D2.4: A typology of on-farm demonstration activities

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Content

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1. Introduction

This document describes the creation of a typology of on-farm demonstrations. To build this typology, we use data from the FarmDemo inventory (D2.3) of demonstration farms and organizations, and by doing so, create a bridge between the FarmDemo inventory (Task 2.3) on the one side, and the case study analyses (WP3-4-5) on the other side, as this typology will be used for case study selection. The development was done in several steps, moving from a typology based on literature to a data-driven typology.

In this typology, demonstration farms are grouped into coherent groups, based on a range of characteristics defined in the inventory. This should enable and assist us to achieve a balanced selection of case studies, and to ensure adequate diversity in our case studies. This will in the first place entail good geographical coverage and representation of all key farming sectors while ensuring a sufficient cross cutting thematic coverage to represent a number of interests and priorities in Europe. In addition, diversity in other characteristics, e.g. participation in a network or programme or scale and scope of demonstrations, need to be taken into account.

2. Development process

Several steps were taken to create a meaningful typology, moving from an approach based on literature to a data-driven approach.

2.1. Two-dimensional typology

To create a first typology, we selected two dimensions based on literature and discussed within the analytical framework of Agridemo-F2F (Koutsouris et al. 2017).
Dimension 1 discerns between single techniques versus a whole-farm focus during demonstrations. 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 on one crop. Single component technologies are the least complex and can easily be managed. Whole farm approaches are composed of several elements which cannot be easily applied separately or which require changes in the farmers' production pattern. Whole farm approaches are thus considered to be more complex because they involve several interacting components, so dimension 1 also gives an indication of the complexity of the farm demonstration activities.
Dimension 2 focuses on science-driven versus innovation-driven[1] demonstrations. Science driven demonstration activities demonstrate research which follows a classical hierarchical flow from science to potential users ('top-down approach'). Innovation driven demonstration activities demonstrate research activities which empower the potential users themselves ('bottom-up approach').

2.1.1. Relating dimensions to the survey data: data transformation

To enable a cluster analysis, based on these two dimensions, we first converted the results from the survey into suitable numerical variables or scores for analysis. For dimension 1, this was quite straightforward, since this dimension is specifically addressed by a specific question in the survey:

"To what extent are your demonstrations focusing on single practices (mulching, machinery, application of pesticide) or more related to a whole farm approach (multiple practices linked to the overall farm management)?"

For this question there are five answer options, which can then be transformed to a set of scores for analysis (Annex 1).

For Dimension 2, we decided to address this dimension through the combination of 3 questions from the survey, i.e.:

"Please indicate the primary organiser of each of the main topics on which you provide demonstration activities"

[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).

"Please indicate the two most important funders of the demonstration activities"

"Who are the two main demonstrators/instructors in the demonstration activities?"

Although none of the 3 questions gives a direct answer to the question on whether a demonstration is more science-driven or more innovation-driven, we consider the combination of these 3 questions a suitable proxy. The conversion of the survey responses to scores is less straightforward than for Dimension 1, since we need to convert string variables (e.g. farmer, researcher…) to a set of scores relating to the dimension. To do so, we created a set of decision rules. Scores were given independently by 3 researchers, after which a final score was proposed for each of the string variables. Finally, for each respondent, the score on Dimension 2 was calculated as the average score for the 3 questions (Annex 1). Higher scores indicate a more innovation-driven approach.

2.1.2. Cluster analysis

Clustering was done by using the SPSS hierarchical clustering method (single linkage or nearest neighbors method). This procedure attempts to identify relatively homogenous groups of cases based on selected characteristics. Single linkage clustering is based on grouping clusters in bottom-up fashion (agglomerative clustering), at each step combining two clusters that contain the closest pair of elements not yet belonging to the same cluster as each other.

2.1.3. Results

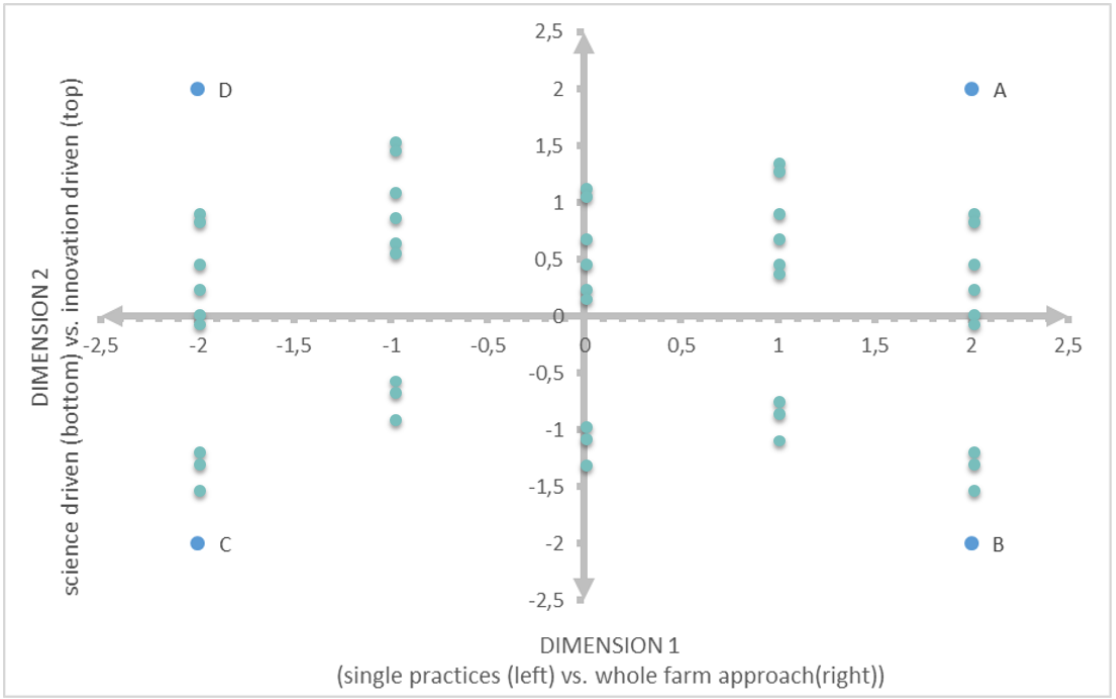

Figure 1: Illustration of two-dimensional typology

Results show that for each dimension there is a continuum of demonstration farms along these dimensions, and as such we can conclude that these dimensions do exist in reality. However, the combination of both these dimensions did not reveal any specific types. As such, we can conclude that a typology based on the results from literature revealed no meaningful clusters in our inventory data set.

2.2. Data driven typology – step 1

In the second stage of our analysis we decided to follow a data-driven approach, rather than working with pre-set dimensions. We used data of 628 European demonstration farms collected at that point in time in the FarmDemo inventory. Statistical analysis of the data is performed using SPSS version 18 (IBM Corporation, San Diego, CA, USA).

2.2.1. Selection of variables

The FarmDemo survey is composed of two main parts, a compulsory part A (necessary for farmers to appear on the inventory map), and an optional part B (for analytical purposes). Since approx. 25% of the respondents did not complete part B of the survey, we decided to include only part A variables in our typology.

Based on theoretical insights and the available information in part A of the survey, we selected 10 variables to be included in the analysis for the typology: number of crops (i), number of animals (ii), number of demo topics crops (iii), number of demo topics animals (iv), number of demo topics other (v), number of demo topics total (vi), network membership (vii), main organizer (viii), number of visitors (ix) and scope (i.e. single techniques vs. whole farm approach; x). Similar to what is described under 2.1.1 all string variables (e.g. names of various crops) were converted into numerical variables, allowing to compute new variables such as number of demo topics, number of crops, number of animals, etc.

2.2.2. Categorical principal components analysis (catPCA)

The goal of principal components analysis is to reduce an original set of variables into a smaller set of uncorrelated components that represent most of the information found in the original variables. By reducing the dimensionality, you interpret a few components rather than a large number of variables. Standard principal components analysis assumes linear relationships between numeric variables. On the other hand, catPCA allows variables to be scaled at different levels (nominal, ordinal, numeric). CatPCA is the nonlinear equivalent of standard PCA, and reduces the observed variables to a number of uncorrelated principal components.

2.2.3. Cluster analysis

In the following step, components extracted from the catPCA analysis are used as clustering variables. For this purpose, the SPSS hierarchical clustering method (single linkage or nearest neighbors method) is used. This procedure attempts to identify relatively homogenous groups of cases based on selected characteristics. Single linkage clustering is based on grouping clusters in bottom-up fashion (agglomerative clustering), at each step combining two clusters that contain the closest pair of elements not yet belonging to the same cluster as each other.

2.2.4. Results

The goal of the catPCA is to extract a number of principal components (dimensions) to be used as clustering variables. Eigenvalue and Cronbach's alpha (Cronbach, 1951) are compared for each scaled model in comparison to the previous model. The objective of this evaluation is to maintain internal consistency among the dimensions, while aiming prospectively for an increase in variance explained by the scaled model.

CatPCA results in a reduction of the original set of 10 variables into a smaller set of 5 dimensions.

Table 1 presents the component loadings, eigenvalues and Cronbach's alpha (a measure of reliability) of the 5 dimensions. As component loadings indicate Pearson correlations between the quantified variables and the principal components, they range between -1 and 1. The first dimension is highly positively correlated to the number of crops, number of demo's on crops, number of demo's in total and moderately positively correlated to the number of animals and the number of demo's on animals. The eigenvalue is 3,883 (Cronbach's alpha : 0,825). The second dimension is highly positively correlated to the number of animals and the number of demo topics on animals, and moderately negatively correlated to the number of crops and the number of demo's on crops. The eigenvalue is 1,856 (Cronbach's alpha : 0,512). The third dimension is highly positively correlated to network membership, and number of visitors. The eigenvalue is 1,620 (Cronbach's alpha : 0,425). The fourth dimension is highly positively correlated to the mean organizer score (bottom-up approach) and the scope (whole farm approach. The eigenvalue is 1,544 (Cronbach's alpha : 0,391). The fifth dimension is highly positively correlated to the number of other demo topics and highly negatively correlated to the mean score of the organizer (top-down approach). The eigenvalue is 1,438 (Cronbach's alpha : 0,338).

Table 1: Component loadings and eigenvalues of the 5 dimensions, Legend : + : 0,45 - 0,65; ++ : >0,65; - : -0,45 - -0,65, -- : <-0,65

	DIMENSION				
	1	2	3	4	5
Nb_Crops	++	-			
Nb_Animals	+	++			
Nb_Demo_topic_crop	++	-			
Nb_Demo_topic_animals	+	++			
Nb_Demo_topic_other					++
Nb_Demo_topic_total	++				
Network			++		
Organiser_mean_score				++	--
Nb_visitors			++		
Scope_Q70				++	
Eigenvalue	3,883	1,856	1,620	1,544	1,438
Cronbach's Alpha	0,825	0,512	0,425	0,391	0,338

The cluster analysis classified 575[2] cases in 7 distinct clusters with sufficient differentiation among the dimensions. The mean object scores of the 5 dimensions for the 7 clusters are summarized in Table 2.

Clusters differ significantly in number of crops, number of animals, number of demo topics on crops, animals or other topics, total number of demo topics, scope (single farm practices versus whole farm approach), network membership, number of visitors and primary organizer of the demonstration activities.

Table 2: mean object scores of the 5 dimensions for the 7 clusters, Legend : + : 0,45 - 0,65; ++ : >0,65; - : -0,45 - -0,65; -- : <-0,65

CLUSTERS	Number of cases	DIM 1	DIM 2	DIM 3	DIM 4	DIM 5
1	146		-	++	+	++
2	245	-		--		
3	66			++		--
4	11	++	--	-		--
5	75	--			--	++
6	10	++	++	--		--
7	22	--	--	++	--	--

Combining categorical principal component analysis with cluster analysis results in seven types of demonstration projects (Table 3)

Table 3: Typology of demonstration farms based on catPCA and cluster analysis

CLUSTERS	Number of cases	DESCRIPTION
1	**146**	**Network; Many visitors; Whole farm approach; Research organized**
2	**245**	**Few demo's; No network; Few visitors**
3	**66**	**Network; Many visitors; Farmer/farmer organization/supply chain comp organized**
4	**11**	**Many demo's; Crop topics; No network; Few visitors; Farmer/farmer organization/supply chain comp organized**
5	**75**	**Few demo's; Single practices; Research organized**
6	**10**	**Many demo's; Animal topics; No network; Few visitors; Farmer/farmer organization/supply chain comp organized**
7	**22**	**Few demo's; Crop topics; Network; Many visitors; Single practices; Research organized**

[2] 53 cases could not be classified. They either belonged to clusters with a number of cases <10, or were categorized as outliers

2.2.5. Feedback on typology 1 from partners during GM3 in Vienna:

These results were presented during the 3rd General Meeting to all partners, representing multi-actors (both practitioner partners and scientific partners). During the discussion in Vienna, it became clear that, although the typology is necessary for our case study selection, it should not be the only element guiding the case-study selection. As a result of these discussions, we propose three main elements or levels in the case-study selection process which will be detailed further in D2.5:

- *The typology*: discussions indicated that to come up with a meaningful typology it should not be overly complex, but rather built on a relatively limited number of variables. Ideally, the typology should distinguish demos on basis of approach/process rather than topic/sectors/numbers.
- *A set of additional characteristics/variables*, not to be included in the typology, but for which we need to check the overall distribution across the case-study set: e.g. are the majority of case studies commercial farms, do we have a good distribution of sectors and topics across the case studies, etc…
- *Expert knowledge*: some interesting variables/characteristics were mentioned, for which we have no suitable questions in the inventory. Examples of this were the farming systems scale (ranging from agroecological to conventional) or the technology level (from traditional to high tech). We will need to evaluate/consider if partners have sufficient knowledge on the individual case studies to assess these characteristics.

