Effectiveness of on-farm demonstration events in the EU: role of structural characteristics

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ABSTRACT

Purpose: The objective of this paper is to undertake an in-depth exploration of how structural characteristics of on-farm demonstration events impact the effectiveness of the demonstration as perceived by participants.

Methodology: An explanatory mixed-methods approach was used based on the responses to 356 post-demonstration questionnaires filled out by the attendees of 31 demonstration events held in 12 EU countries in 2018, together with the qualitative data from an observation tool, interviews and case study reports relating to the same 31 events. Factor analysis was employed to predict general effectiveness, complemented with a qualitative analysis of participants' responses to improve the understanding of the quantitative results.

Findings: Results indicate that peer-to-peer learning activities and good facilitation increase participants' perception of the effectiveness of a demonstration event. Furthermore, characteristics such as the structure of the day, the suitability of the host farm, a trustworthy demonstrator, and group size add much to the effectiveness of a demo event. Group dynamics – including group connectedness and composition – have the potential to impact perceived effectiveness.

Practical implications: The paper contains clear messages for practitioners when designing a demonstration event.

Theoretical implications: Our results connect with theories on motivation and adult learning in the context of farmer learning during on-farm demonstration.

Originality: The paper is based on a rich empirical dataset. It reveals that group size and learning methods are crucial to achieve effective learning outcomes during demonstration events.

KEYWORDS

On-farm demonstration; structural characteristics; facilitation; motivation; peer-to-peer learning

Introduction

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 (EIP-AGRI 2014). Currently, there are many debates about how to organise the production, accumulation and distribution of knowledge to support innovative agriculture (IPES-Food 2016). There is a consensus among scholars and policy makers that farmers prefer to learn from their peers, and that on farm demonstration is a much-valued tool to facilitate this

knowledge exchange amongst peers (Kroma and Flora 2001; Kilpatrick and Johns 2003; Hamunen et al. 2015). In addition, demonstrations offer the potential to enable farmers to learn first-hand about improved agricultural production practices from their peers, as well as from multi-actors (scientists, advisors, policy, etc.). As such, demonstrations are a popular and longstanding extension education tool across the agricultural community (Hancock 1997; Leeuwis and Van den Ban 2004; Burton 2020). On-farm demonstration (OFD) has 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 (Koutsouris et al. 2017). Demonstration can communicate a rich spectrum of messages to farmers; when farmers can see for themselves that a technology works, they are more likely to try it. Conversely, poor quality OFDs can negatively affect the learning process and dissuade farmers from adopting new practices (Mbure and Sullivan 2017). Given their significance and potential, efforts are needed to develop the full potential of OFDs for exchanging knowledge and best practices. If appropriately planned and structured, OFDs can be a very powerful tool providing an environment where active learning can take place through visualisation and discussion (Bailey et al. 2006; Pappa et al. 2018; Yigezu et al. 2018).

The aim of this research is to disentangle the role of the structural dimension in the perceived effectiveness of demonstration events. To do so, an exploratory mixed-methods methodology was used. We analysed the responses to 345 post-demonstration questionnaires filled out by the attendees of 31 demo events held in 12 EU countries, in 2018. The questionnaire data were complemented with qualitative data gathered using an observation tool, interviews and case study reports on the corresponding 31 events.

Theoretical background and analytical framework

The theoretical background of this paper is based on the work done by the research team of the H2020 Agridemo-F2F project. The theoretical basis draws on an analytical framework (devised by Koutsouris et al. 2017) derived from in-depth reviews of structural and functional characteristics (see Pappa et al. 2018 and Ingram et al. 2018 respectively) and a conceptual framework devised to investigate the role of peer learning at OFDs (Cooreman et al. 2018). Drawing on these multiple elements and the wider literature, we now critically explore the key terms and concepts relevant to the central aim of this paper.

Defining on farm demonstration

Demonstration activities can be diverse, ranging from the application of scientific techniques on commercial or monitor farms by both research institutes (Nuthall, Pangborn, and Woodford 2011) and commercial companies (e.g. Bayer ForwardFarming 2020), to farmer-led groups who experiment in more informal ways (Prager and Creaney, 2017). These activities can therefore represent both science-driven

and innovation-driven models (Koutsouris et al. 2017). Demonstration activities can thus be commissioned and organised by a variety of actors within and outside the Agricultural Knowledge and Innovation System (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) that can be subsequently applied in their own farming practices to bring about positive changes on their farm (Adamsone-Fiskovica, Tisenkopfs, and Grivins 2017; Ingram et al. 2018).

