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FoPIA-Surefarm Case-study Report Romania

Work Performed by Partner 13, IEA-AR

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1 Abstract

The Romanian case study is set in the North-Eastern region of the country. The studied area is traditionally dominated by small mixed farms, which are generally family run.

The type of challenges the studied farming system (small mixed family farms) is facing is largely influenced by the particular identity of the system. The key actors are also specific – one can notice the absence of large companies (input suppliers, wholesalers, retailers, banks) which are not willing to work with small farmers.

In the Romanian case-study, the main functions identified by the stakeholders that participated in the workshop were *'deliver healthy and affordable food products'* and *'animal welfare',* while the *'protect biodiversity of habitats, genes and species'* function was evaluated as the least important one. Generally speaking, the functions representing private goods were much better scored than those representing public goods.

Although the participants easily agreed when selecting the indicators to represent the essential functions of the farming system, when scoring the importance and the performance per indicator, the stakeholders' opinions were diverse, thus making it difficult to reveal any general trends. The participants reached an agreement only regarding the good representation capacity of the indicators for the 'food production' function.

Of all indicators, 'subsidies' performed the best in all stakeholder groups' opinion. Indeed, in small farms, subsidies are covering an important part of the production costs. In contrast, indicator 'management of agricultural waste' showed the lowest performance, despite that it was included in the list by the stakeholders themselves, proof that its importance has been acknowledged, but for the time being the priorities lay in the production and efficiency areas.

The range of the perceived challenges is explicitly linked to the characteristics of the farming system. The strategies identified as responses to specific challenges are aiming to deal with the encountered hindrances, but the final target is to reach the level of economic efficiency allowing a reasonable welfare level for the farmer and his family. The strategies discussed and scored by the stakeholders in terms of effect on the resilience forms showed positive effects mostly on adaptability and transformability, and less on transformability.

The perceived performance of attributes in the analysed farming system (small-mixed farms) points to positive contribution to adaptability and secondly to transformability. Robustness is considered the least present resilience capacity in the Romanian case-study farming system.

2 Introduction

2.1 General introduction to the case-study area

The case study in Romania consists of small-size, mixed family farms in the Nord-Est region (NUTS2 area "RO21"). Figure 1 shows the map of the case-study area. The last Farm Structural Survey (2016) shows that 73% of the Romanian farms are mixed (have both utilized agricultural area and livestock). Of those, the largest share (22%) are located in the Nord-Est region. In terms of utilized agricultural area, 98% of the farms in Nord-Est region have less than 10 ha and 95% less than 5 ha. The livestock is composed (% in the region's total LLU) of: bovines (42%, mostly dairy cows), poultry (19%), sheep (15%), pigs (12%), and equidae (9%, mainly horses for transport purposes). A more recent development in the region is the intensification of bee farming.

Source: http://adrnordest.ro/index.php?page=REGION_MAP

Figure 1. Map of Nord-Est region in Romania (the case-study area)

In terms of specialization, FADN data indicate in 2016 a total of 79,840 mixed farms - field crops-grazing livestock combined (type 80 in TF8 classification, calculated with SO), of which 34% are located in the Nord-Est region. Romanian FADN data do not include the very small-size farms (less than 1 ha UAA, which are not eligible for CAP support). These very small-size farms represent 53% of the total number of farms (at national level), and 56% of the total number of farms in region Nord-Est.

2.2 Challenges

The main challenges that were identified by the Romanian research team prior to the FoPIA-Surefarm workshop are listed in Table 1.

Table 1. Economic, environmental, social and institutional challenges identified for Nord-Est region (RO21).

	Economic	Environmental	Social	Institutional
Shocks (non-permanent)	Price fluctuations	Pests and diseases	Sudden changes of on-farm social capital (illness, death, divorce)	Neonicotinoids legislation
	Emergence / loss of alternative off-farm income source	Extreme weather events (drought / floods / hail)	Succession problems	Changes in CAP support
Long-term pressures	Low farm-gate prices	Climate changes	Emigration of young people	Social aid (support) legislation – too permissive (disincentive to work)
	Poor integration of small farms in agri-food chains	Environmental regulations	Lack of local labour	Complicated / unclear implementation rules for European-funded projects
	High costs of inputs and services		Lack of farming skills and knowledge	Lack of skills of the civil servants involved in European-funded projects
	Low profitability of traditional agriculture		Farmers' ageing	
	Import competition		Experience acquired abroad as pressure for change	