Based on these comments, we decided to perform a second step towards our final typology.

2.3. Data driven typology – step 2

Within this second step, we repeated the combination of catPCA and cluster analysis, described in step 1, with two main differences:

- Since the feedback during the GM3 in Vienna indicated that the questions on 'topics' were considered to reveal little relevant information for the construction of a typology of demonstration farms, we decided to reduce the number of variables to 5, i.e. network membership (i), main organizer (ii), number of annual visitors (iii), number of annual demonstration events (iv) and scope (i.e. single techniques vs. whole farm approach; v).
- Data analysis was done on 735 farms, compiled in our inventory at the time of this second step.

2.3.1. Results catPCA + cluster analysis

CatPCA resulted in a reduction of the original set of 5 variables into a smaller set of 3 dimensions.

Table 4 presents the component loadings, eigenvalues and Cronbach's alpha (a measure of reliability) of the 3 dimensions. As component loadings indicate Pearson correlations between the quantified variables and the principal components, they range between -1 and 1. The first dimension is moderately positively correlated to the scope (whole farm approach), and highly positively correlated to the annual number of visitors and the number of annual demonstration

events. The eigenvalue is 1,521 (Cronbach's alpha : 0,428). The second dimension is moderately positively correlated to the scope (whole farm approach) and the organizer mean score. The eigenvalue is 1,060 (Cronbach's alpha : 0,069). The third dimension is highly positively correlated to network membership. The eigenvalue is 1,033 (Cronbach's alpha : 0,040).

Table 4: Component loadings and eigenvalues of the 3 dimensions, Legend : + : 0,45 - 0,65; ++ : >0,65; - : -0,45 - -0,65, -- : <- 0,65

	DIMENSION		
	1	2	3
Network	0,401	-0,404	0,865 (++)
Scope_Q70	0,554 (+)	0,606 (+)	0,161
Organiser_mean_score	0,276	0,622 (+)	0,149
Nb_annual demo events	0,714 (++)	-0,153	-0,394
Nb_annual visitors	0,683 (++)	-0.344	-0.287
Eigenvalue	1,521	1,060	1,033
Cronbach's Alpha	0,428	0,069	0,040

The cluster analysis classified 731[3] cases in 6 distinct clusters with sufficient differentiation amongst the dimensions. The mean object scores of the 3 dimensions for the 6 clusters are summarized in Table 5.

Table 5: mean object scores of the 5 dimensions for the 6 clusters, Legend : + : 0,45 - 0,65; ++ : >0,65; - : -0,45 - -0,65; -- : <- 0,65

CLUSTERS	Number of cases	DIM 1	DIM 2	DIM 3
1	172	0,689 (++)	1,2089 (++)	-0,6449 (-)
2	196	-0,7651 (--)	-0,0268	-0,7469 (--)
3	249	0,2118	-0,6506 (--)	0,9363 (++)
4	16	4,4374 (++)	-1,4079 (--)	-2,5122 (--)
5	36	-1,3164 (--)	-1,8713 (--)	-0,9991 (--)
6	61	0,8407 (++)	0,7761 (++)	1,4213 (++)

Figures 2, 3 and 4 display the positions of the 6 clusters according to the 3 catPCA dimensions. The size of the bubbles indicates the number of demo farms in the respective clusters.

[3] 4 cases were not classified, and were categorized as outliers

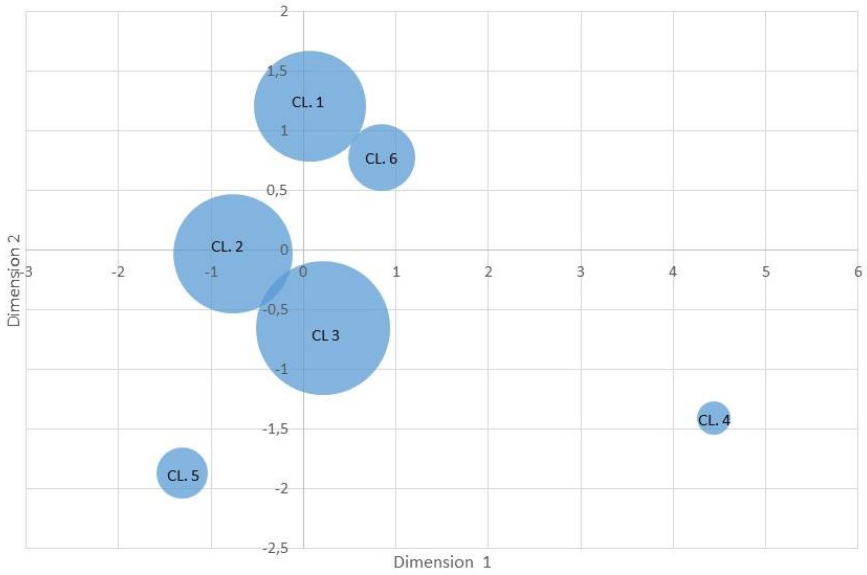

Figure 2: Cluster positioning (average object scores) with respect to dimensions 1 (scope- + = whole farm, - = single practices, annual number of visitors and number of annual demonstration events, += high numbers, - = low numbers) and 2 (scope and the organizer mean score, +: farmer/farmer organization/supply chain company organized,;-: research organized)

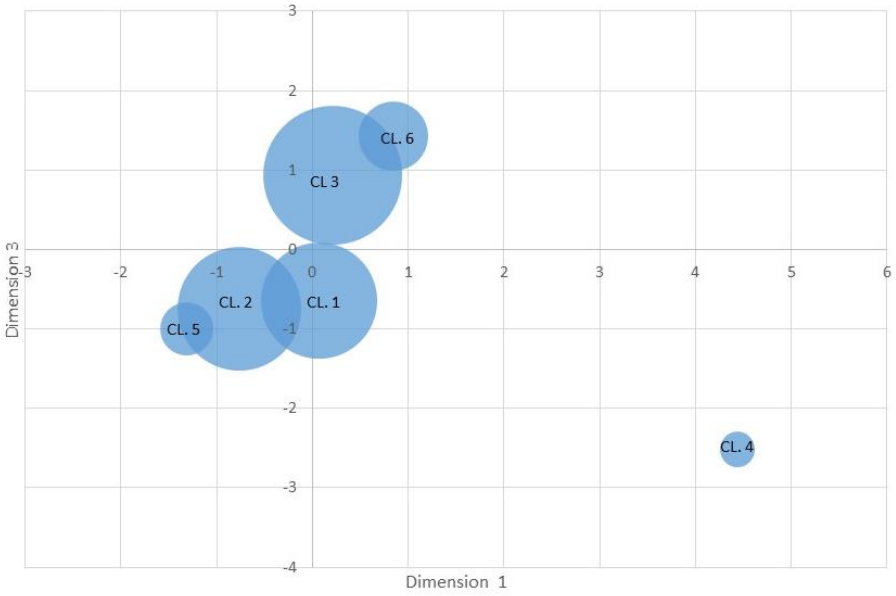

Figure 3: Cluster positioning (average object scores) with respect to dimensions 1 ((scope- + = whole farm, - = single practices, annual number of visitors and number of annual demonstration events, += high numbers, - = low numbers) and 3 (network/programme membership, +- part of a network/programme; -: not part of a network/programme)

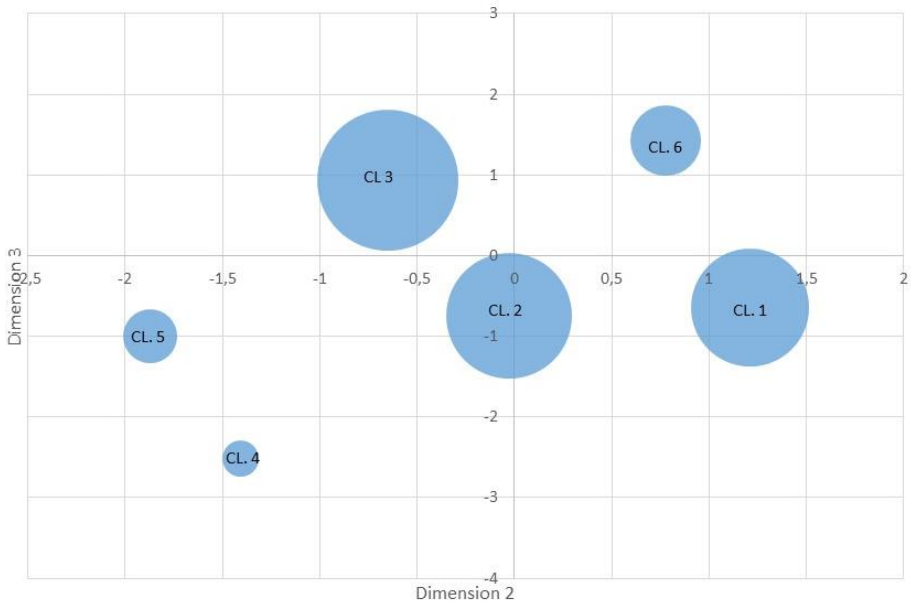

Figure 4: Cluster positioning (average object scores) with respect to dimensions 2 (scope; + = whole farm, - = single practices and the organizer mean score, +: farmer/farmer organization/supply chain company organized,;-: research organized) and 3 (network/programme membership, +- part of a network/programme; -: not part of a network/programme)

2.3.2. Cluster descriptions

To enable a clear and full description of the demonstration farms, we now also look at the variable mean scores (Table 6). There are two main reasons to do so: First, some of the mean object scores (Table 5) and component loadings (Table 4) fall close to the cut-off value. Second, cluster 4 in particular is a small cluster, and standard deviations for the object scores are relatively high (results not shown). As a result, we have to take care in interpreting these results. By including the variable mean scores for the cluster descriptions, it allows us to give a more accurate view of the demonstration farms within a single cluster (Table 7). Figure 5 gives a visual representation of the cluster positions in relation to the 5 variables.

Table 6: Variable mean scores. Network: 1: not part of a network or programme – 2: part of a network or programme; Scope: 1: single techniques – 5: whole farm approach; Organizer: 2: farmer organized – 1: farmer organization/supply chain company organized – 0: advisory organized - -2: research organized.

	Network	Scope	Organizer	N° demo's	N° visitors
Cluster 1	1	4.23	1.5682	8.72	203.64
Cluster 2	1	2.19	0.8561	3.87	110.25
Cluster 3	2	2.82	0.8417	7.96	374.98
Cluster 4	1.5625	4.06	1.5750	83.63	4253.33
Cluster 5	1.1212	1.44	-1.2296	3.23	180.87
Cluster 6	2	4.87	1.6983	6.02	195.34
Total	**1.4481**	**3.11**	**0.9957**	**8.40**	**323.14**

Table 7: Typology of demonstration farms based on catPCA and cluster analysis

CLUSTERS	Number of cases	DESCRIPTION
1	172	Farms are not part of a network or programme, demonstrations tend to focus more on whole farm approaches, and are in most cases organized by farmers or by farmers organizations. The annual n° of demonstrations is rather low, and visiting groups are rather small.
2	196	Farms are not part of a network or programme, demonstrations tend to focus somewhat more on single techniques, and are organized by a variety of actors (farmers, farmer organizations, supply chain company, advisory services, research). The annual n° of demonstrations is low, and visiting groups are rather small.
3	249	Farms are part of a network or programme, demonstrations can focus both on single techniques and whole farm approaches, and are organized by a variety of actors (farmers, farmer organizations, supply chain company, advisory services, research). The annual n° of demonstrations is higher, and visiting groups are somewhat larger.
4	16	Network or programme partnership is variable, demonstrations tend to focus more on whole farm approaches, and are and are in most cases organized by farmers or by farmers organizations or supply chain companies. The annual n° of demonstrations is high, with high numbers of annual visitors
5	36	Farms are generally not part of a network or programme (but there is some variation), demonstrations tend to focus more on single techniques, and are and are in most cases organized by research. The annual n° of demonstrations is low, but with larger visiting groups
6	61	Farms are part of a network or programme, demonstrations focus on whole farm approaches, , and are in most cases organized by farmers or by farmers organizations or supply chain companies. The annual n° of demonstrations and visitors is rather low.

