to mention that a demonstration programme can follow a more or less participatory approach; the degree and the extent to which stakeholders are involved may vary a lot. In most cases, demonstration programs aim at the actual involvement and participation of farmers to the overall demonstration functions such as decision-making, design, research, evaluation, monitoring, demonstration event organization and implementation, etc. (Okiror, 2016; Stammen, 2016; Mitchell, 2016; Shrestha, 2014; Hellin & Dixon, 2008; PACC, 2015). The same applies for the involvement and participation of multiple stakeholders (Pangborn *et al.,* 2011; Morris & Winter 1999; Kuipers *et al.,* 2005; Bailey *et al.,* 2006; Shrestha, 2014; Okiror, 2016; Gros & Oldeweme, 2013; Hellin & Dixon, 2008; Franz *et al.*, 2009; Kiełbasa & Kania, 2015; Franzel *et al.,* 2015). Especially the opportunity to link extension education provision with the needs of local farmers reinforces bottom-up processes. In this respect, on-farm demonstration programmes and events ensure that the conducted research and proposed solutions are directly relevant and focused on farmers' needs and the problems individual businesses are facing. Networks also promote bottom-up planning with local participation and the engagement of multiple stakeholders in every demonstration functions (Shrestha, 2014). In this respect demonstration programmes and events can be discriminated to those actually following or aiming at a participatory approach to all or most of project/process stages or a more top-down approach with defined tasks assigned to responsible agents. Rzewnicki (1991) underlines the necessity to develop research programs or related activities that incorporate greater farmer participation. 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).

As far as the roles of various actors in on-farm

demonstrations are concerned the results of the literature review are summarized in the following sub-sections.

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.); b) private/commercial companies (Syngenta, 2016; Gros & Oldeweme, 2013); c) NGOs and/or other agricultural/ developmental organisations (Qamar, 2013; Okiror, 2016); d) extension services or other advisory services (Penn State Extension, 2017); e) research institutes/ universities (Pangborn *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 (Kemp & Michalk, 2011, BMEL, 2016), regional, or EU origin or operates within a co-financing scheme. 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).

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 to be familiar with (and deeply concerned about) the local situation, 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 & 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 & 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 & Schroeder, 1983).

Demonstrators: The demonstrator can also be a farmer, researcher, specialist/extension agent, private sector employee, advisor, or student. 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; 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 & Cox, 2006; Kuipers *et al.,* 2005; Oakley & Garforth, 1985; Kumar, 2014). 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 & Leuthold, 1962), while elsewhere they may be recruited by the local growers (Kittrell, 1974).

Furthermore, the demonstrator farmers' characteristics are identified in the literature as an important factor in effective demonstrations. Farmer demonstrators should be experienced and continuously involved in commercial farming, with good farming skills in their local context and conditions. They are preferably full-time residents in the community, can communicate in the local language and are 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 & 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 & 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 & 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*., 2017). Training received by demonstrators increases the demonstration effectiveness; the value of 'train the trainer' schemes has been described by several authors (Smallshire *et al.*, 2004; Franz, 2009; Fischer & Vasseur, 2002).

Organisers should be realistic and transparent about the expected requirements from the host farmers; negative experiences could put them and their peers and potential future hosts off running future demonstrations (Bailey *et al.*, 2006; Bellon, 2001; Gibbons & Schroeder, 1983).

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 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, con¬sumers, students, etc. and all at different spatial levels (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 (Tripathi *et al.,* 1992). Furthermore, the number of people involved and reached by the activities is important and 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. (PACC, 2015). There is also value in organizing demonstrations for clusters of peer farmers (Janvry *et al.,* 2016; Franzel *et al.,* 2015; Rogers & Leuthold, 1962). Furthermore, 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 though discussions, which are often held in the frame of on-farm demonstrations (Bailey *et al.,* 2006; Kiełbasa & Kania, 2015; Franzel *et al*., 2015; Pangborn *et al.,* 2011).

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). 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). 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; Hellin & 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). A network of farmer-owned demonstrations allows for greater geographic distribution of demonstration activities (Warren *et al*., 2017).

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 & Kania, 2015).

Moreover, as aforementioned, demonstration farms are the "meeting place" for all network participants (Pangborn *et al.*, 2011; BMEL, 2016; Stammen, 2016; USDA/NRCS, 2016; Mitchell, 2016). Thus farmers benefit from the availability of multiple sources of information; 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; Kiełbasa & Kania, 2015; Franzel *et al*., 2015; Kuipers *et al.*, 2005; CCCA, 2013; Okiror, 2016; Pangborn *et al*., 2011). 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 & Cox, 2006). However, the need for involvement of multiple stakeholder groups may also give rise to coordination difficulties. 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.

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

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; Franz, 2009; Fischer & 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, etc. 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).

Structural characteristics – Farm (event) level

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) and/or exemplary demonstration designs (notably method or result demonstrations) or just the showcasing of existing experience.

Two types of demonstration projects are found in literature: (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 (Tripathi *et al.,* 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).