Defining effectiveness

Effective OFD activities have multiple different dimensions which have been thoroughly discussed in Cooreman et al. (2018). The Agridemo-F2F project explored effectiveness through the concepts of the extent and nature of learning (OECD 2010, 2013). This paper focuses on the extent of learning which is addressed by both value-added assessment and possible adoption rates. Extent of learning is assessed by (i) the number of participants stating the OFD met or exceeded their expectations; (ii) the number of participants stating they have learned something because of the OFD; and (iii) how much participants learned as a result of the OFD. Possible adoption rates (i.e. putting into practice what was learned) (Rogers 2003) are assessed by the number of participants considering implementation of new practices based on what they have seen during the demonstration. However, the deliberate choice of certain participants to not implement changes on their farm as a result of the OFD event is also a valuable measure, as not all innovative farming practices are applicable to all farming contexts (Cooreman et al. 2021 in this special issue). This reflection is a very important learning outcome of a demonstration.

By focusing on the extent of learning, this paper did not take into account the concept of diffusion, i.e. how many participants acknowledge, after a set period of time, having learned something because of the demonstration event, as well as discussions and interactions on demonstration content with those who did not attend the OFD themselves (Rogers 2003). This would form an important and complimentary avenue for future research.

Defining structural characteristics

The actors and structural arrangements for delivering demonstration activities sit within, and are not independent of, a wider advisory landscape and AKIS (Birner et al. 2009). As such, these structures are of influence at different levels: at AKIS, network, organisation, programme or project and farm or event level. Pappa et al. (2018) discuss the structural characteristics of relevance: actors and their roles, demonstration farm networks, resources and finances, and specific farm and event level characteristics (i.e. type and topic of demonstration, host farm, and frequency, duration and timing of the event). In order to fulfil the aim of this paper, we focus on the characteristics that are crucial at demonstration

event level: the role of the demonstrator and the facilitation, the attendees, the structure of the day and the host farm.

Firstly, the role of the demonstrator is important. Of particular significance, is the background and skills of a demonstrator. They can be a farmer, a researcher, an advisor or a student. Skills relate mainly to how knowledgeable the demonstrator is. Demonstrators need to possess both experience and expertise (Elmquist and Krysztoforski 2015; La Grange et al. 2010). They should be good communicators, trusted, respected and credible. Secondly, facilitation is at the core of collaborative learning and problem solving ensuring effective mediation in the process of demonstration (Leeuwis and Pyburn 2002).

The characteristics of the group also affect the demonstration event. Evidence suggests that farmers get more out of smaller group settings. Ideally, no more than 20 farmers should attend, otherwise it can be difficult for all participants to see and hear, and even more challenging for everybody to get '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). Composition of the group is also relevant and is a key consideration during event recruitment. Factors that shape group composition include whether farmers know each other, and if attendees come from similar farming contexts. As such, working with pre-existing, locally based initiatives, groups and networks can add to the effectiveness of demonstration activities (Franzel et al. 2015; Kiptot et al. 2006). On the other hand, a variety of participant types (in terms of gender, age and levels of prior learning) can prove fruitful – bringing a range of experiences, ideas and perspectives to the demonstration event. Background characteristics such as previous training and experiences of participants are likely to impact the level of effectiveness of OFD (Koutsouris et al. 2017). 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.

With regard to the structure of the day, the duration may vary from half or one full day, to several consecutive days (Koutsouris et al. 2017). Timing can also be a crucial element in recruiting farmers which are dependent on the biological cycle of animals, plants and the weather. As such, it is important to take into account the timing within the day (depending on the milking cycle of cows) or within the season (depending on crop growth cycles). Furthermore, the inclusion of a variety of activities can also impact on the effectiveness of the demonstration (Marchand et al. 2019).

The host farm facilities can impact the effectiveness of the demonstration. Fundamentally, the biophysical context and the farming system determines what can be demonstrated (Pappa et al. 2018). During OFDs, 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). In addition, there seems to be a greater chance of making an impact when a demonstration occurs on an actual working farm, at the field scale, thus setting innovations in 'real' contexts (as opposed to a scientific context, e.g. a research

station), and placing them firmly within the bounds of a farmer's everyday experience (Gibbons and Schroeder 1983; Lauer 2009).

Materials and methods

As data source for this research, we build on data obtained in 2018 through the Horizon 2020 research project, AgriDemo-F2F aims at understanding the role of European commercial demonstration farms. The partners of Agridemo-F2F were responsible for gathering data on a set of case studies (OFDs), using well-structured data collection tools and user guidelines, based on the conceptual framework (Cooreman et al. 2018) and the analytical framework of the AgriDemo-F2F project (Koutsouris et al. 2017). Agridemo-F2F partners were also responsible for translating the answers from the local language into English. During 31 OFDs across the 12 EU countries, described in Table 1, data were gathered using pre- and post-demonstration self-administered surveys, filled in by participants. In addition, interviews with organisers at the programme and/or the event level, demonstrators and host-farmers were also carried out. Additional information on events were gathered through an observation tool which was completed by a national researcher, attending the event. Finally, these results were discussed in focus groups carried out in each partner country. For each case study, this process resulted in a report on the structural, functional and peer learning characteristics of the OFDs (Agridemo-F2F 2020). At last, recommendations were discussed and implemented within the H2020 NEFERTITI project.