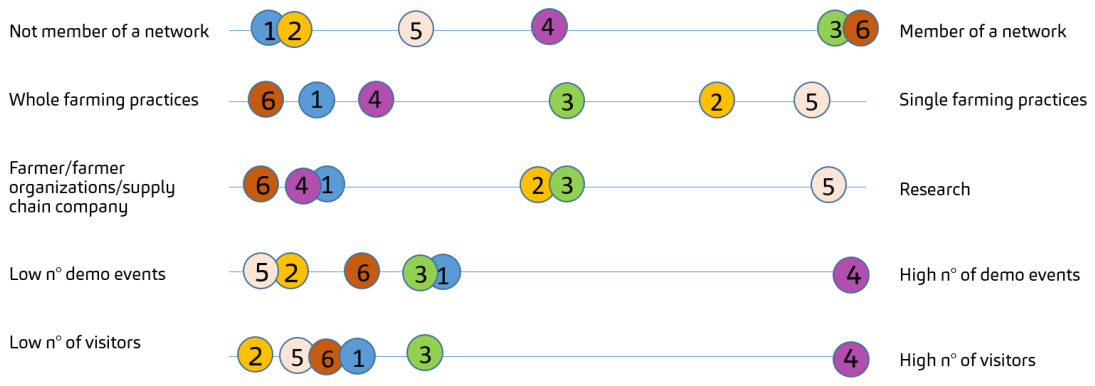

Figure 5: Visual representation of cluster distribution for the 5 selected variables

2.3.3. Cluster membership per country

Finally, to better grasp diversity of these types or clusters across Europe, we also present an overview of the distribution of all cases over the different clusters, per country (Table 8). Results show that in some countries all types are represented, e.g. Bulgaria and Germany, while for other countries, we see 2 or 3 predominant types, e.g. Ireland and Sweden. However, since the inventory was not meant to be exhaustive, this may not represent the actual situation in those countries. Further discussion with all partners and a wider stakeholder set, should reveal if the results demonstrated here, reflect the real-life situation.

Country * Cluster membership Crosstabulation

Count

		Cluster membership						Total
		1	2	3	4	5	6	
Country	Austria	4	1	1	0	0	0	6
	Belgium	7	5	8	2	0	0	22
	Bulgaria	21	34	5	1	11	2	74
	Croatia	6	7	1	0	0	1	15
	Czech Republic	5	6	3	0	2	1	17
	Denmark	1	1	0	0	1	0	3
	Finland	9	7	2	1	1	2	22
	France	5	9	24	1	1	5	45
	Germany	2	4	25	8	1	15	55
	Hungary	12	12	9	0	0	5	38
	Ireland	0	0	41	0	0	16	57
	Italy	0	0	1	0	0	0	1
	Latvia	1	4	2	0	1	0	8
	Lithuania	12	5	3	0	0	1	21
	Malta	0	0	0	1	1	0	2
	Netherlands	8	12	5	0	1	0	26
	Norway	1	1	1	0	0	1	4
	Poland	27	56	7	0	8	1	99
	Portugal	0	0	1	0	0	0	1
	Romania	17	14	0	1	2	0	34
	Serbia	0	0	2	0	0	0	2
	Slovakia	9	6	0	0	0	0	15
	Slovenia	4	1	2	0	0	0	7
	Spain	16	8	3	0	4	3	34
	Sweden	0	2	45	0	1	0	48
	United Kingdom	5	1	58	1	1	9	75
Total		172	196	249	16	36	62	731

Figure 6: Cluster membership per country

2.4. Data driven typology – step 3

Following the AgriDemo-F2F project review meeting (March 2018) and the feedback that was obtained during the meeting, the analysis was further refined. Within this third step, we repeated the combination of CatPCA and cluster analysis described in step 1 and step 2, with following adaptations:

- After a quality check of the data we decided to remove the cases with outliers and missing data, resulting in an updated and corrected data file of 653 European demonstration farms. The new data analysis was done on this data file.

- In consultation with the project partners, the hierarchical clustering method was complemented with a K-means clustering method in order to obtain more homogeneous clusters. Indeed, K-means clustering is often used to 'fine tune' the results of hierarchical clustering, taking the cluster solution from hierarchical clustering as its inputs (Hair et al., 2014).

2.4.1. Results CatPCA + cluster analysis

CatPCA resulted in a reduction of the original set of variables into a smaller set of only 2 dimensions (compared to 3 dimensions in the previous analysis in step 2). A third dimension was not retained since the eigenvalue of this dimension was smaller than 1.

Table 7 presents the component loadings, eigenvalues and Cronbach's alpha (a measure of reliability) of the 2 dimensions. As component loadings indicate Pearson correlations between the quantified variables and the principal components, they range between -1 and 1. The first dimension is highly positively correlated to the number of annual demo events and the number of annual visitors. The eigenvalue is 1,845 (Cronbach's alpha : 0,573). The second dimension is highly negatively correlated to network membership, moderately positively correlated to the scope (whole farm approach) and highly positively correlated to the organizer mean score. The eigenvalue is 1,343 (Cronbach's alpha : 0,319).

Table 7: Component loadings and eigenvalues of the 2 dimensions. Legend : + : 0,45-0,65; ++ : >0,65; - : -0,45— -0,65; --: <-0,65

	DIMENSION	
	1	2
Network	0,376	-0,656 (--)
Scope_Q70	0,412	0,522 (+)
Organiser_mean_score	0,274	0,774 (++)
Nb_annual demo events	0,863 (++)	-0,012
Nb_annual visitors	0,845 (++)	-0,202
Eigenvalue	1,845	1,343
Cronbach's Alpha	0,573	0,319

As in the previous steps, the components extracted from the CatPCA are used as clustering variables in the cluster analysis. In the previous steps (step 1 and 2) a hierarchical clustering method was used. But even though hierarchical techniques have been widely used and accepted, they do have the disadvantage that outliers can have a substantial impact. It is recommended to 'fine- tune' the hierarchical clustering method with a K-means clustering method, allowing the switching of cluster membership in order to obtain more homogeneous clusters. Another advantage is its ability to delineate clusters that are usually more distinctive than the hierarchical cluster solution. The K-means clustering solution, due to the ability to reassign observations between clusters, also has a more even dispersion among the clusters (Hair et al., 2014).

A hierarchical approach is used to select the number of clusters and profile cluster centers that serve as initial cluster seeds in the K-means clustering procedure. The K-means clustering then clusters all observations using the seed points to provide more accurate cluster memberships.

Research shows that the K-means method is the most efficient when the same optimization criterion is used as to generate the start configuration. In the K-means method, this criterion consists of minimizing the distances within each cluster to the center of that cluster. This is the same criterion used in Ward's hierarchical method. This means that the construction of a good procedure consists of two steps. First, a hierarchical cluster analysis is performed using Ward's method. Then, the results of this serve as input for a K-means method (Hair et al., 2014[4]).

Application of the above cluster method results in the classification of the 653 cases in 6 distinct clusters with sufficient differentiation amongst the dimensions. The mean object scores of the 2 dimensions for the 6 clusters are summarized in Table 8. The table also includes ANOVA and post hoc Duncan test results showing that the mean object scores of the two dimensions differ significantly.

Table 8: Mean object scores of the 2 dimensions for the 6 clusters. Legend: + : 0,45-0,65; ++> 0,65; - : -0,45—0,65; -- : <-0,65

Clusters	Number of cases	DIM 1	DIM 2
1	149	-0,457[b] (-)	1,196[f] (++)
2	92	-1,3287[a] (--)	0,990[e] (++)
3	120	0,530[c] (+)	-1,314[a] (--)
4	62	1,101[d] (++)	-0,268[c]
5	142	-0,457[b](-)	-0,615[b] (--)
6	88	1,401[e] (++)	-0,040[d]
Total	653	0,000	0,000
Sign. (p-value)		0,000	0,000

[abcdef] Different characters indicate significant differences of the dimension mean scores between the clusters at 5 % significance level.

[4] Hair J.F.Jr., Black W.C., Babin B.J., Anderson R.E. (2014). Multivariate data analysis. Seventh Edition, Pearson Education Limited, Essex

Figure 6 displays the positions of the 6 clusters according to the 2 CatPCA dimensions. The size of the bubbles indicates the number of demo farms in the respective clusters.

Compared to the outcomes in step 2, one can observe that the clusters do have a more even dispersion, making the size of the bubbles more similar.

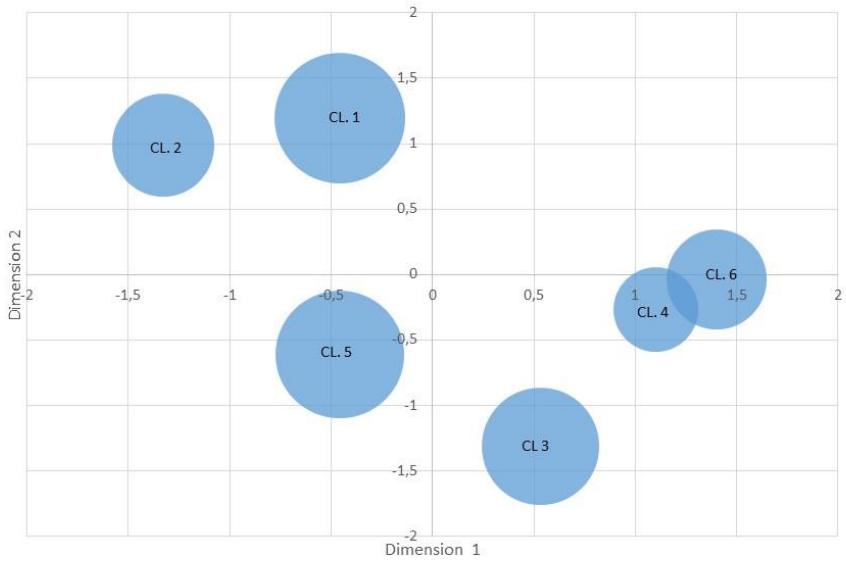

Figure 6: Cluster positioning (average object scores) with respect to dimension 1 (positively correlated with number of annual demo events and number of annual visitors) and dimension 2 (negatively correlated with network membership and positively correlated with scope: + : whole farm approach and positively correlated with the organiser mean score : +: farmer/farmer organization/supply company organized)

2.4.2. Cluster descriptions

To enable a clear and full description of the demonstration farms, we now also look at the variable mean scores (Table 9). The table also includes ANOVA and post hoc Duncan test results, showing the statistical differences in variable means across the 6 clusters. The results suggest that the clusters are adequately discriminating the observations.

Looking at the variable mean scores for the cluster descriptions allows us to interpret the meanings of the clusters and to give a more accurate view of the demonstration farms within a single cluster (Table 10). This is also facilitated by analyzing the pattern of the cluster means shown in Figure 7, which gives a visual representation of the cluster positions in relation to the 5 variables.

Table 9: Variable mean scores. Network: 1: not part of a network or programme – 2: part of a network or programme; Scope: 1: single techniques – 5: whole farm approach; Organizer: 2 : farmer organized – 1: farmer organization/supply chain company organized – 0: advisory organized- -2: research organized.

Clusters	Number of cases	Network	Scope	Organizer	N°demo's	N°visitors
1	149	1,04[a]	3,34[c]	1,65[d]	3,11[a]	50,65[a]
2	92	1,03[a]	2,46[a]	0,32[b]	1,43[a]	29,29[a]
3	120	1,99[d]	2,78[a]	-0,10[a]	8,55[b]	457,52[b]
4	62	1,66[c]	3,61[c]	0,81[c]	23,47[c]	940,97[d]
5	142	1,63[c]	2,87[b]	0,29[b]	3,00[a]	94,13[a]
6	88	1,40[b]	4,44[d]	1,76[d]	23,90[c]	721,73[c]
Total	653	1,45	3,18	0,78	8,58	306,83
Sign (p-value)		0,000	0,000	0,000	0,000	0,000

[abcd] Different characters indicate significant differences of the variable mean scores between the clusters at 5 % significance level.