The Romanian rural population, characterized by an accelerated aging process, by low levels of education and by redundant skills in a labour market where the pace of adoption of technological innovation is very fast, has found in agriculture the area where its vulnerabilities are easier to manage, and the economic activity is able to cover the need for primary consumer goods, thus responding to the pressure created by the income deficit. Employment in agriculture has become an adaptive response to job crisis and to the decline in overall welfare. The abundance of labour

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force in rural areas and agriculture in particular resulted in fact in under-employment of the rural population, hence the low level of income. The vicious circle of perpetuation of a low welfare level, generated by excessive dependence on the land resources exploitation, forced the search for alternatives. Labour emigration was one of the main responses to the chronic lack of non-agricultural occupational opportunities in Romania. Occupational migration outside the country can also be considered a resilient response of the rural population. Large farms are highly specialized in intensive crop production – hence their vulnerability to climate change; they are also well connected to the world market and the global economic system – resulting in economic vulnerabilities linked to crises and price volatility on the world market (Tudor, 2017: 112-113).

2.3   FoPIA-Surefarm Workshop 1

The Romanian FoPIA-Surefarm workshop on current resilience was held on March 6, 2019, in Iași (the largest municipality in the Nord-Est region). It was organized by the Institute of Agricultural Economics of the Romanian Academy (IEA-AR – Partner 13 in the SURE-Farm Project) in collaboration with "Gh. Zane" Institute of Economic and Social Research - ICES (Romanian Academy, Iași Branch).

There were 14 stakeholders that participated in the workshop that belonged to four stakeholder groups: 6 farmers, 3 participants from government bodies, 3 from the processing industry and 2 from NGOs. The list of stakeholders that participated is detailed in Appendix A – Table A1).

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3 Farming system

3.1 Geographical boundaries, soil, climate and agro-ecological conditions

The Nord-Est Region is the largest region in Romania (36,850 km^2, representing 15.5% of the total area of the country). Its territorial boundaries are: to the North – external border with Ukraine; to the East – external border with Republic of Moldova; to the South – Region Sud-Est (RO22); to the West – Region Centru (RO12); to the North-West – Region Nord-Vest (RO11). The Nord-Est region consists of 6 counties: Bacău, Botoşani, Neamţ, Iaşi, Suceava and Vaslui, administrative-territorial units of NUTS 3 level.

The Nord-Est region has the largest population (3.22 million inhabitants, representing 16.5% of the total population of the country) among the 8 regions in Romania (Eurostat, 2018). More than half of the population (58.4%) lives in rural areas.

The landscape includes mountains (in the western part of the region, up to 1900 m altitude), hills (in the center and southern part) and plains (in the north-eastern part of the region). The hills and plains are favorable for a very diversified range of agricultural activities. The climate conditions vary along altitude and landscape, from mountain climate to temperate-continental climate. The high hills area has an average annual temperature of 8-9°C and about 600-700 mm rainfall, while in the lower areas (low hills and plains), the average annual temperature is 9-10°C, with cold winters and very hot summers, and about 400-500 mm rainfall, thus exposed to frequent droughts[1].

Agricultural area takes 57.7% (2.12 million ha) of the total area of the region; and forests take 33.4% (1.23 million ha). The structure of the agricultural area is: 65% arable land (1.38 million ha); 32.6% grassland (0.69 million ha); 1.5% vineyards (31.2 thou ha); and 0.9% orchards (19.1 thou ha). The main crops are maize, wheat, sunflower and vegetables; the region produces also important quantities of fruits and wine.

The farming system of the Nord-Est (RO21) region in Romania includes the following main farm types (typical farms) established within SURE-Farm (D3.1; Bijttebier et al., 2018):

- TF1: Very small size, semi-subsistence (1-2 ha) / family farms / various crops + livestock
- TF2: Small size (2-5 ha) / family farms / field crops + livestock
- TF3: Medium size (5-20 ha) / family farms / field crops + livestock
- TF4: Medium size (≥20 ha) / farms with legal status (commercial farms) / field crops

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[1] Source: www.adrnordest.ro.