Analysis to achieve the overall aim of this study, gaining insights into the link between structural characteristics of an OFD event and the perceived effectiveness of it, was undertaken by the authors of this paper. An explanatory mixed method design (Creswell and Clark 2011) was used, starting with a quantitative analysis of responses of participants collected through the post-demonstration questionnaire (QUAN) (Figure 1). At the end of demonstration events, demonstration participants were asked to indicate their level of agreement with certain statements concerning their experiences during the demonstration, as well as their level of satisfaction pertaining to the overall demonstration. A structured questionnaire covering different areas such as structural, functional, and learning characteristics of the event, along with their opinion on the event's effectiveness was used. Participants' agreement with a variety of statements was measured with a four-point Likert scale, 1 'strongly disagree', 2 'disagree', 3 'agree', 4 'strongly agree', with the ability to answer 'not applicable' and add remarks/explanation.

The data collection culminated a total of 345 questionnaires filled out by participants attending the 31 OFDs. Out of the 42 4-point Likert scale questions, 15 variables were selected that focused on the structural and social interaction aspects of the demonstration event, along with 6 variables aimed to capture respondents' assessment of the 'general effectiveness' of the demo they attended. A factor analysis with principal component analysis and Varimax rotation was employed as a next step to reduce

Table 1. Description of the 31 On-farm demonstration event cases across Europe.

Cases	Topic	Type of Demo	Host Farmer = Demonstrator	Group Size	Nº Post Surveys	Gender		Age			% Farmer participants
						% male	% female	%<30	%31-55	%>55	
AUSTRIA 1	10 trials on fertilisation and varieties in: winter rape, winter barley, winter wheat & grain maize	series	Yes	350	37	97	3	66	14	2	43 mainly students
Austria 2	No-tillage & Roller-Crimper; vermicomposting; agroforestry and flower strips	one-off	Yes	8	8	100	0	0	38	62	88
BELGIUM 1	Agroforestry: nut trees and cattle	one-off	Yes	40	4	100	0	50	25	25	100
BELGIUM 2	Mechanical weed control in maize	one-off	No	100	21	81	19	20	45	35	75
BELGIUM 3	Calculation tool for optimising farm management + new barn with latest technologies in dairy	one-off	Yes	40	15	71	29	29	57	14	93
BELGIUM 4	Care of orchards	series	No	10	4	100	0	0	100	0	0
DEnmark 1	Roughage for organic milk cows	one-off	No	100	4	100	0	unknown	75		
DEnmark 3	Intelligent buffer zones	series	No	20	9	70	30	11	56	33	11 mainly advisers
Spain 1	Organic production of milk and other dairy products	one-off	Yes	20	20	80	20	100	0	0	55 mainly advisers
Spain 2	Resource management to improve efficiency and productivity	one-off	Yes	12	12	75	25	100	0	0	92
Spain 3	Pistachios crop	one-off	Yes	5	2	50	50	50	50	0	50
France 1	New barn, farmer co-working, robot and grazing	series	Yes	15	11	55	45	27	64	9	64
France 2	Experimental vegetable farm tour	yearly	No	36	6	83	17	0	100	0	100
France 3	Parasitism on Heifer	series	Yes	6	4	100	0	0	100	0	100
GReece 1	Alternative spraying tools and equipment + farmers' health and environment protection	one-off	No	30	22	77	23	15	77	8	77
Greece 3	Cheese production	yearly	No	7	7	86	14	43	57	0	43
Ireland 1	Agroforestry: establishment options & management	Series	Yes	9	5	80	20	20	40	40	60
Ireland 2	Organic cereal production and on-farm processing	series	Yes	50	15	47	53	17	33	50	33
Ireland 3	Beef production and cross breeding	yearly	No	700	27	88	12	14	67	19	60
The Netherlands 1	Precision farming in arable farming (potatoes)	one-off	Yes	50	10	70	30	90	10	0	80
The Netherlands 2	Open greenhouse days; red pepper	yearly	Yes	25	11	91	9	9	82	9	64

Cases	Topic	Type of Demo	Host Farmer = Demonstrator	Group Size	Nº Post Surveys	Gender		Age			% Farmer participants
						% male	% female	%<30	%31-55	%>55	
The Netherlands 3	Strawberry demo day: vertical ventilation strawberry	yearly	Yes	25	13	92	8	39	46	15	54
POLAND 1	Conventional and organic farming	series	Yes	20	20	61	39	23	77	0	44
POLAND 2	Maize production; decision support system in plant protection; computer + gps control of agricultural machinery	yearly	Yes	25	25	75	25	8	50	42	58
POLAND 3	Specialised organic vegetable production	yearly	Yes	18	13	15	85	33	50	17	77
SERBIA 1	Lora system for communication with sensors and meteorological stations	series	Yes	50	11	80	20	60	40	0	67
SERBIA 2	Repetition of event SE1	series	Yes	30	8	87	13	86	14	0	63
SWEDEN 1	Growers day; plots at biogas facility, winter wheat, ley and canola fields	yearly	Yes	15	4	unknown					
SWEDEN 2	Samzones-protectives zones in or around fields	series	Yes	30	3	unknown					
United Kingdom 1	Alternative methods for terminating cover crops	series	No	6	6	100	0	33	33	33	66
United Kingdom 2	Benchmarking in arable framing	series	Yes	25	3	66	33	66	33	0	33
Total	31		22 Yes 9 No	1877	345						
Average						78%	22%	39%	44%	17%	66%