Interpretation begins by looking for extreme values associated with each cluster. In other words, variable means that are the highest or lowest compared to other clusters are useful in this process.

Cluster 1 has **149 observations** and is most distinguished by the lack of a network or programme, organization of the demo's by farmers and farmers organizations and a low number of annual demonstrations and visitors. Demonstrations can focus both on single techniques and whole farm approaches.

Cluster 2 has **92 observations** and is comparable to cluster 1 with respect to the lack of a network or programme and a low number of annual demonstrations and visitors *(no significant differences of the variable mean scores in comparison with cluster 1*). Compared to cluster 1 demonstrations focus somewhat more on single farm approaches and are less organized by farmers and farmer organizations *(significant differences of the variable mean scores in comparison to cluster 1).*

Cluster 3 has **120 observations** and is most distinguished by the membership of a network *(significant difference of the variable mean score compared to all other clusters).* The mean scores of the other variables (scope of the farming practices, organization of demo's, annual n° of demo's and visitors) are moderate.

Cluster 4 has **62 observations** and is most distinguished by a high number of annual *demonstrations (significant difference of the variable means scores compared to all clusters except cluster 6)* and a high number of and visitors *(significant difference of the variable means scores compared to all clusters).* Network or programme partnership is variable, demonstrations tend to focus more on whole farm approaches, and are organized by a variety of actors (farmers, farmer organizations, supply chain company, advisory services, research).

Cluster 5 has **142 observations** and is most distinguished by a low number of annual demonstrations and visitors *(no significant differences of the variable mean scores compared to clusters 1 and 2).* Network or programme partnership is variable, demonstrations can focus both

on single techniques and whole farm approaches, and are organized by a variety of actors (farmers, farmer organizations, supply chain company, advisory services, research).

Cluster 6 has **88 observations** and is most distinguished by the focus of the demonstrations on a whole farm approach *(significant difference of the variable means scores compared to all clusters*), the organization of the demo's by farmers and farmers organizations *(significant difference of the variable means scores compared to all clusters except cluster 1),* the high number of demo events *(significant difference of the variable means scores compared to all clusters except cluster 4)* and the high number of visitors *(significant difference of the variable means scores compared to all clusters*). Network or programme partnership is variable.

Table 10: Typology of demonstration farms based on catPCA and cluster analysis

CLUSTERS	Number of cases	DESCRIPTION
1	149	Farms are not part of a network or programme, demonstrations can focus both on single techniques and whole farm approaches, and are in most cases organized by farmers or farmers organizations. The annual n° of demonstrations and the annual n° of visitors is rather small.
2	92	Farms are not part of a network or programme, demonstrations can focus both on single techniques and whole farm approaches, and are organized by a variety of actors (farmers, farmer organizations, supply chain company, advisory services, research). The annual n° of demonstrations and the annual n° of visitors is rather small.
3	120	Farms are part of a network or programme, demonstrations can focus both on single techniques and whole farm approaches, and are organized by a variety of actors (farmers, farmer organizations, supply chain company, advisory services, research). The annual n° of demonstrations and the annual n° of visitors is moderate.
4	62	Network or programme partnership is variable, demonstrations tend to focus more on whole farm approaches, and are organized by a variety of actors (farmers, farmer organizations, supply chain company, advisory services, research). The annual n° of demonstrations and the annual n° of visitors is high.
5	142	Network or programme partnership is variable, demonstrations can focus both on single techniques and whole farm approaches, and are organized by a variety of actors (farmers, farmer organizations, supply chain company, advisory services, research). The annual n° of demonstrations and the annual n° of visitors is rather small.
6	88	Network or programme partnership is variable, demonstrations tend to focus more on whole farm approaches, and are in most cases organized by farmers or farmers organizations. The annual n° of demonstrations and the annual n° of visitors is high.

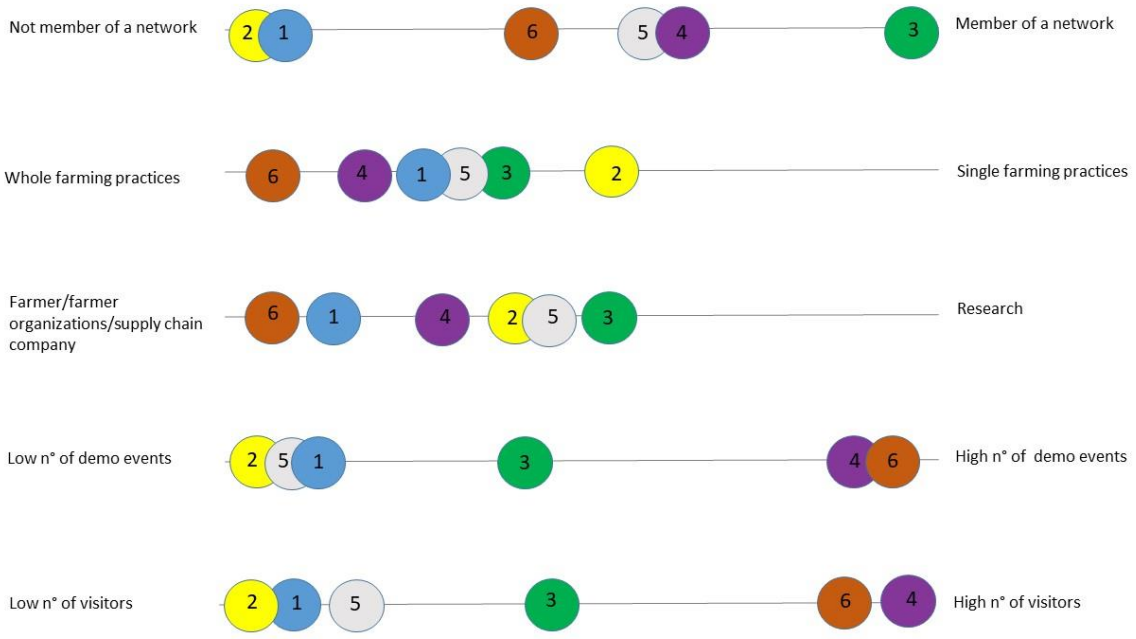

Figure 7: Visual representation of cluster distribution for the 5 selected variables

2.4.3. Cluster membership per country

Finally, to better grasp diversity of these types of clusters across Europe, we also give a visual representation of the cluster distribution per country (Figure 8).

The results show that country membership has an important influence on the cluster distribution.

Cluster 1 is the predominant type in **Slovakia** (73 % of 15 cases), **Lithuania** (53 % of 15 cases), **Spain** (50 % of 30 cases), **Poland** (49 % of 86 cases), **Romania** (47 % of 30 cases), **the Czech Republic** (38 % of 16 cases) and **Hungary** (32 % of 28 cases). Although not predominantly, the importance of cluster 1 is also considerable in **Croatia** (28 % of 14 cases) and **Bulgaria** (26 % of 72 cases).

Cluster 2 is the predominant type in **the Netherlands** (58 % of 26 cases), **Bulgaria** (44 % of 72 cases) and **Belgium** (25 % of 20 cases). Although not predominantly, cluster 2 is also important in **Croatia** (29 % of 14 cases) and **Poland** (26 % of 86 cases).

Cluster 3 is the predominant type in **Sweden** (59 % of 34 cases), **UK** (51 % of 77 cases) and **France** (50 % van 32 cases). Although not predominantly, cluster 3 is also meaningful in **Ireland** (29 % of 55 cases).

Cluster 4 is the predominant type in **Germany** (37 % of 52 cases) and **Finland** (35 % of 20 cases). Although not predominantly, it is also quite important in **Belgium** (20 % of 20 cases).

Cluster 5 is the predominant type in **Ireland** (58 % of 55 cases). Although not predominantly, cluster 5 is also important in **Sweden** (41 % of 34 cases), **Finland** (30 % of 20 cases), **Croatia** (29 % of 14 cases), **France** (25 % of 32 cases), **UK** (23 % of 77 cases) and **Spain** (20 % of 30 cases).

Cluster 6 is not the predominant type in most countries, but is quite important in **Romania** (37 % of 30 cases), **Germany** (29 % of 52 cases), **Hungary** (29 % of 28 cases), **UK** (21 % of 77 cases), Belgium (20 % of 20 cases) and **Finland** (20 % of 20 cases).

In Annex 2 this distribution is further linked to information from the FarmDemo country reports (https://agridemo-h2020.eu/farm-inventory-country-report-posters/), which provide a summary, per country of the inventory data.

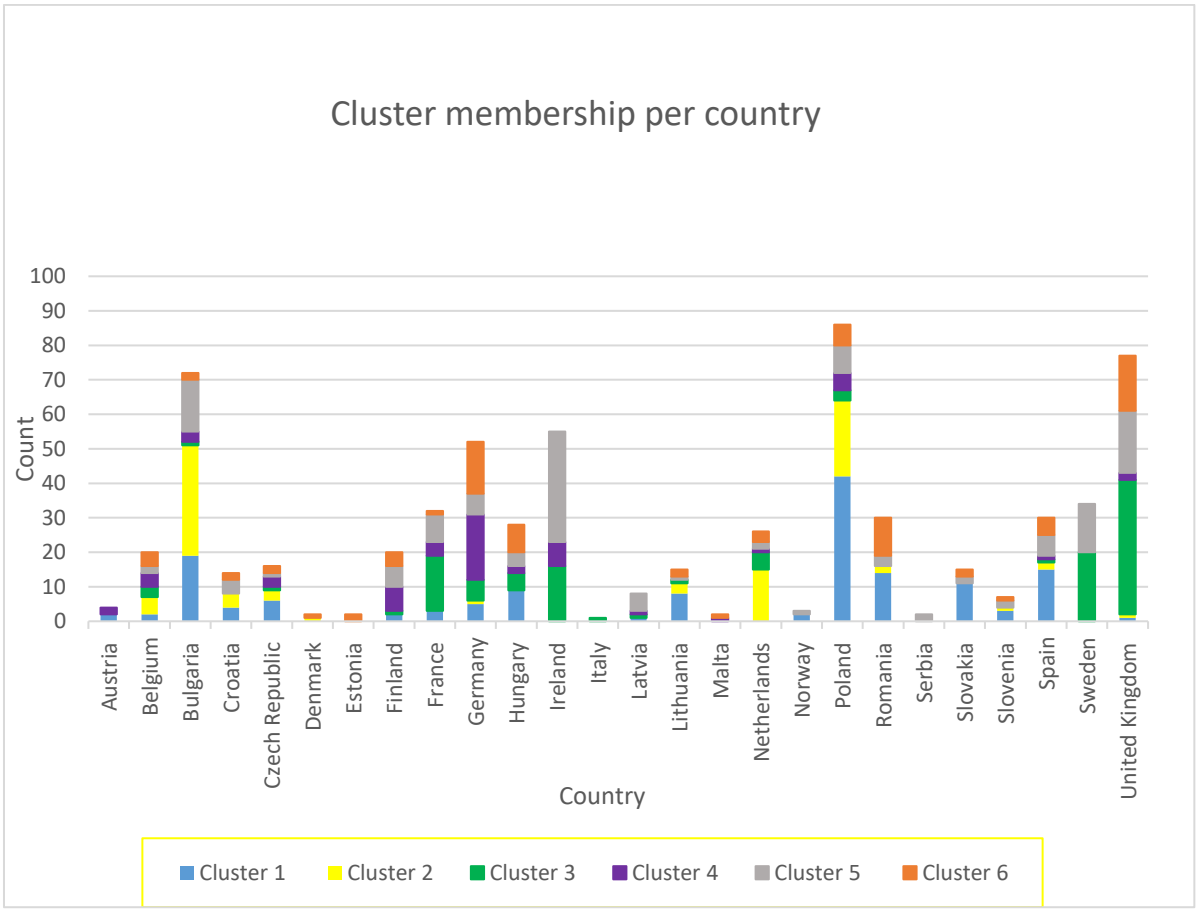

Figure 8: Visual representation of cluster distribution per country

3. Conclusion

A first typology was developed based on two main dimensions, emerging from literature. However, this approach did not reveal any relevant types of on-farm demonstrations. Nevertheless to be complete, we described this two-dimensional analysis. In a second stage, we developed a typology following a two-step data-driven approach, which we evaluated with several variables of the inventory. Clustering methods were optimised during several consecutive analytical steps, which in the end resulted in a meaningful set of on-farm demonstration types. Our final result reveals 6 clusters of demonstration farms, relating to 6 main 'types' of demonstration farms.