Location and layout: The selection of the demonstration farm is important for effective demonstrations. The farms' biophysical context and farming system are important determinants of what can be demonstrated. Moreover, according to the available literature one of the most critical factors for demonstration effectiveness is the farmer's ownership of the demonstration farm (Gibbons & Schroeder, 1983; Bailey *et al.,* 2006; Miller & Cox, 2006; Lauer, 2009); 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. This way, during on-farm demonstrations, farmers can see particular technologies or management practices in operation on a working farm not too dissimilar (soil type, rainfall, equipment, management practices, etc.) to their own. For this reason, demonstrations should be carried out on local farms, rather than on an extension plot or research stations (Gibbons & Schroeder, 1983; Miller & Cox, 2006; Oakley & Garforth, 1985; PACC, 2015; Bailey *et al*., 2006). 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); it is important to offer the opportunity for groups to move to other farms for one-off events if the latter can better demonstrate a particular issue (Bailey *et al.,* 2006). 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 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 (Havlin *et al*., 1990; Hancock, 1997; Warren et al., 2017). 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; Franzel *et al.,* 2015). The site should also be centrally located and visible, in order to attract maximum attention of potential audience/farmers (Cunningham & Simeral, 1977; Gibbons & 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 (Gibbons & Schroeder, 1983).

Frequency, duration and timing: With regard to the frequency of farm demonstrations, it is important to distinguish between single and repeated events. The former concern one-off 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 demonstration events varies according to the site setup and the purposes of the demonstration programme. The duration of technology management on demonstration farms can be distinguished into single season demonstrations which last for only one season and

cropping/production pattern demonstrations which are operational for more than one season (DAE, 1999). Repetition of demonstration events concerning the same topic may add to the effectiveness according to literature (Hancock, 1997); a series of events, especially in cases in which the demonstration is available for a season/year and showcases a cropping pattern, provides 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. 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 characterizing 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 organize 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).

Aftermath: The aforementioned data concern the structural characteristics of on-farm demonstrations and, consequently, fit to the 'structural characteristics' box of the provisional model (framework) showing the main building blocks followed for the study of farmer-to-farmer learning through on-farm demonstrations (Figure 1).

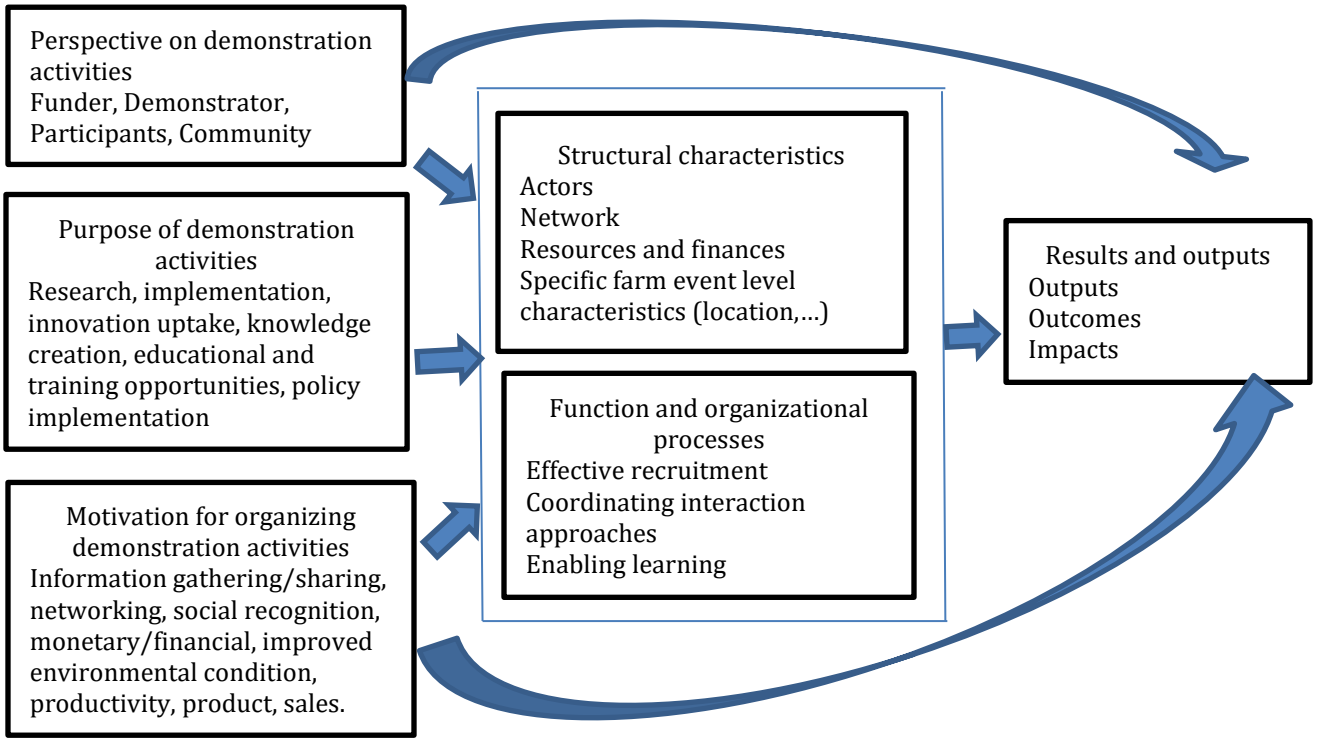

Figure 1. Model (framework) for the analysis of on-farm demonstrations.

A number of case-studies ranging between 24 and 36 is currently selected and research tools (pre- and post-demonstration questionnaires; demonstration observation tools; demonstration farm level interview; etc.) are developed by the project consortium in order to examine the influence of structures as well as of functions (see, Ingram *et al.,* 2018) and on on-farm demonstrations' effectiveness with emphasis on peer-to-peer learning and innovation uptake and dissemination (see, Cooreman *et al.,* ,this Special Issue).

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