the set of 15 variables. To increase our understanding of the results from the factor analysis, and to define a label for each factor, we specified which concept the statements within each factor refer to. Furthermore, qualitative data from the observation tool, the interviews and the country reports was used to supplement quantitative results and derive a better understanding. These data sources were coded for quotes related to each of the factors (Figure 1). Finally, the three generated factors, which resulted from the factor analysis, were used to compute new continuous independent variables, which then fed a Multiple Linear Regression model with general effectiveness as the response variable, in order to understand how the generated factors could predict the general effectiveness of a demonstration event. At last, we discuss the results based on existing literature and theories on the relevant concepts.

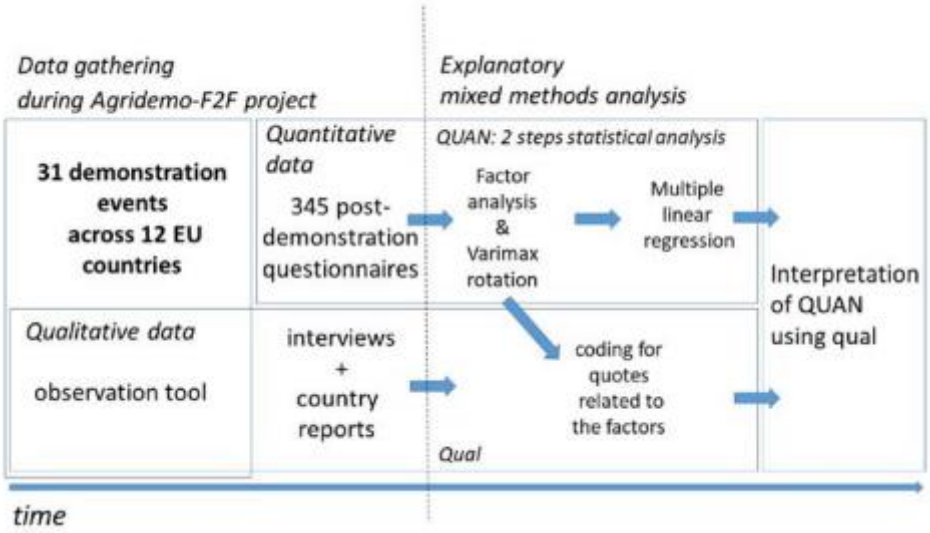

Figure 1 Data gathering and explanatory mixed methods approach.

Results

To address the effectiveness of an OFD, a dimension, named as 'general effectiveness' (Table 2), was constructed using 6 variables. This dimension was based on our theoretical definition of effectiveness and comprised three variables describing the evaluated effectiveness of the event(s) based on participants expectations (value assessment) and three variables which focused on participant statements about their readiness to implement specific actions as a result of the event they attended (potential adoption). The reliability test of this dimension returned a Cronbach-alpha score of 0.80, which implies a very good internal consistency of the scale created (Malhotra et al. 2006).

Table 2 The list of variables, which formed 'general effectiveness'.

'General Effectiveness'
Cronbach-a = 0.804
The demonstration met my expectations regarding what I wanted to learn.
The demonstration exceeded my expectations.
How effective did you find the demonstration for you to learn something?
I thought about how I could implement some of the ideas and practices on my own farm.
I felt like the demonstration increased my ability to rely on myself as a farmer.
I'm thinking about an action I could undertake myself, because of the demonstration.

Subsequently, a factor analysis with principal components and Varimax rotation was run with the remaining 15 variables. The factor analysis generated three factors, explaining 54,336% of the variables' variance (Table I – Annex, Supplementary material). Table 3 presents how the 15 variables were categorised in the three factors, in descending factor loading order. To better understand the grouping of these statements, the theoretical concepts to which the statements refer to were added in bold. The grouping of the statements and associated concepts also aided to define a label for each factor: the first factor was named 'interaction and facilitation', the second one 'structural set-up' and factor 3 'group dynamics'. Reliability tests for the variables comprising each of the three generated factors were then performed to ensure the internal consistency of the three scales and their suitability for composing new continuous variables. As depicted in Table 3, the 'interaction and facilitation' factor variables returned a Cronbach-alpha score of 0.815; the 'structural set-up' factor variables a score of 0.703; and the 'group dynamics' factor variables 0.678. These scores indicate that it is adequate to produce three new continuous variables from the mean score of variables in each group. Based on the qualitative data analysis, the ensuing sections detail the interpretation of each of the three factors.