- TF5: Large size (> 500 ha) / corporate farms / field crops

The case study concerns small, mixed, family farms; therefore, within the workshop we considered only the farm types TF1, TF2 and TF3.

The main actors identified in the inner circle of the case-study farming system are: farmer's family members, neighbours, other small farmers, local (peasant) markets, direct customers, small producers' associations, local selling networks; they are influencing farms, and, conversely, farms also influence these actors.

In the small family farms, the members of the family (relatives included) are the main influencers in decision-making, and also the main source of funding; loan arrangements among members of the family and trusted friends are frequent and generally informal (Florian et al., 2019).

The neighborhood relations are important in the farming system because they maintain their traditional rural functionality: neighborhood is the space of economic mutual aid – mainly in kind and mutual assistance for productive activities), exchange of information and knowledge, and also the space where economic conflicts and rivalries are born (Florian et al., 2019).

An important economic challenge identified for the farming system in the case-study region (Table 1) is the poor integration of small farms in agri-food chains. Wholesalers and retailers are not interested in buying products from small farmers. Consequently, the farmers found alternative markets for their products: local and urban peasant (wet) markets, local selling networks and sales to direct customers (using "customer lists"[2]). The farmers influence the consumers through diversity and quality of products. Prices are strongly influenced by competition from other small farmers. The farmers are influenced by the volatility of the demand and by the changes in the consumers' requirements concerning the origin of products: there is an increasing demand for local products (as opposed to imported products).

There is a reluctance to association (memories of the communist times when joining the soviet-type cooperatives was compulsory). Nevertheless, small producers' associations started emerging where small farmers found common interests (such as the need to be part of an association in order to be eligible for grassland subsidies).

Feedback from participants on the social boundaries of the farming system were:
- To be added in the inner circle: local selling networks;

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[2] The farmer identified a number of loyal customers; these customers are placing regularly orders (by phone) to the farmer (type of product, quantity, day of delivery), and the farmer either delivers himself the order, or the customer comes to the farm and picks his order.

- To be added in the mid-circle: cereal traders and wholesale markets;
- To be moved from inner circle to mid-circle: research stations (*"… they are not influenced by the farming system"*);
- To be moved from outer circle to mid-circle: EU policy makers (*"… they influence directly the farmers"*).

The new image of the farming system, updated by the participants is shown in Figure 1.
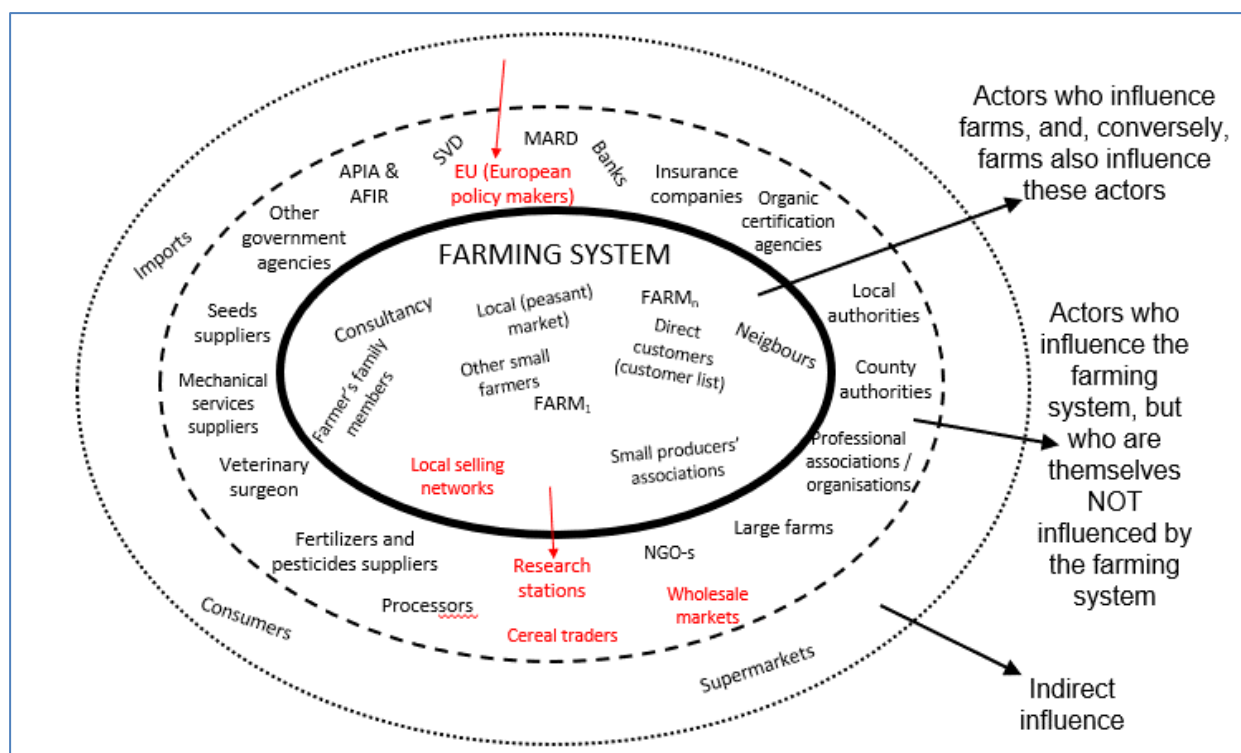
Figure 1. Updated farming system visualisation after feedback from participants. Actors in red font have changed position after feedback of participants.