Cluster 1 has 149 observations and is most distinguished by the lack of a network or programme, organization of the demo's by farmers and farmers organizations and a low number of annual demonstrations and visitors. Demonstrations can focus both on single techniques and whole farm approaches. Cluster 1 is the predominant type in several Eastern European countries (Slovakia, Lithuania, Poland, Romania, the Czech Republic, and Hungary). Also, cluster 1 is also predominant in Spain. Cluster 2 has 92 observations and is comparable to cluster 1 with respect to the lack of a network or programme and a low number of annual demonstrations and visitors. Compared to cluster 1 demonstrations focus somewhat more on single techniques and are less organized by farmers and farmer organizations. Cluster 2 is the predominant type in the Netherlands, Bulgaria and Belgium. Cluster 3 has 120 observations and is most distinguished by the membership of a network. The mean scores of the other variables (scope of the farming practices, organization of demo's, annual n° of demo's and visitors) are moderate. Cluster 3 is the predominant type in Sweden, UK and France. Cluster 4 has 62 observations and is most distinguished by a high number of annual demonstrations and a high number of and visitors. Network or programme partnership is variable, demonstrations tend to focus more on whole farm approaches, and are organized by a variety of actors (farmers, farmer organizations, supply chain company, advisory services, research). Cluster 4 is the predominant type in Germany and Finland. Cluster 5 has 142 observations and is most distinguished by a low number of annual demonstrations and visitors. Network or programme partnership is variable, demonstrations can focus both on single techniques and whole farm approaches, and are organized by a variety of actors (farmers, farmer organizations, supply chain company, advisory services, research). Cluster 5 is the predominant type in Ireland. Finally, cluster 6 has 88 observations and is most distinguished by the focus of the demonstrations on a whole farm approach, the organization of the demo's by farmers and farmers organizations, the high number of demo events and the high number of visitors. Network or programme partnership is variable. Cluster 6 is not the predominant type in any country.

Since the inventory was not constructed to be exhaustive, this distribution may not reflect the actual situation across Europe. Further research, through discussions with project partners and wider stakeholder groups and more detailed analysis of the results per farm within the clusters, is necessary to reveal the importance of each of the different types we present here. Also, theoretically it is also possible that other types exist, which are not covered by our inventory, or are not revealed by our typology.

In a next step, we will use the typology to guide our case-study selection. From the cases in the inventory, we will select between 24 and 36 case studies. The case-study selection should cover the diversity of existing on-farm demonstration activities and demonstration farms. However, the typology alone will not suffice to have a balanced case-study selection. We will use the typology, together with a set of additional characteristics/variables, not included in the typology, but for which we need to check the overall distribution across the case-study set: (e.g. geographical distribution, a good distribution of sectors and topics, etc…) and expert knowledge of our partners. The latter is mainly to identify information about possible cases that was not covered by the inventory (e.g. information about farming systems (ranging from agroecological to conventional) or the technology level (from traditional to high tech). We will need to evaluate/consider if partners have sufficient knowledge on the individual case studies to assess these characteristics. This approach, integrating three elements for the final case study selection, should enable and assist us to achieve a balanced selection of case studies, and to ensure adequate diversity in our case studies.

Annex 1

Table A.1: Decision rules for the transformation of response categories to dimension 1 scores

Description	Scores for analysis
Always one or a few single practices	-2
Commonly one or a few single practices	-1
Equally one or a few single pr./whole farm approach	0
Commonly whole farm approach	1
Always whole farm approach	2

Table A.2: Decision rules for the transformation of primary organizer response categories to dimension 2 scores

Description	Scores
Individual farmer	2
Supply chain company	1
Farmers' organization	1
NGO/charity and/or other agricultural development organization	1
Private/public extension or advisory service	0
Research institution	-2

Table A.3: Decision rules for the transformation of funder response categories to dimension scores

Description	Description	
First funder	Second funder	Scores
Self-funded	Supply chain company funded	1,5
Self-funded	Public funded (regional, national, EU...)	1
Self-funded	Charitably/NGO funded	1,5
Self-funded	Farming organization funded	1,5
Self-funded	Advisory/extension service funded	1
Self-funded	Research funded	0
Self-funded	Other	?
Self-funded	Self-funded	2
Supply chain company funded	Self-funded	1,5
Supply chain company funded	Public funded (regional, national, EU...)	0,5
Supply chain company funded	Charitably/NGO funded	1
Supply chain company funded	Farming organization funded	1
Supply chain company funded	Advisory/extension service funded	0,5
Supply chain company funded	Research funded	-0,5
Supply chain company funded	Other	?

Supply chain company funded	Supply chain company funded	1
Public funded (regional, national, EU…)	Self-funded	1
Public funded (regional, national, EU…)	Supply chain company funded	0,5
Public funded (regional, national, EU…)	Charitably/NGO funded	0,5
Public funded (regional, national, EU…)	Farming organization funded	0,5
Public funded (regional, national, EU…)	Advisory/extension service funded	0
Public funded (regional, national, EU…)	Research funded	-1
Public funded (regional, national, EU…)	Other	?
Public funded (regional, national, EU…)	Public funded (regional, national, EU…)	0
Charitably/NGO funded	Self-funded	1,5
Charitably/NGO funded	Supply chain company funded	1
Charitably/NGO funded	Public funded (regional, national, EU…)	0,5
Charitably/NGO funded	Farming organization funded	1
Charitably/NGO funded	Advisory/extension service funded	0,5
Charitably/NGO funded	Research funded	-0,5
Charitably/NGO funded	Other	?
Charitably/NGO funded	Charitably/NGO funded	1
Farming organization funded	Self-funded	1,5
Farming organization funded	Supply chain company funded	1
Farming organization funded	Public funded (regional, national, EU…)	0,5
Farming organization funded	Charitably/NGO funded	1
Farming organization funded	Advisory/extension service funded	0,5
Farming organization funded	Research funded	-0,5
Farming organization funded	Other	?
Farming organization funded	Farming organization funded	1
Advisory/extension service funded	Self-funded	1
Advisory/extension service funded	Supply chain company funded	0,5
Advisory/extension service funded	Public funded (regional, national, EU…)	0
Advisory/extension service funded	Charitably/NGO funded	0,5
Advisory/extension service funded	Farming organization funded	0,5
Advisory/extension service funded	Research funded	-1
Advisory/extension service funded	Other	?
Advisory/extension service funded	Advisory/extension service funded	0
Research funded	Self-funded	0
Research funded	Supply chain company funded	-0,5
Research funded	Public funded (regional, national, EU…)	-1
Research funded	Charitably/NGO funded	-0,5
Research funded	Advisory/extension service funded	-1
Research funded	Farming organization funded	-0,5
Research funded	Other	?
Research funded	Research funded	-2

Other	Self-funded	?
Other	Supply chain company funded	?
Other	Public funded (regional, national, EU…)	?
Other	Charitably/NGO funded	?
Other	Farming organization funded	?
Other	Advisory/extension service funded	?
Other	Research funded	?
Other	Other	?

Table A.4: Decision rules for the transformation of demonstrator response categories to dimension scores

Description		
First demonstrator	Second demonstrator	Scores
Farmer	Public/Private advisor(s)	1
Farmer	Researcher, Students	0
Farmer	Policy maker	1
Farmer	Funder	1
Farmer	Supply chain actor	1,5
Farmer	Farmer	2
Public/Private advisor(s)	Farmer	1
Public/Private advisor(s)	Researcher, Students	-1
Public/Private advisor(s)	Policy maker	0
Public/Private advisor(s)	Funder	0
Public/Private advisor(s)	Supply chain actor	0,5
Public/Private advisor(s)	Public/Private advisor(s)	0
Researcher, Students	Farmer	0
Researcher, Students	Public/Private advisor(s)	-1
Researcher, Students	Policy maker	-1
Researcher, Students	Funder	-1
Researcher, Students	Supply chain actor	-0,5
Researcher, Students	Researcher, Students	-2
Policy maker	Farmer	1
Policy maker	Public/Private advisor(s)	0
Policy maker	Researcher, Students	-1
Policy maker	Funder	0
Policy maker	Supply chain actor	0,5
Policy maker	Policy maker	0
Funder	Farmer	1
Funder	Public/Private advisor(s)	0
Funder	Researcher, Students	-1
Funder	Policy maker	0

Funder	Supply chain actor	0,5
Funder	Funder	0
Supply chain actor	Farmer	1,5
Supply chain actor	Public/Private advisor(s)	0,5
Supply chain actor	Researcher, Students	-0,5
Supply chain actor	Policy maker	0,5
Supply chain actor	Funder	0,5
Supply chain actor	Supply chain actor	1

Annex 2

CLUSTER 1 :

Cluster 1 has **149 observations** and is most distinguished by the **lack of a network or programme, organization of the demo's by farmers and farmers organizations** and **a low number of annual demonstrations and visitors.** Demonstrations can focus **both on single techniques and whole farm approaches.**

Cluster 1 is the predominant type in the eastern countries : **Slovakia** (73 % of 15 cases), **Lithuania** (53 % of 15 cases), **Poland** (49 % of 86 cases), **Romania** (47 % of 30 cases), **the Czech Republic** (38 % of 16 cases) and **Hungary** (32 % of 28 cases). Although not predominantly, the importance of cluster 1 is also considerable in **Croatia** (28 % of 14 cases) and **Bulgaria** (26 % of 72 cases). Besides the eastern countries cluster 1 is also predominant in **Spain** (50 % of 30 cases),

Slovakia : Since 1920 (after the political changes in Slovakia) demonstration activities started on transformed commercial farms with the support of newly established organisations (e.g. associations and unions of plant growers and livestock breeders, Agri-food chamber and private supply and sales business companies). Types of demo's: Mostly one-off events or repeating events at demonstration farms (field days, rearing days, etc.), Very few permanent demo farms. Slovakia is a geographically diverse country; this determines the type of agricultural production and thus demonstration activity. In demo activities, **large-scale commercial farms closely cooperate with input (seed, agri-chemicals) and technology suppliers.** Large-scale commercial farms serve as knowledge holder and innovation broker for small farms. **Demo activities in very specific areas (berries, organic farming, social innovation, green care) are held mainly on small farms**

Lithuania : The precursor to demonstration farms were experimental stations, starting in the beginning of the 20th century. These good examples made the start for creation of demonstration activities on commercial farms. **Over the last 40 years, the number of demonstrations on farms has been increasing.** Interest in the demonstrations taking place on farms in Lithuania is increasing. Usually **younger farmers and participants of different EU projects actively choose to host the demonstrations.**

Poland : Before the transition from central to market economy (before 1986) public advisory services managed their own demonstration farms. Most of them were closed as a result of socio-economic transformation in the nineties. **Agricultural advisors, therefore, had to maintain the network of farmers involved in sharing demonstration venues.** Accession of Poland to EU accelerated the development in agriculture. **Commercial companies developed networks of dealerships and applied a dual approach to demo farms, running their own company managed demo farm (1) and signing contracts with farmers to use part of their farms for demonstration activities (2).** Long traditions of demo farms run by research organizations which collaborate with public advisory services to among others organize open days of farmers. Providers of demonstration : **In Poland the majority of agricultural demonstrations are set-**

up by farmers and public advisory services. Demonstrations are often carried out jointly by advisors and farmers. Majority of demonstration farms belong to field walks with farmers, owners of demonstration farms acting as guides. In many cases they are supported by agricultural advisors from the public advisory service as initiators/facilitators of farmers involvement in demonstration activities. Demonstration activities are undertaken by commercial and experimental farms with 80/20 partitioning. Demo farms do usually not participate in regional and national networks. Demo farms managed by farmers organize a smaller number of demo's with a small number of visitors per year. Demo activities run by organizations are bigger. A limitation of this study is that demonstration farms managed by company producing/selling material for farming are clearly underrepresented within our inventory. The reason is confirmed by experiences of many other social researches in Poland, trends amongst commercial companies to not participate in any research is due to the non-direct relation with their core business.

Romania : The demonstrative activities present in Romania in part have their roots in socialist agriculture. The main actors of the modernization of socialist agriculture were the research institutes
and research stations, which also had an activity of popularization of developed varieties and technologies. Some of these institutions are still functioning today. In the post-communist era big companies producing and distributing conventional agricultural inputs entered Romania. They also introduced new demonstration techniques, namely the system of demonstration lots placed on farms – the later becoming the largest and most frequent demonstration farms. Besides the above commercial farms many smaller family farms experimenting with alternative technologies or with breeds and breeds that are non-existent/rare in the country emerged. These also organize demonstration activities frequently. In the post-socialist period several demonstrative farms with a
background in the associational sphere have emerged. These NGO-based farms are, however, quite rare. Major providers of demonstration activities are commercial farms (partners of input-firms, conventional agriculture, demonstrative plots, few demo activities, large audiences, externally initiated demo activities), research institutes (state financed, research led, few demo activities, relatively large audience, self initiated) and small farms (self initiated, self funded, many demo activities, few participants, ideologically motivated).

the Czech Republic : Czech individual farmers started their own demonstration activities after "Velvet revolution" in 1989. There were mainly activities leading to the higher crop production, involving new technologies, machinery, pesticides and herbicides, new products of breading, etc.