Interaction and facilitation

For the first factor 'interaction and facilitation', we can clearly distinguish a set of statements that relate to creating an open, friendly atmosphere, engaging farmers to (actively) participate in the demonstration event, motivating them and make them feel confident to
share their knowledge. The importance of a structured, facilitated process was also confirmed by focus group reports.

To have a professional facilitator can also be important for a good dialogue. It may also be that person who is able to pick up questions and comments from visitors, or the one who challenges or provokes in a nice and interesting manner. (Denmark & Sweden report)

Table 3 The lists of statements comprising the three factors.

Factor 1 = Interaction and facilitation *Cronbach-α* = 0.815	**Factor 2 = Structural Set-up *Cronbach-α* = 0.703**	**Factor 3 = Group dynamics *Cronbach-α* = 0.678**
If participants didn't agree with each other during discussions, somebody (demonstrator/other participant) tried to reach a consensus between them. *(.754)* **C: Facilitation**	I think the day was well structured. *(.770)* **C: Structure of the day**	A lot of the other participants are part of the same farmer network as me. *(.814)* **C: Group connectedness**
I had the feeling that I could share my own knowledge as relevant information. *(.599)* **C: Interaction and competence**	I think the host farm operation was well suited for this demonstration. *(.739)* **C: Host farm**	I could relate well to other participants. *(.643)* **C: Group connectedness**
I got along very well with the demonstrator. *(.575)* **C: Participants can relate to the demonstrator**	I think the demonstrator had the right skills to carry out the demonstration. *(.726)* **C: Role of demonstrator**	I think the group consisted of an interesting mix of people. *(.630)* **C: Group composition**
The demonstration felt like an informal activity to me. *(.558)* **C: Informal interactions**	The group was the right size. *(.569)* **C: Group size**	
I felt encouraged to ask questions during the demonstration. *(.549)* **C: Facilitation and interaction**		
When there were discussions, I felt comfortable sharing my opinion. *(.549)* **C: Interaction and competence**		
It was my own choice to be here. *(.509)* **C: Autonomy**		
I had the feeling the demonstrator was like one of us. *(.476)* **C: Participants can relate to the demonstrator**		

Source: Table II – Annex.

Looking to the statements included in this factor, we recognise that a focus on peer-to-peer activities, including informal exchanges, can be crucial and stimulating in this context. Quotes from the reports support the importance of a climate that fosters peer-to-peer exchange:

I think hearing it from the farmer themselves. It was made up of predominately a farmer audience so it was peer to peer learning and I think that made it very effective. (Ireland demo1 – Demonstrator)

Structural set-up

For the second factor, mainly structural characteristics related to the host farm and demonstration-set up were discerned. In the first instance, we see that the structure of the day, which relates to the time available for planned activities, seems to be an important factor influencing effectiveness. Regarding this, at least seven case study reports cited 'more time' as a way to improve the demonstration activity.

Ideas for improvement could be to make the demonstration last for more time than 5 hours. (Poland demo1 – report)

In addition, at least eight case study reports mentioned the importance of organisation, scheduling and structure of the demonstration to the effectiveness of OFDs. This highlights the importance of thorough preparation, for example regarding timing.

The participants seemed interested in the demonstration, but everything was a bit rushed, since there was very little time for each presentation. This also meant that there was very little time for questions and no time for discussion. (Denmark demo1 – report)

The data also suggests that the deployment of a combination of different learning activities has the potential to increase the effectiveness of a demonstration. The importance of interactive activities such as hands-on experiences or opportunities to try methods for themselves emerged strongly in the thematic analysis of the interview transcripts. There was a good degree of consensus around the importance of 'seeing' and even 'doing' things.

It's a mix of a little bit of theory but importantly getting out…I think if they can get out and kick a tyre or feel some dirt, that's their life, they're practical people, ultimately. Even if it's a financial one, I've done a meeting on banking, you can give them a financial exercise to work out - as long as they're doing something, that's OK. (UK demo2 – programme interviewee)

Secondly, participants need to be able to relate to the farm and the host operation should suit the demonstration. The qualitative data revealed that a demo event is preferably hosted on a commercial working farm, and at field scale. This ensures the event relates – at least in part – to farmers' everyday practices, enabling more effective peer-to-peer learning. The importance of the similarity to 'real life' conditions can be reflected in terms of production systems, agricultural practices, technologies and constraints.

Works for us to be honest, we're a farm not a show farm. I think a mixture works for us. Some of that is off the back of the fact we are a mixed farm, so we have livestock. And some of what we do on the arable side influences the livestock and vice-versa, that's why it's more of a whole farm approach. (UK demo2 -farmer)

A third factor is the (perceived) skills of the demonstrator. A demonstrator that is recognised by the community of participants as knowledgeable, honest and dedicated, increases the trust participants will have in their teaching, and thus, is likely to influence the impact of the demonstration. Furthermore, it is also important that a demonstrator is adequately skilled to lead demonstrations (either entirely or in part) and facilitate discussion.