4   Functions

In FoPIA-Surefarm, functions were subdivided towards the provisioning of private goods and public goods. Table 2 lists the farming system functions and their short descriptions which will be used in discussions and results presentation.

Table 2. Overview of farming system functions and their short descriptions

Farming system function	Short description
PRIVATE GOODS	
Deliver healthy and affordable food products	Food production
Deliver other bio-based resources for the processing sector	Bio-based resources
Ensure economic viability (viable farms help to strengthen the economy and contribute to balanced territorial development)	Economic viability
Improve quality of life in farming areas by providing employment and offering decent working conditions.	Quality of life
PUBLIC GOODS	
Maintain natural resources in good condition (water, soil, air)	Natural resources
Protect biodiversity of habitats, genes, and species	Biodiversity & habitat
Ensure that rural areas are attractive places for residence and tourism (countryside, social structures)	Attractiveness of the area
Ensure animal health & welfare	Animal health & welfare

By far, *'deliver healthy and affordable food products'* was indicated as the main function of the farming system (average 25%). All *stakeholder groups* agreed on that (Figure 2). The second most important function identified was '*animal health & welfare'* (14%); *farmers* and *NGO-s* agreed on that. The function *'bio-based resources'* scored on average 13%; *farmers*, *government* and *NGO stakeholders* agreed on that too. On the contrary, *processors* scored low (2%), because they stated that *"… the small mixed farms are not viable suppliers for the processing industry, they are too small, they are able to supply products only for on-farm / small traditional processing"*.