1953-1962: Czechoslovak Academy of Agricultural Sciences; 1963-1989: Centralized control of the agriculture; After 1989: separated Czech and Slovak Academies of Agricultural Sciences created.

Providers of demonstrations are mostly individual farmers. The most important types of farm demonstrations are : farm-field walks (peer observation), hands-on experience/training sessions/workshops and demonstration display (e.g. equipment, machinery).

Since 2016 Czech Ministry of Agriculture started a formation of the method for a subsidy policy called "Demonstration farm" to help farmers in the form of illustrative practical demonstrations

of comprehensive sustainable farming practices. The main topic for the year 2017 was "soil protection".

Hungary : The history of demonstrative activities in Hungary strongly intertwines with agarian higher education system. Educational farms have been operating in the country since the first establishment of agrarian universities and colleges – since the 1800s. Today, 9 out of 22 public universities run educational farms which function as the main practical knowledge provider for the agrarian higher education. **Demonstrative activities of commercial farms are deeply rooted in socialist agriculture. After 2004, when Hungary joined the EU, significant funds have started to be allocated for agricultural improvement,** namely : sustainable practices, organic agriculture, modernization, etc. **In 2014, a state call was opened to farmers to apply for the title of "demonstration farm", lasted for 2 years – and 110 farms were successfully given this new role with funding to initiate demonstration activity.** In the inventory half of the demonstration providers are profit-oriented (small or big) commercial farms, followed by research, experimental, or knowledge transfer farms, educational farms. Oral presentations and interactive discussions are the most favoured demonstration type. Characteristics of commercial farms: surprisingly small amount of average demo activities and attendees, self-funded events, initiated and organized by farmers or researchers- sometimes funded by advisory service. Entrance is not free of charge. Topics : innovative cropping technologies and demonstration of new varieties or breeds.

Croatia : The transfer of agricultural knowledge, information and implementation of new technologies is carried out by a number of **national, public expert services but mostly by the Advisory Service Croatia. The Advisory Service Croatia works in close collaboration with companies in private sector involved in seed production and distribution, agricultural mechanization, artificial fertilization and pesticide. There are no financial resources for demonstration activities in Croatia**. The organize of demonstration activities covers all the costs and participant have to pay for their own travel costs. There is a lack of peer to peer knowledge transfer amongst farmers.

Bulgaria : The history of demonstration activities in Bulgaria in the field of agriculture is divided into **two periods**, differing mainly on the ownership of agricultural land: (1) until 1989 (state property of land). It started the period of socio-economic change in the countries of Eastern Europe, including Bulgaria. The 2nd **is after 1990, when private commercial companies for machinery, seeds, preparations for agricultural production start to enter the agricultural sector and make demonstrations in private farms and cooperatives. NAAS (National Agricultural Advisory Service) starts the organization of demonstrations after its establishment in 1999.** Most demonstrations are organized in well-developed agricultural regions. Only NAAS organizes demonstrations on the territory of the whole country because it has regional offices in every district. Almost all demonstrations are **free of charge** to all participants. The focus of demonstrations is on **single technologies**. Common demonstration between farmers and NAAS, agrarian universities and supply chain companies.

Spain : The first demonstrations took place in 1980. The attendees were local farmers. They were organized by the public advisory service and with public funding. Since then, demonstrations related to crop innovation, have been one of the more appreciated activities of INTIA, as a public advisory service. **In livestock the demonstrations are more linked to**

reference farms and production systems. The demonstrations are made by visiting the farm itself in the case of livestock, and through a guided field walk in the case of crops. In the inventory the role of farmers was relevant, both as organizer and funder. Half of the events were organized by farmers directly or throughout some organization. 52 % of demonstrations were financed by the farmers themselves and only 13 % were financed with public resources. Remark : The sample is biased towards the northern part of Spain. In the northern part of Spain there are more livestock farms than in the south.

CLUSTER 2 :

Cluster 2 has **92 observations** and is **comparable to cluster 1** with respect to **the lack of a network or programme** and a **low number of annual demonstrations and visitors** *(no significant differences of the variable mean scores in comparison with cluster 1*). **Compared to cluster 1 demonstrations focus somewhat more on single techniques and are less organized by farmers and farmer organizations** *(significant differences of the variable mean scores in comparison to cluster 1).*

Cluster 2 is the predominant type in **the Netherlands** (58 % of 26 cases), **Bulgaria** (44 % of 72 cases) and **Belgium** (25 % of 20 cases). Although not predominantly, cluster 2 is also important in **Croatia** (29 % of 14 cases) and **Poland** (26 % of 86 cases).

The Netherlands : Around 1950 : integrated approach in research, advice and education, focused on higher production. From 1990 shift to new targets, e.g. sustainability, and tendering of support activities. **Providers of demonstrations are: non-agrarian innovators, farmers organisations and cooperatives, research, education and extension, commercial business, individual farms/groups of farms.** In **recent years, demos have become increasingly larger, from single technologies to large scale manifestations with a variety of topics**. On the other hand **study groups keep their relevance. In the atmosphere of trust information is shared and details of innovations are shown to colleagues**.

Bulgaria : The history of demonstration activities in Bulgaria in the field of agriculture is divided into **two periods**, differing mainly on the ownership of agricultural land: (1) until 1989 (state property of land). It started the period of socio-economic change in the countries of Eastern Europe, including Bulgaria. The 2nd **is after 1990, when private commercial companies for machinery, seeds, preparations for agricultural production start to enter the agricultural sector and make demonstrations in private farms and cooperatives. NAAS (National Agricultural Advisory Service) starts the organization of demonstrations after its establishment in 1999.** Most demonstrations are organized in well-developed agricultural regions. Only NAAS organizes demonstrations on the territory of the whole country because it has regional offices in every district. Almost all demonstrations are **free of charge** to all participants. The focus of demonstrations is on **single technologies**. Common demonstration between farmers and NAAS, agrarian universities and supply chain companies.

Belgium : From 1920 on, the dissemination of agricultural knowledge across the whole country became important, in the beginning mainly boosted by **farmers' organisations like**

Boerenbond. Later on, the **Ministry of Agriculture** also played an important role in advising farmers. In Belgium the two main types of demonstrations are : demonstrations on 'commercial farms' and demonstrations on 'experimental, research farms'. Organizations often establish networks of like-minded farmers interested in exchanging information on innovative practices. There are more demonstrations in the field of crop production than in animal husbandry. Main 'models' for on-farm demonstrations : **European and regional projects**: mostly **temporary demonstration farms** (Dairyman (Interreg), EuroDairy, GoedGerund, GoedgePASt, ...). Demonstrations by experimental research centers/farms. **Flanders has made the strategic choice to host on-farm demonstrations through applied research farms, rather than on commercial farms.** These research farms have several demonstration plots and sites, and often **cooperate with local farmers to host demonstrations**. Demonstrations cover a wide range of topics. Demonstrations **by farmer networks**: most common examples are the organic farms networks ('Biobedrijfsnetwerken'). Demonstrations **initiated by commercial suppliers** (of machines, seeds, plant protection products, et.), together with farmers on their farm. Furthermore, several informal networks (relatively small in size), which were more informal groups, consisting of farmers that know each personally.

Croatia : The transfer of agricultural knowledge, information and implementation of new technologies is carried out by a number of **national, public expert services but mostly by the Advisory Service Croatia. The Advisory Service Croatia works in close collaboration with companies in private sector involved in seed production and distribution, agricultural mechanization, artificial fertilization and pesticide. There are no financial resources for demonstration activities in Croatia**. The organize of demonstration activities covers all the costs and participant have to pay for their own travel costs. There is a lack of peer to peer knowledge transfer amongst farmers.

Poland : Before the transition from central to market economy (before 1986) public advisory services managed their own demonstration farms. Most of them were closed as a result of socio-economic transformation in the nineties. **Agricultural advisors, therefore, had to maintain the network of farmers involved in sharing demonstration venues**. Accession of Poland to EU accelerated the development in agriculture. **Commercial companies developed networks of dealerships and applied a dual approach to demo farms, running their own company managed demo farm (1) and signing contracts with farmers to use part of their farms for demonstration activities (2).** Long traditions of demo farms run by research organizations which collaborate with public advisory services to among others organize open days of farmers. Providers of demonstration : **In Poland the majority of agricultural demonstrations are set-up by farmers and public advisory services. Demonstrations are often carried out jointly by advisors and farmers.** Majority of demonstration farms belong to field walks with farmers, **owners of demonstration farms acting as guides**. In many cases they are **supported by agricultural advisors from the public advisory service as initiators/facilitators of farmers involvement in demonstration activities. Demonstration activities are undertaken by commercial and experimental farms with 80/20 partitioning. Demo farms do usually not participate in regional and national networks. Demo farms managed by farmers organize a smaller number of demo's with a small number of visitors per year. Demo activities run by organizations are bigger.** A **limitation** of this study is that **demonstration farms managed by company producing/selling material for farming are clearly underrepresented within**

our inventory. The reason is confirmed by experiences of many other social researches in Poland, trends amongst commercial companies to not participate in any research is due to the non-direct relation with their core business.

CLUSTER 3 :

Cluster 3 has **120 observations** and is most distinguished by the **membership of a network** *(significant difference of the variable mean score compared to all other clusters).* **The mean scores of the other variables (scope of the farming practices, organization of demo's, annual n° of demo's and visitors) are moderate.**

Cluster 3 is the predominant type in **Sweden** (59 % of 34 cases), **UK** (51 % of 77 cases) and **France** (50 % van 32 cases). Although not predominantly, cluster 3 is also meaningful in **Ireland** (29 % of 55 cases).

Sweden : The **OiB network (Farming In Balance)** started in 1991 as an initiative from farmers, with the aim to get ecology and economy in balance. Today OiB consists of **17 demonstration farms**. The **voluntary advisory program Focus on nutrients** started in 2001. It is based on the OiB concept that when the farmer gets knowledge about how the production affects the environment, farmers take voluntary actions to protect the environment. OiB was part of **the Baltic Deal project**. A **farm network** with **organizations around the Baltic Sea**, with the aim to putting best agricultural practices into work. **Future Farming** is a demonstration network of 24 enterprises with the aim to show energy efficiency and production of renewable energy. The project **Biodiversity on the plain** is a project with ten farms. Providers of demonstration : In Sweden the majority of on-farm demonstrations are initiated by **organizations, advice services from an advisory company or an adviser from the authorities**. Also **suppliers** are initiating demonstrations on farms showing the latest varieties, different fertilization strategies, new pesticides etc. **The most common is that the farmer leads the demonstration on the farm himself/herself. Advisors, suppliers or authority are often engaged to act as facilitators to ensure smooth running of the actual events.** Purpose of demonstrations : Suppliers initiate demonstrations that can increase the farmers profit. **Advisory services and network is about environmental issues or how to increase productivity.** The **farm network Odling I Balans** have had demonstrations for about 27 years, on their farms about **environmental issues and best management practices**. The **largest advisory company "Hushållningssällskapet"** (The Rural Economy and Agricultural Societies) arrange **field walks and demonstrations on several places in Sweden. Borgeby field days** are the biggest agricultural show in Europe with ~10 000 visitors, organized by them. During that event several demonstrations are held. Sharing of information : Farmers are happy to cooperate when it comes to environmental issues. Farmers are less likely to share how to increase production or increases profits. Such advice usually takes place individually.