The demonstrator is a real farmer with real aims to share knowledge and he has a lot of experience and field access (from other farmers). (UK demo2- Participant)

Lastly, based on the descriptive analysis, the possible link between group size, and (perceived) demonstration effectiveness was explored. Based on our experience within the Agridemo-F2F and NEFERTITI consortium, the following numbers for group size were chosen: a large group has more than 100 participants, a medium-size event has between 25 and 99 participants, and a small group consists of a maximum of 24 participants. Although it is recognised that there is no good or bad group size, a general preference for smaller demonstrations was broadly shown by the data. Notably, participants from smaller demonstrations were more likely to rate the demonstration as 'effective' (Table 4). Also the question asking whether participants perceive the group size as the 'right size' revealed similar conclusions. Participants attending a demonstration with small participant groups answered more positively compared to their counterparts who attended medium and large events. Both associations were significant at the 0.05 level (Table 5).

Table 4 Responses to 'was the demonstration effective?' according to the group size.

	Not effective *or* Neutral	**Effective**
Large	36.8%	63.2%
Medium	25.9%	74.1%
Small	19.2%	80.8%

These results are reinforced by the qualitative analysis. For only one demonstration event, the attendance at a large demonstration event (an event of approximately 350 people) actually resulted in a (perceived) effective demonstration. On the contrary, 13 event reports clearly suggest that smaller groups are more effective. This is attributable to the fact participants were easier to ask questions and gives everybody the opportunity to take part in group discussions which support more interaction. Across

Table 5 Responses to 'was the group size right?' according to the group size.

	Disagree	Neither agree nor disagree	Agree
Large	14.6%	52.4%	32.9%
Medium	29.5%	33.9%	36.6%
Small	4.6%	38.5%	56.9%

the qualitative responses, a group size of less than 30 attendees emerged as an optimum. The following quote is taken from host farmer interview attests this.

If they have questions to ask, they will be able to ask them, whereas when a group is too big, what happens is that there are multiple smaller groups that form themselves. (France demo1, Farmer)

However, the qualitative data also revealed that there is no 'one size fits all' for demonstration numbers. The optimum size of the group is strongly linked to the objective or goal of the demonstration activity, and the optimum scale will – and should – vary accordingly. As illustrated with the following example from a Belgian demonstration event, the farmer specified how, for a machinery demonstration, a larger group is appropriate. By comparison, he recalled how a topic demanding more interaction and discussion is better suited to a smaller group size.

Well that depends I think, now for machine demonstration 200 people is good, doesn't have to be more. Sometimes when you want to focus more on a practice or if you want verbal interaction, smaller groups with for example five people is better. It really depends on the topic (Belgium demo2- host farmer)

Based on the qualitative data, it was apparent that desired group size influenced selected recruitment methods. If the intention is to run a large-scale demonstration, the event is typically advertised widely, and through a number of different channels. By comparison, smaller events can and should utilise more informal methods, e.g. word of mouth. 'Bigger events with researchers as speakers are advertised via our member journal and newsletter some time in advance to address a wide audience. SMS and email are more effective for smaller events like field days and allow planning on a short-term basis' (Austria demo2- host farmer)

The intended group size can also be determined by the host farm. Practicalities that need to be considered when deciding on the 'right' group size include sufficient space for parking, access for participants and abundancy of facilities such as furniture, toilets, audio etc. The importance of clear audio and visuals was stressed across the sample, which should be also guaranteed in bigger groups. Screens, (portable) microphones and loudspeakers need to be provided particularly when demonstrations are aimed at larger audiences. When people are unable to hear what is being said, the effectiveness of the demonstration will be limited (regardless of the quality of the content).

Group dynamics

The third factor relates to OFD participants, specifically how well participants know each other, and group composition, i.e. the mix of participants in attendance. The qualitative responses support the importance of group dynamics. In the case of the UK demonstration below, the fact that the group had met before was seen as advantageous.

[Mentioned as a factor contributing to effectiveness:] The fact the group had met before meant participants and demonstrator could build on previous discussions and had prior knowledge. (UK demo1 – report)

The results also indicated that a mixture of attendees can be a good basis for starting inspiring discussions. Approaches to recruitment do not just impact group size, but also shape the composition of the group; using different channels can encourage a mixture of attendees, while sending the invitation within one specific sector network will probably bring similar profiles of farmers. Group composition is also linked to group connectedness. Groups can differ regarding age, gender, occupations, expertise, interest, commitment, openness, etc.

Announcement of the event through diverse channels brought a mixture of attendees, encompassing farmers and students, and professors of agriculture. This created a good starting point for discussion among participants. (Spain demo1 – Programme interviewee)

As such, defining the target group for recruitment is important and might be broad in scope (all agricultural actors) or more specific by sector (dairy farmer, organic farmer). Some topics and organisations have particular groups (innovators, new entrants) or minority groups, e.g. young farmers or women farmers. Furthermore, organisers can focus on a specific network, province, or target a nationwide audience.