Government stakeholders ranked high also '*economic viability'* and *'quality of life'*, but ranked low *'biodiversity & habitat'* and *'attractiveness of area'*. *Farmers* ranked high the three functions covering their area of interest (*'food production', 'animal welfare'* and *'economic viability'*). *NGO stakeholders* ranked high *'attractiveness of the area', 'animal welfare'* and '*bio-based resources'* functions, since their activity is oriented to the sustainable development of the rural area in the region, based on stimulating the farms to diversify their activities and income sources (through local/on-farm processing, selling the farm products on local markets, etc.).
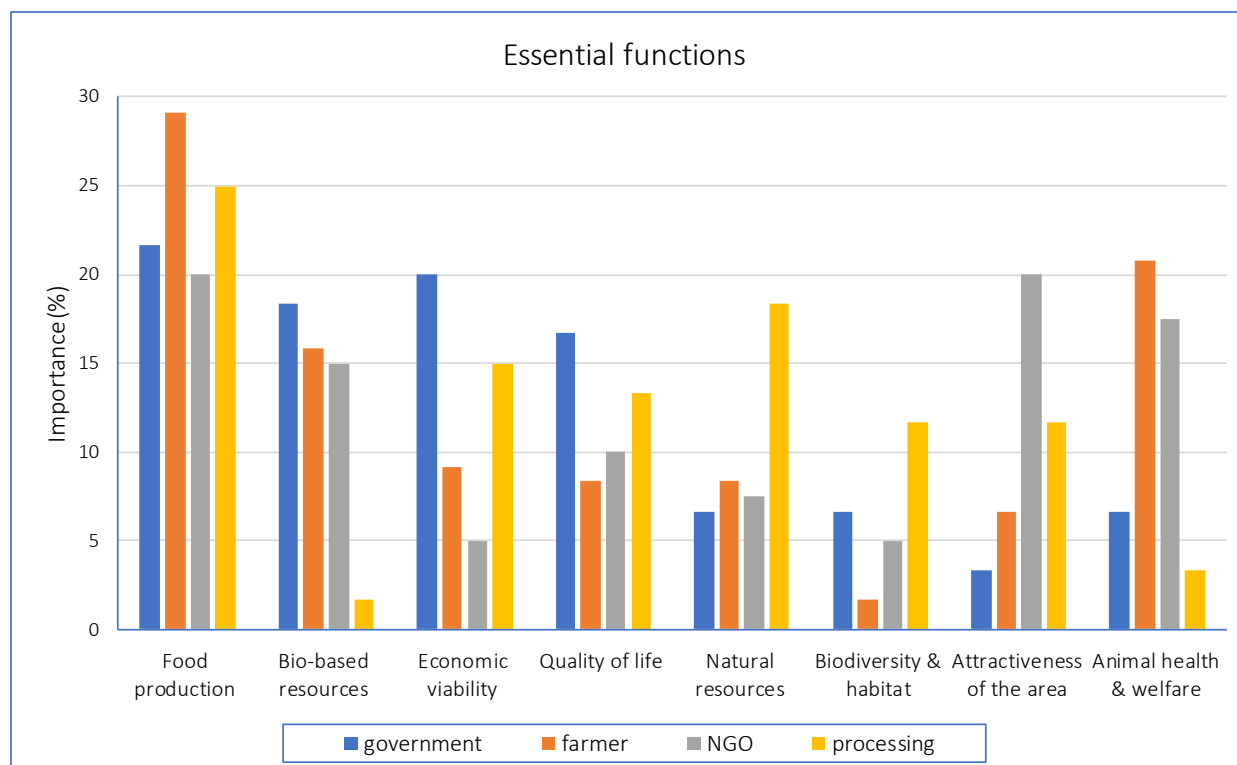
Figure 2. Bar graph with **scoring per function**, aggregated by stakeholder group (100 points divided over 8 functions)(n=14)

The *'biodiversity & habitat'* function was scored as the least important (5%), and was scored as such by all stakeholder groups, indicating a lack of interest for this function.

[The tables with means and standard deviations, aggregated by stakeholder group, can be found in Appendix B (Table A2, Table A 5, Figure A 1)].

The participants scored the private functions as more important (62%) than the public ones (38%); *government stakeholders* and *farmers* value much more the private functions (*government* 77%/23%, *farmers* 63%/37%); while *processors* and *NGO-s* scored them quite balanced (*processors* 55%/45%, *NGO-s* 50%/50%).

5   Indicators of functions

5.1   Indicator importance

As compared to the initial indicators of functions proposed by the research team, during the plenary discussion, some indicators were removed, the meaning of some indicators was widened and consequently, these indicators were renamed. Also, new indicators were introduced. The moderator asked the participants to explain and provide arguments for their proposals – why the new indicators are representative for the function and how they relate with the farming system functions. The discussions continued until consensus was reached. The debates focused mostly on the indicators representing public goods functions: '*maintain natural resources in good condition'*, '*protect biodiversity of habitats, genes and species'* and '*ensure animal health & welfare'*, because some of them are qualitative indicators and participants had to figure out how to assign numbers (points) to score the indicators' representativeness for the functions. Table 3Table 2 summarizes the changes agreed by the participants and Table 5 presents the final list of indicators, as well as their short descriptions (which will be used in discussions and results presentation).