UK : Historical agricultural demonstration differs between the 4 countries, but appears to be largely **government run and funded** or **educational institute** run and either publically or government funded. It must be remembered that historical documents and accounts are more readily available for this type of demonstration. **Farmer initiated and run demonstration may have been word of mouth** and therefore the documentation for these types of demonstration may be more difficult to source or missing. The precursor to demonstration farms were **Model**

farms, starting the in the 19th century. These farms were experimental, **demonstrating improvements in agricultural techniques, efficiency** and **building layout.** Model farms were started by wealthy landowners. After this **government bodies and educational establishments** took on the task of agricultural demonstration. Providers of demonstration: **The majority of on-farm demonstrations are initiated by organizations (except in England), although the farmers actively choose to offer their premises to host the demonstrations**. The organizers are **increasingly encouraging the farmers to lead the choice of demonstration top**ic, in some cases **a management team for the demonstration farm** discuss and select the topic. Increasingly **local farm advisor groups are engaged to act as facilitators** to ensure smooth running of the actual events. **Demonstrations taking place on farms in the UK are increasing in popularity. Organisations are establishing networks of like-minded individuals wanting to exchange innovations.** Monitor farm programmes led by farmers, for farmers where the emphasis is on practical farming and good business decisions rather than theory. **Availability of funding for farmers to host their own demonstrations may encourage them to take the initiative.**

France : In the 1960s, a large number of agricultural extension groups were created on the initiative of **farmers' unions and chambers of agriculture**. Actually, there are 2 main types of demonstrations: **(1) Demos on commercial farms (main type)** : hosted by a commercial farm, organized by a local organization (chamber of agriculture, association, cooperative…), **part of a regional or national network,** often on a specific product or technology, sometimes on a production system, various sizes : from small groups of farmers to open days with > 200 visitors, peer to peer learning and exchanges between farmers, example for other farmers, present and disseminate the results of public-funded projects; **(2) Demos on experimental stations** : hosted by a research or applied research farm, cross fertilization between researchers, advisers and farmers.

Providers of demonstration : Organizers : **Even if the demo takes place on a commercial farm, it is usually organized by a chamber of agriculture, a research institute or a farmers' association**. Funders : Demo activities are mostly **financed by public funds (local, regional, national, EU)**. Demonstrators : Usually, farmers present their practices and farm organization, while advisors or researchers present project results.

Distinguishing characteristics : Mainly on commercial farms and experimental farms. **Usually, part of a regional or national network from 10 to more than 1000 farms.** Demo topics well-balanced between crop production and animal husbandry. Audience mainly from local or regional level.

Ireland : In recent years (since the 1990s), there has been a tendency towards the **co-ordinated organization, primarily by Teagasc**, and **delivery of demonstration events on private farms in collaboration with industry partners.**

Providers of demonstrations : **Teagasc,** a semi-state (public) organization, is the **most frequent organizer of demonstration activities in Ireland**. Teagasc is furthermore **leading a number of 'joint programmes'** co-funded and co-developed by other actors (mainly supply chain actors, co-ops and agrimedia) across Ireland. The **Teagasc adviser** is identified as the **'main demonstrator'**, yet **demonstrations** typically take place on **client farmers' farms**. In this context, **the farmer** was also identified by respondents to the FarmDemo survey as **having**

involvement in choosing topics, and preparing for demonstration events as well as communicating to participants at open days. Distinguishing characteristics : The majority of farm demonstrations are organized by Teagasc's advisory service and are co-funded/co-developed by the private sector (supply actors, as well as local farming co-ops and the farming media). Most demonstration farm walks are official 'Knowledge Transfer (KT) events' – a certain number of these must be attended (as part of the CAP-funded KT Groups Scheme) in order for farmers to fulfil their obligations to receive a payment under the scheme.

CLUSTER 4 :

Cluster 4 has **62 observations** and is most distinguished by **a high number of annual demonstrations** *(significant difference of the variable means scores compared to all clusters except cluster 6)* **and a high number of and visitors** *(significant difference of the variable means scores compared to all clusters).* Network or programme partnership is variable, **demonstrations tend to focus more on whole farm approaches**, and are **organized by a variety of actors** (farmers, farmer organizations, supply chain company, advisory services, research).

Cluster 4 is the predominant type in Germany (37 % of 52 cases) and Finland (35 % of 20 cases). Although not predominantly, it is also quite important in Belgium (20 % of 20 cases).

Germany : 20th century : Parallel emergence of public advisory services and strong private knowledge-sharing initiatives, esp. in the organic sector. Important organic demo network established in 2002. New networks and exchange of knowledge facilitated through farmer associations set a pattern for other demo networks to emerge lately (e.g. collaboration between science and practice).

Providers of demonstration: Many organic demonstration farms joined the PLAID network. Most of them follow whole-farm approaches. If there is a focus on a certain topic, it is integrated into the whole-farm approach. The demonstration activities of the other members joining the network usually target single practices. Most demonstration activities are provided by farmers themselves, often in collaboration with public advisory services or farmers' associations. Funding mainly comes from the farmers themselves or from public budgets through demo-networks.

Other issues: More demonstration activities take place in federal states with a strong public extension institution (e.g. in Bavaria and North Rhine-Westphalia). Germany has strong regional difference: There are fewer but bigger farms in the eastern states of Germany and more but smaller farms in the south and west of Germany. Organic farmers are very active in the organization of demo activities in Germany. This might be a result of the historic organization in producer networks and the endeavor for acceptance in the mainstream agricultural sector.

Germany has a large number of demonstration activities organized by and for farmers. Public advisory institutions and farmer associations are important for knowledge transfer in agriculture in Germany. Many farmers are organized in (publically funded) networks and can receive public funding for demo-activities. Topics of public interest receive more public funding

(e.g. nature conservation, animal welfare). The cooperation between science and practice is increasing.

Finland : In 1892 a **research station for agricultural production** was established in Tikkurila, Vantaa – this later became **MTT Agrifood research Finland,** which operates **under the Ministry of Agriculture and Forestry.** Teaching and spreading agricultural knowledge : **Folk schools** conducted agricultural demonstration with the aim of spreading practices and technologies to home farms. The **University of Helsinki** took over **Viikki farm in Helsinki** as a research and teaching farm in 1931. Its aim was to **develop a model farm for university-level teaching and research.**

Types of demonstrations : Finland is a country of **family farms**. Thus, **direct sales** and **farm tourism activities on private farms** are the most common types of farm demonstration activities in Finland.

Official demonstration activities, including those on private farms, tend to target **efficiency. Privately organized demonstration activities** more frequently (but not exclusively) relate to **organic farming, local food, uncommon crop varieties and heritage breeds, and nature and heritage biotope management.**

On-farm energy production has a strong showing through **'E-farm'**, which showcases different types of on-farm energy production on at least 11 diffferent farms.

Hands-on demonstration is also carried out under the Finnish **'talkoot', or community volunteering.**

Farmers with and without demonstration activities often give tours to **local school classes at no cost,** even if they otherwise charge for farm visits.

Providers of demonstration : c. 105 farms identified : 59 certified organic, 5 certified biodynamic

Majority privately held **family farms (86)** : direct sales & farm tourism; demo for school groups; cooperation with external producer organizations, extension services, private companies, State bureaus, environmental organizations, vocational schools & universities, overlap of activities. Other: **Share companies/partnership/LLC's (8):** are usually partnerships between multiple farms; similar profile as above; **Cooperatives (2), Foundations (3), University and vocational schools** : own farms/gardens for teaching, research, demo; projects with farming community as part of teaching and research; **State Institutes (Under umbrella of Natural Resources Finland)** : funding, leading demo projects; own research farms, cooperation & support, **Producer & extension organizations** : demo organizers/partners, **Nature management organizations** : teaching, organizing, **Private companies** : consulting, showcasing, information dissemination.

Distinguishing characteristics : From showcasing high-tech solutions like milking robots and energy self-sufficiency technologies to focusing on nature management, green care and agricultural production in the far north, Finland has a fascinating range of demonstration activities. **'Field days'** – held annually and widely advertised- are important to farmers (2017 : +/- 3000 people attended the field day at Västankvarn farm in Southern Finland

Belgium : From 1920 on, the dissemination of agricultural knowledge across the whole country became important, in the beginning mainly boosted by **farmers' organisations like**

Boerenbond. Later on, the **Ministry of Agriculture** also played an important role in advising farmers. In Belgium the two main types of demonstrations are : demonstrations on 'commercial farms' and demonstrations on 'experimental, research farms'. Organizations often establish networks of like-minded farmers interested in exchanging information on innovative practices. There are more demonstrations in the field of crop production than in animal husbandry. Main 'models' for on-farm demonstrations : **European and regional projects**: mostly **temporary demonstration farms** (Dairyman (Interreg), EuroDairy, GoedGerund, GoedgePASt, ...). Demonstrations by experimental research centers/farms. **Flanders has made the strategic choice to host on-farm demonstrations through applied research farms, rather than on commercial farms.** These research farms have several demonstration plots and sites, and often **cooperate with local farmers to host demonstrations**. Demonstrations cover a wide range of topics. Demonstrations **by farmer networks**: most common examples are the organic farms networks ('Biobedrijfsnetwerken'). Demonstrations **initiated by commercial suppliers** (of machines, seeds, plant protection products, et.), together with farmers on their farm. Furthermore, several informal networks (relatively small in size), which were more informal groups, consisting of farmers that know each personally.

CLUSTER 5 :

Cluster 5 has **142 observations** and is most distinguished by a **low number of annual demonstrations and visitors** *(no significant differences of the variable mean scores compared to clusters 1 and 2).* **Network or programme partnership is variable, demonstrations can focus both on single techniques and whole farm approaches, and are organized by a variety of actors** (farmers, farmer organizations, supply chain company, advisory services, research).

Cluster 5 is the predominant type in **Ireland** (58 % of 55 cases). Although not predominantly, cluster 5 is also important in **Sweden** (41 % of 34 cases), **Finland** (30 % of 20 cases), **Croatia** (29 % of 14 cases), **France** (25 % of 32 cases), **UK** (23 % of 77 cases) and **Spain** (20 % of 30 cases).

Ireland : In recent years (since the 1990s), there has been a tendency towards the **co-ordinated organization, primarily by Teagasc**, and **delivery of demonstration events on private farms in collaboration with industry partners.**

Providers of demonstrations : **Teagasc,** a semi-state (public) organization, is the **most frequent organizer of demonstration activities in Ireland**. Teagasc is furthermore **leading a number of 'joint programmes'** co-funded and co-developed by other actors (mainly supply chain actors, co-ops and agrimedia) across Ireland. The **Teagasc adviser** is identified as the **'main demonstrator'**, yet **demonstrations** typically take place on **client farmers' farms**. In this context, **the farmer** was also identified by respondents to the FarmDemo survey as **having involvement in choosing topics**, and **preparing for demonstration events** as well as **communicating to participants at open days.** Distinguishing characteristics : The majority of farm demonstrations are **organized by Teagasc's advisory service** and **are co-funded/co-developed by the private sector (supply actors, as well as local farming co-ops and the farming media).** Most demonstration farm walks are **official 'Knowledge Transfer (KT) events'**

– a certain number of these **must be attended** (as part of **the CAP-funded KT Groups Scheme) in order for farmers to fulfil their obligations to receive a payment under the scheme.**

Sweden : The **OiB network (Farming In Balance)** started in 1991 as an initiative from farmers, with the aim to get ecology and economy in balance. Today OiB consists of **17 demonstration farms**. The **voluntary advisory program Focus on nutrients** started in 2001. It is based on the OiB concept that when the farmer gets knowledge about how the production affects the environment, farmers take voluntary actions to protect the environment. OiB was part of **the Baltic Deal project**. A **farm network** with **organizations around the Baltic Sea**, with the aim to putting best agricultural practices into work. **Future Farming** is a demonstration network of 24 enterprises with the aim to show energy efficiency and production of renewable energy. The project **Biodiversity on the plain** is a project with ten farms. Providers of demonstration : In Sweden the majority of on-farm demonstrations are initiated by **organizations, advice services from an advisory company or an adviser from the authorities**. Also **suppliers** are initiating demonstrations on farms showing the latest varieties, different fertilization strategies, new pesticides etc. **The most common is that the farmer leads the demonstration on the farm himself/herself. Advisors, suppliers or authority are often engaged to act as facilitators to ensure smooth running of the actual events.** Purpose of demonstrations : Suppliers initiate demonstrations that can increase the farmers profit. **Advisory services and network is about environmental issues or how to increase productivity.** The **farm network Odling I Balans** have had demonstrations for about 27 years, on their farms about **environmental issues and best management practices**. The **largest advisory company "Hushållningssällskapet"** (The Rural Economy and Agricultural Societies) arrange **field walks and demonstrations on several places in Sweden. Borgeby field days** are the biggest agricultural show in Europe with ~10 000 visitors, organized by them. During that event several demonstrations are held. Sharing of information : Farmers are happy to cooperate when it comes to environmental issues. Farmers are less likely to share how to increase production or increases profits. Such advice usually takes place individually.

Finland : In 1892 a **research station for agricultural production** was established in Tikkurila, Vantaa – this later became **MTT Agrifood research Finland,** which operates **under the Ministry of Agriculture and Forestry**. Teaching and spreading agricultural knowledge : **Folk schools** conducted agricultural demonstration with the aim of spreading practices and technologies to home farms. The **University of Helsinki** took over **Viikki farm in Helsinki** as a research and teaching farm in 1931. Its aim was to **develop a model farm for university-level teaching and research.**

Types of demonstrations : Finland is a country of **family farms**. Thus, **direct sales** and **farm tourism activities on private farms** are the most common types of farm demonstration activities in Finland.