General effectiveness

The second step of the statistical analysis encompassed a multiple linear regression (more details in Annex, Tables III–V, Supplementary material) to try to ascertain how much each of the factors attribute to the effectiveness of the demonstration event. The F-test was found significant at the 99.5% confidence level ($F(3,327) = 100.605$, $p < .005$) and the multiple linear regression model summary revealed that the adjusted R^2 of the model is 0.475. All three variables contributed positively and statistically significantly to the prediction of the dependent variable ($p < .05$) meaning that at a 95% confidence level, the hypothesis that each factor does not impact on the model is rejected. This analysis revealed that the general effectiveness of *interaction and facilitation*, *structural set-up* and *group dynamics*, could be predicted as follows:

Model Equation: GENERAL EFFECTIVENESS = 0.274 + 0.426 * (interaction) + 0.268 * (structural set up) + 0.172 * (group dynamics)

Furthermore, the three independent factors used in the multiple linear regression explain 47.5% of the variance of the perceived effectiveness by the participants. The coefficients in the model equation reveal that *interaction and facilitation* (0.426) is the most important factor in creating an effective demo event.

Discussion

The aim of this paper is to understand the role of the structural dimension in the effectiveness of OFD events. The mixed-methods approach reveals that (in order of magnitude) i*nteraction and facilitation*, the *structural set-up* and *group dynamics* during the event all add to the perceived effectiveness of a demonstration event.

A first observation pertains to the *interaction and facilitation* statements, of which many encompass concepts related to motivation. Self Determination Theory (SDT) (Deci and Ryan, 2000) states that a satisfaction of the three basic psychological needs: autonomy, relatedness and competence are required to support optimal functioning, personal growth and intrinsic motivation. These concepts are clearly present in this factor *interaction and facilitation*. For example, 'autonomy' is represented by the statement 'It was my own choice to be here'; 'competence' by 'I had the feeling that I could share my own knowledge as relevant information' and 'When there were any discussions, I felt comfortable sharing my opinion'; and 'relatedness' by 'I got along very well with the demonstrator', 'I had the feeling the demonstrator was like one of us' and 'The demonstration felt like an informal activity to me.' This suggests that if a demonstration event can realise a space that can satisfy these three basic needs of the participants, then the event will likely provide a space in which participants can (actively) join the discussions and can start an internalisation process (Ryan and Deci 2000) of externally regulated behaviours. This internalisation process is defined as 'an active, natural process in which individuals attempt to transform socially sanctioned mores or requests into personally endorsed values and self-regulations' (Deci and Ryan 2000). This suggests that participants taking part in events that create a motivational space are able to start the internalisation process of the practices shown and discussed during that event, meaning that they value the practices and might change their behaviour to align with these practices. Factors that may increase the likelihood of this internalisation process occurring are both peer-to-peer interaction and strong facilitation. Strong facilitation is imperative for managing critical discussion among participants with the view that over time and with successive events, deeper levels of understanding, inquiry, and innovation can be created. This is of particular significance given that open dialogue and discussions are widely recognised as crucial to learning about and for sustainable agriculture

(Tilbury 2011; Dyball, Brown, and Keen 2007). A recently developed evaluation framework for agricultural extension and education projects – the VELVET approach (Charatsari and Lioutas 2020) – also emphasises the importance of participation and learning to (re-)shaping farmers' value systems, and the contribution to his or her empowerment and transformation. Correlation with the SDT framework in our study is surprising (as the research was designed independently of this), but serves to emphasise the importance of these elements in OFD design. Although this is a clear finding, further testing this SDT framework in future research on motivation for peer learning in OFDs should confirm these findings.

Based on the results related to the second factor, *the structural set-up*, demonstrations should comprise a range of diverse activities and adhere to the schedule for planned activities. Examples may be field walks, observing practical demonstrations, and letting participants carry out hands-on activities. Such practical activities can support participant interactions, and boost understanding and learning amongst participants. This result mirror existing farmer learning frameworks in the agricultural literature, such as experiential learning (Kolb 1984) or as learning-by-doing (Dewey 1938; Millar and Curtis 1997; Lankester 2013) and the principles of Knowles (1980), in which hands-on experimenting has proved to effectively mediate knowledge and skills. In addition, evidence was found in the wider literature that the creation of cognitive conflict, the 'starting point' for reflection on participants' own farming practices/learning, can be generated by 'surprises', i.e. showing or discussing the unexpected (Brédart and Stassart 2017). As such, OFDs can benefit from surprise effects that have the potential to destabilise the participants thinking. Furthermore, in many contexts of application, the concept of relatedness is very relevant in creating value through personal and interpersonal relationships and relatedness may also increase the satisfaction people experience in their contact with the natural environment (Forleo and Palmieri 2018). To promote relatedness between participants and the host farm, demonstrations can benefit from being carried out on local farms, rather than on an extension plot or research stations (Miller and Cox 2006; Oakley and Garforth 1985). Third, when looking at our results and the supporting literature on what is expected from a demonstrator, characteristics such as knowledgeable, honest, dedicated and trust are important. The importance of trust is also illustrated in a recent study of Burton (2020) within which the lack of trust between demonstrators and participants is highlighted as one of the failures of early, nineteenth-century demonstration activities. Furthermore, the demonstrator needs to be skilled to manage discussions and guide participants on the farm. We propose the concept of the 'trustworthy' demonstrator to indicate this. A clear list of preferred characteristics for this concept could help to facilitate demonstrator recruitment, but would also aid demonstrator training. In addition, the demonstration can be farmer-led, thus providing a sense of ownership for both the demonstrator and participants (Bailey et al. 2006; Miller and Cox 2006). When the host farmer is the demonstrator, events benefit from having a dedicated farmer who is an expert in his or her farm, who is well-placed to field questions and open up discussions in a way that is naturally respected amongst their peers; by virtue of these characteristics the host farmer becomes a 'trustworthy' demonstrator. Lastly, our results indicated