Table 3. Changes in the list of indicators of functions proposed and agreed by the participants

Person from stakeholder group	Function	Indicator change proposal & agreed
government	Food production	Initial indicator '*Cereal production'* to be enlarged to '*Crop and vegetable production'*
farmer	Food production	same
government	Quality of life	Adding indicator '*Attachment to family and community'*
government	Natural resources	Adding indicator '*Areas under forests'*
government	Natural resources	Adding indicator '*Management of agricultural waste'*
farmer	Natural resources	Same as above
government	Biodiversity & habitat	Adding indicator '*Awareness of biodiversity importance'*
government	Attractiveness of the area	Adding indicator '*Transport infrastructure'*
NGO	Attractiveness of the area	Adding indicator '*Leisure opportunities'*
farmer	Attractiveness of the area	Initial indicator '*Number of touristic boarding-houses'* to be enlarged to '*Number of agro-touristic boarding-houses and diversity of leisure opportunities'*
farmer	Animal health & welfare	Initial indicator '*Area of shelters for animals'* to be replaced with '*Animal density in shelters'*

Table 4. Final list of indicators for functions selected in the Romanian case study

Function	Selected indicators	Short description
PRIVATE GOODS Deliver healthy and affordable food products	Animal production (thousand tons) Crop and vegetables production (thousand tons)	Animal production Crop & vegetables production
Deliver other bio-based resources for the processing sector	Sales of animal products (thousand tons) Sales of crop and vegetables products (thousand tons)	Sales of animal products Sales of crop & vegetables production
Ensure economic viability (viable farms help to strengthen the economy and contribute to balanced territorial development)	Number of mixed farms Income from agricultural products sales Subsidies	Number of mixed farms Income from agricultural production sales Subsidies
Improve quality of life in farming areas by providing employment and offering decent working conditions.	Number of jobs in agriculture Ratio average income in agricultural households / average income in all households (%) Attachment to family / community	Number of jobs in agriculture Average income in agricultural households Attachment to family / community
PUBLIC GOODS Maintain natural resources in good condition (water, soil, air)	Quantity of fertilizers used Areas under land reclamation Areas under forests Management of agricultural waste	Quantity of fertilizers used Areas under land reclamation Areas under forests Management of agricultural waste
Protect biodiversity of habitats, genes, and species	Quantity of pesticides used Area benefitting from agri-environmental subsidies (% in total) Awareness of biodiversity importance	Quantity of pesticides used Areas with agri-environmental subsidies Awareness of biodiversity importance
Ensure that rural areas are attractive places for residence and tourism (countryside, social structures)	Number of agro-touristic board-houses and diversity of leisure opportunities Share of villages having schools and medical offices in total number of villages (%) Share of villages having water and sewerage networks in total number of villages (%) Transport infrastructure	Number of agro-touristic board-houses Villages having schools and medical offices Villages having water and sewerage networks Transport infrastructure
Ensure animal health & welfare	Animal density in shelters Share of animals grown in extensive regime Responsible use of veterinary drugs	Animal density in shelters Share of animals grown in extensive regime Responsible use of veterinary drugs

The only function where all stakeholder groups were in agreement that the indicators have a good capacity to represent it and also scored them rather high was again '*food production*' (Figure 3). The indicators representing '*food production*' and '*animal welfare*' functions received almost equal importance. In contrast, '*biodiversity & habitat*' was poorly represented by the selected indicators.

Indicators for the function '*economic viability*' scored also high, but with disagreements among the stakeholders: *farmers*, *government* and *processors* considered all three indicators rather important, in contrast with the *NGO-s*. In a similar way, indicators for the function '*animal welfare*'

scored also rather high, but there were disagreements among the stakeholder groups: *farmers* and *NGO-s* scored them high, but not *government,* nor *processors.*

Indicators for the function *'quality of life'* scored also rather high, again with disagreements: *government* and *processors* considered them important, while *farmers* appreciated them as moderately representative.

As a general conclusion, the stakeholders' opinions were diverse, thus making it difficult to reveal some more general trends.