Official demonstration activities, including those on private farms, tend to target **efficiency. Privately organized demonstration activities** more frequently (but not exclusively) relate to **organic farming, local food, uncommon crop varieties and heritage breeds, and nature and heritage biotope management.**

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Majority privately held **family farms (86)** : direct sales & farm tourism; demo for school groups; cooperation with external producer organizations, extension services, private companies, State bureaus, environmental organizations, vocational schools & universities, overlap of activities. Other: **Share companies/partnership/LLC's (8):** are usually partnerships between multiple farms; similar profile as above; **Cooperatives (2), Foundations (3), University and vocational schools** : own farms/gardens for teaching, research, demo; projects with farming community as part of teaching and research; **State Institutes (Under umbrella of Natural Resources Finland)** : funding, leading demo projects; own research farms, cooperation & support, **Producer & extension organizations** : demo organizers/partners, **Nature management organizations** : teaching, organizing, **Private companies** : consulting, showcasing, information dissemination.

Distinguishing characteristics : From showcasing high-tech solutions like milking robots and energy self-sufficiency technologies to focusing on nature management, green care and agricultural production in the far north, Finland has a fascinating range of demonstration activities. **'Field days'** – held annually and widely advertised- are important to farmers (2017 : +/- 3000 people attended the field day at Västankvarn farm in Southern Finland

Croatia : The transfer of agricultural knowledge, information and implementation of new technologies is carried out by a number of **national, public expert services but mostly by the Advisory Service Croatia. The Advisory Service Croatia works in close collaboration with companies in private sector involved in seed production and distribution, agricultural mechanization, artificial fertilization and pesticide. There are no financial resources for demonstration activities in Croatia**. The organize of demonstration activities covers all the costs and participant have to pay for their own travel costs. There is a lack of peer to peer knowledge transfer amongst farmers.

France : In the 1960s, a large number of agricultural extension groups were created on the initiative of **farmers' unions and chambers of agriculture**. Actually, there are 2 main types of demonstrations: **(1) Demos on commercial farms (main type)** : hosted by a commercial farm, organized by a local organization (chamber of agriculture, association, cooperative…), **part of a regional or national network,** often on a specific product or technology, sometimes on a production system, various sizes : from small groups of farmers to open days with > 200 visitors, peer to peer learning and exchanges between farmers, example for other farmers, present and disseminate the results of public-funded projects; **(2) Demos on experimental stations** : hosted by a research or applied research farm, cross fertilization between researchers, advisers and farmers.

Providers of demonstration : Organizers : **Even if the demo takes place on a commercial farm, it is usually organized by a chamber of agriculture, a research institute or a farmers' association**. Funders : Demo activities are mostly **financed by public funds (local, regional,**

national, EU). Demonstrators : Usually, farmers present their practices and farm organization, while advisors or researchers present project results.

Distinguishing characteristics : Mainly on commercial farms and experimental farms. **Usually, part of a regional or national network from 10 to more than 1000 farms.** Demo topics well-balanced between crop production and animal husbandry. Audience mainly from local or regional level.

UK : Historical agricultural demonstration differs between the 4 countries, but appears to be largely **government run and funded** or **educational institute** run and either publically or government funded. It must be remembered that historical documents and accounts are more readily available for this type of demonstration. **Farmer initiated and run demonstration may have been word of mouth** and therefore the documentation for these types of demonstration may be more difficult to source or missing. The precursor to demonstration farms were **Model farms**, starting the in the 19th century. These farms were experimental, **demonstrating improvements in agricultural techniques, efficiency** and **building layout.** Model farms were started by wealthy landowners. After this **government bodies and educational establishments** took on the task of agricultural demonstration. Providers of demonstration: **The majority of on-farm demonstrations are initiated by organizations (except in England), although the farmers actively choose to offer their premises to host the demonstrations.** The organizers are **increasingly encouraging the farmers to lead the choice of demonstration topic**, in some cases **a management team for the demonstration farm** discuss and select the topic. Increasingly **local farm advisor groups are engaged to act as facilitators** to ensure smooth running of the actual events. **Demonstrations taking place on farms in the UK are increasing in popularity. Organisations are establishing networks of like-minded individuals wanting to exchange innovations.** Monitor farm programmes led by farmers, for farmers where the emphasis is on practical farming and good business decisions rather than theory. **Availability of funding for farmers to host their own demonstrations may encourage them to take the initiative.**

Spain : The first demonstrations took place in 1980. The attendees were local farmers. They were organized by the public advisory service and with public funding. Since then, demonstrations related to crop innovation, have been one of the more appreciated activities of INTIA, as a public advisory service. **In livestock the demonstrations are more linked to reference farms and production systems. The demonstrations are made by visiting the farm itself in the case of livestock, and through a guided field walk in the case of crops. In the inventory the role of farmers was relevant, both as organizer and funder**. Half of the events were **organized by farmers directly or throughout some organization. 52 % of demonstrations were financed by the farmers themselves and only 13 % were financed with public resources.** Remark : The sample is biased towards the northern part of Spain. In the northern part of Spain there are more livestock farms than in the south.

CLUSTER 6 :

Cluster 6 has **88 observations** and is most distinguished by the focus of the demonstrations on a **whole farm approach** *(significant difference of the variable means scores compared to all clusters*), the **organization of the demo's by farmers and farmers organizations** *(significant difference of the variable means scores compared to all clusters except cluster 1),* the **high number of demo events** *(significant difference of the variable means scores compared to all clusters except cluster 4)* and the **high number of visitors** *(significant difference of the variable means scores compared to all clusters*). **Network or programme partnership is variable.**

Cluster 6 is not the predominant type in most countries, but is quite important in **Romania** (37 % of 30 cases), **Germany** (29 % of 52 cases), **Hungary** (29 % of 28 cases), **UK** (21 % of 77 cases), **Belgium** (20 % of 20 cases) and **Finland** (20 % of 20 cases).

Romania : The demonstrative activities present in Romania in part have their roots in socialist agriculture. The main actors of the modernization of socialist agriculture were the **research institutes and research stations**, which also had an activity of popularization of developed varieties and technologies. **Some of these institutions are still functioning today. In the post-communist era big companies producing and distributing conventional agricultural inputs entered Romania. They also introduced new demonstration techniques, namely the system of demonstration lots placed on farms – the later becoming the largest and most frequent demonstration farms. Besides the above commercial farms many smaller family farms experimenting with alternative technologies or with breeds and breeds that are non-existent/rare in the country emerged. These also organize demonstration activities frequently. In the post-socialist period several demonstrative farms with a background in the associational sphere have emerged. These NGO-based farms are, however, quite rare.** Major providers of demonstration activities are commercial farms (partners of input-firms, conventional agriculture, demonstrative plots, few demo activities, large audiences, externally initiated demo activities), research institutes (state financed, research led, few demo activities, relatively large audience, self initiated) and small farms (self initiated, self funded, many demo activities, few participants, ideologically motivated).

Germany : 20th century : **Parallel emergence** of **public advisory services** and **strong private knowledge-sharing initiatives, esp. in the organic sector.** Important **organic demo network** established in 2002. **New networks** and exchange of knowledge facilitated through **farmer associations** set a pattern for **other demo networks to emerge lately** (e.g. collaboration between science and practice).

Providers of demonstration: Many **organic demonstration farms** joined the PLAID network. Most of them follow **whole-farm approaches.** If there is a focus on a certain topic, it is integrated into the **whole-farm approach.** The demonstration activities of the other members joining the network usually target single practices. **Most demonstration activities are provided by farmers themselves, often in collaboration with public advisory services or farmers' associations. Funding** mainly comes from the **farmers themselves or from public budgets through demo-networks.**

Other issues: More demonstration activities take place in **federal states with a strong public extension institution** (e.g. in Bavaria and North Rhine-Westphalia). Germany has strong regional difference: There are fewer but bigger farms in the eastern states of Germany and more but smaller farms in the south and west of Germany. **Organic farmers are very active in the organization of demo activities in Germany.** This might be a result of the historic organization in producer networks and the endeavor for acceptance in the mainstream agricultural sector.

Germany has a large number of demonstration activities organized by and for farmers. Public advisory institutions and **farmer associations** are important for knowledge transfer in agriculture in Germany. **Many farmers are organized in (publically funded) networks** and can receive **public funding for demo-activities.** Topics of public interest receive more public funding (e.g. nature conservation, animal welfare). The cooperation between science and practice is increasing.

Hungary : The history of demonstrative activities in Hungary strongly intertwines with agarian higher education system. Educational farms have been operating in the country since the first establishment of agrarian universities and colleges – since the 1800s. Today, 9 out of 22 public universities run educational farms which function as the main practical knowledge provider for the agrarian higher education. **Demonstrative activities of commercial farms are deeply rooted in socialist agriculture. After 2004, when Hungary joined the EU, significant funds have started to be allocated for agricultural improvement,** namely : sustainable practices, organic agriculture, modernization, etc. **In 2014, a state call was opened to farmers to apply for the title of "demonstration farm", lasted for 2 years – and 110 farms were successfully given this new role with funding to initiate demonstration activity.** In the inventory half of the demonstration providers are profit-oriented (small or big) commercial farms, followed by research, experimental, or knowledge transfer farms, educational farms. Oral presentations and interactive discussions are the most favoured demonstration type. Characteristics of commercial farms: surprisingly small amount of average demo activities and attendees, self-funded events, initiated and organized by farmers or researchers- sometimes funded by advisory service. Entrance is not free of charge. Topics : innovative cropping technologies and demonstration of new varieties or breeds.

UK : Historical agricultural demonstration differs between the 4 countries, but appears to be largely **government run and funded** or **educational institute** run and either publically or government funded. It must be remembered that historical documents and accounts are more readily available for this type of demonstration. **Farmer initiated and run demonstration may have been word of mouth** and therefore the documentation for these types of demonstration may be more difficult to source or missing. The precursor to demonstration farms were **Model farms**, starting the in the 19th century. These farms were experimental, **demonstrating improvements in agricultural techniques, efficiency** and **building layout.** Model farms were started by wealthy landowners. After this **government bodies and educational establishments** took on the task of agricultural demonstration. Providers of demonstration: **The majority of on-farm demonstrations are initiated by organizations (except in England), although the farmers actively choose to offer their premises to host the demonstrations.** The organizers are **increasingly encouraging the farmers to lead the choice of demonstration topic**, in some cases **a management team for the demonstration farm** discuss and select the topic. Increasingly **local farm advisor groups are engaged to act as facilitators** to ensure smooth

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Types of demonstrations : Finland is a country of **family farms**. Thus, **direct sales** and **farm tourism activities on private farms** are the most common types of farm demonstration activities in Finland.

Official demonstration activities, including those on private farms, tend to target **efficiency. Privately organized demonstration activities** more frequently (but not exclusively) relate to **organic farming, local food, uncommon crop varieties and heritage breeds, and nature and heritage biotope management.**

On-farm energy production has a strong showing through **'E-farm'**, which showcases different types of on-farm energy production on at least 11 diffferent farms.

Hands-on demonstration is also carried out under the Finnish **'talkoot', or community volunteering.**

Farmers with and without demonstration activities often give tours to **local school classes at no cost,** even if they otherwise charge for farm visits.

Providers of demonstration : c. 105 farms identified : 59 certified organic, 5 certified biodynamic

Majority privately held **family farms (86)** : direct sales & farm tourism; demo for school groups; cooperation with external producer organizations, extension services, private companies, State bureaus, environmental organizations, vocational schools & universities, overlap of activities. Other: **Share companies/partnership/LLC's (8):** are usually partnerships between multiple farms; similar profile as above; **Cooperatives (2), Foundations (3), University and vocational schools** : own farms/gardens for teaching, research, demo; projects with farming community as part of teaching and research; **State Institutes (Under umbrella of Natural Resources Finland)** : funding, leading demo projects; own research farms, cooperation & support, **Producer & extension organizations** : demo organizers/partners, **Nature management organizations** : teaching, organizing, **Private companies** : consulting, showcasing, information dissemination.

Distinguishing characteristics : From showcasing high-tech solutions like milking robots and energy self-sufficiency technologies to focusing on nature management, green care and agricultural production in the far north, Finland has a fascinating range of demonstration

activities. **'Field days'** – held annually and widely advertised- are important to farmers (2017 : +/- 3000 people attended the field day at Västankvarn farm in Southern Finland.