a general preference for smaller groups. Small groups create more effective opportunities for organised peer learning (Topping et al. 2017). Despite a preference for smaller groups, it is possible to increase participation in larger demonstrations by actively giving participants the opportunity to share their experiences with the audience by organising smaller group/breakout discussions or by organising follow-up workshops in which active knowledge exchange is stimulated. This has also been confirmed by a recent but smaller study from Frick et al. (2019) based on data from 4 Swiss demonstration events.

The wider literature does echo our findings on *group connectedness* and the importance of building on previous discussions and prior knowledge (Grudens-Schuck et al. 2003; Velardi et al. 2020). Each farmer has their own prior knowledge, conceptual understanding, skills and beliefs. This frame of reference will influence farmers' thinking during a demonstration event, and they will likely interpret and respond to different aspects of the demonstration and learning environment. New learning is constructed on the basis of prior knowledge (Bransford 2000). Starting with benchmarking and assessing what farmers already know through asking questions and shaping the demonstration and discussions around this is a possible technique. However, sometimes, prior knowledge can be resistant to change, and if so, the demonstrator will need to assist farmers to unlearn what they already know (Brookfield 1995). A strategy for ascertaining and subsequently changing unwanted knowledge involves surprising learners with situations that enable them to experience a 'disorienting dilemma' (Mezirow 1991). When the group of participants is more homogenous, this prior knowledge building, or unlearning when needed, can often be easier. Furthermore, when participants perceive each other as relatively equal, like-minded and equally knowledgeable, it can favour trust and thus support the openness during the OFD. On the other hand, the combination of different types of actors can be beneficial to spark discussions, introduce other opinions and encourage participants to look at the same problems together from different angles (Dyball, Brown, and Keen 2007; Beers, van Mierlo, and Hoes 2016). For example, during a recent study of Singh et al. (2018), agricultural producers suggest that cover crop demonstration sites and field days allow for learning about practices from persons outside their regular social and professional network. This group connectedness is also something that farmers appreciate during their learning activities. The sense of belonging to a community of diverse farmers and agricultural scientists who shared an interest in learning is often cited as the number one benefit for farmers participating in extension activities (Knook et al. 2018; Velardi et al. 2020). However, we need to exercise caution. Different opinions are positive when they relate to the specific task or application of knowledge (Topping et al. 2017). In contrast, personal and social comparisons (particular relating to competences) can be unhelpful (Buchs and Butera 2015).

Conclusion

Given both their significance and potential, this paper has responded to a need to understand the role of OFD's structural dimensions and characteristics in their perceived effectiveness. Three important factors

emerge to explain 47.5% of the effectiveness of an OFD within the Agridemo-F2F cases. In terms of *interaction and facilitation*, the importance of three basic needs can be identified: autonomy, relatedness and competence, as per SDT theory. As such, our study indicates that if the three basic needs are fulfilled by the OFD, participants will be more likely to actively join discussions and perceive the event as effective. Therefore, we hypothesise that the creation of a motivational space might lead to a better learning process and internalisation of practices shown, whether eventually implemented on their own farm or not. However, this remains a hypothesis, as this was not extensively tested in this research. The results suggest a variation of peer-to-peer learning activities and good facilitation add much to the motivation to learn and thus to the participants' perception of the effectiveness of an OFD. In addition, the *structure* of the day, including available time for the planned activities and time management, the suitability of the host farm, the use of a trustworthy demonstrator, as well as group size, contribute to the perceived effectiveness of a demonstration event. Lastly, *group dynamics* also have the potential to impact the effectiveness of a demonstration event, mainly relating to group connectedness and group composition.

Understanding of these three structural characteristics and their role within demonstration effectiveness are likely to be of significant value for organisers of demonstration events and are further exploited in the H2020 NEFERTITI project. Furthermore, this study indicates that OFDs offer a way to involve farmers within the AKIS community and thus support innovation through co-creation activities. The importance of both good facilitation and trustworthiness of demonstrators highlighted in this paper are also likely to be useful to inform policy discussions and decision making in relation to education and training of facilitators, demonstrators and demonstration organisers (EU-AKIS 2019).

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