When analysing the importance of indicators by stakeholder groups (Appendix B, Table A3), one can see that for *farmers*, the main indicators were 'crop and vegetable production' (32%), 'animal density in shelters' (27%) and 'animal production' (26%) (all linked to **food production** and **animal welfare** functions). For them, the least important indicators were 'share of area benefitting from agri-environmental subsidies' (1.3%), and 'awareness of biodiversity importance' (1%), because in the small mixed farms, technologies are rather extensive or moderately-intensive, hence their lack of interest. For *government stakeholders*, the main indicators are obviously linked to the CAP policies: subsidies (28%), crop and vegetable production (26.7%) and number of jobs in agriculture (23.3%).
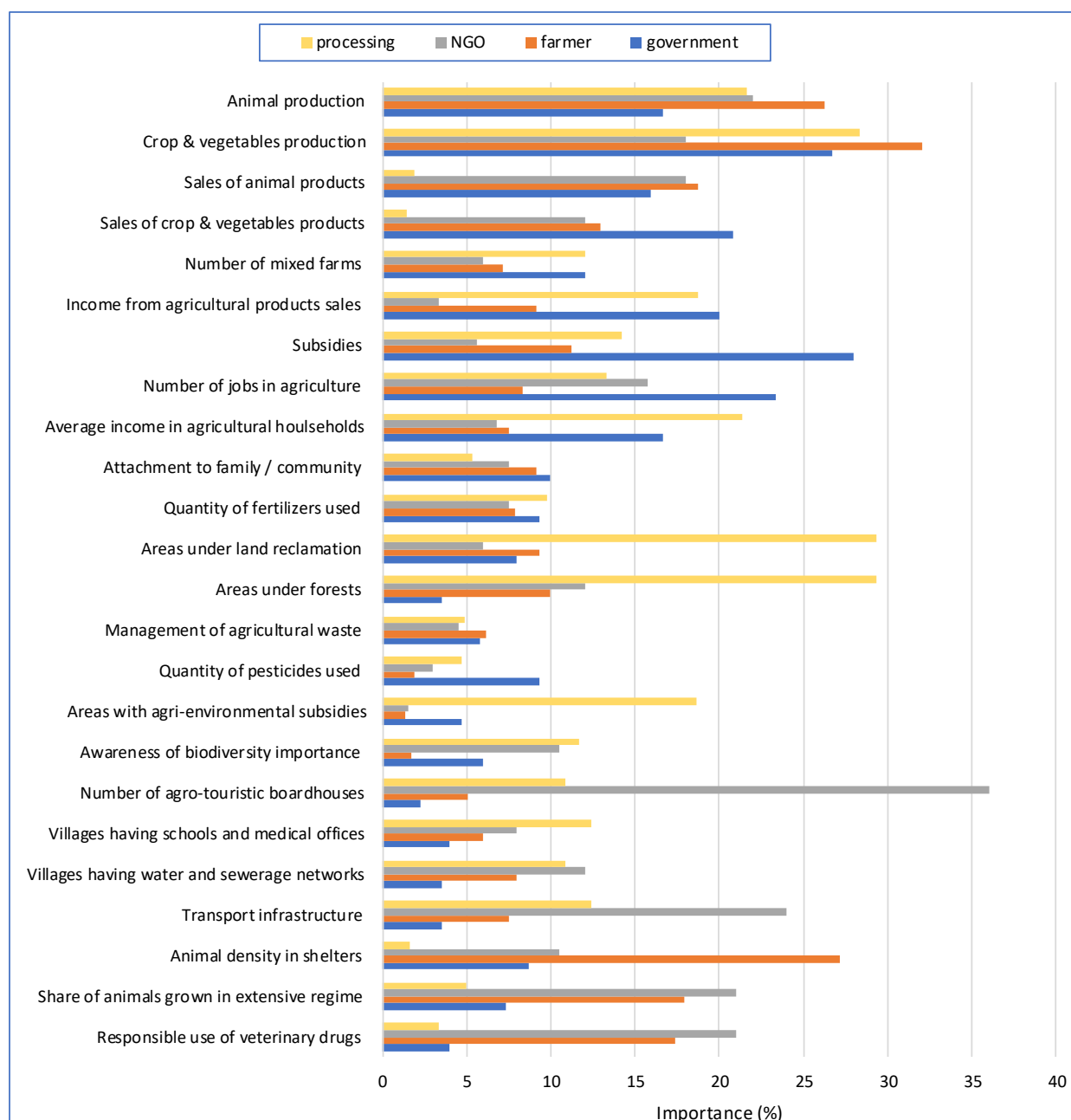
Figure 3. Bar graph with scoring of **importance per indicator**, aggregated by stakeholder group. Per essential function, 100 points were divided over the indicators (values are transformed to include the importance and number of indicators of the function that the indicators represent) (n=14)

[Tables with means and standard deviations, for original and transformed values, aggregated by stakeholder group, are in Appendix B (Table A3, Table A 4).]

The least important indicators reflect those policy areas which have not yet been properly tackled in terms of rural development: 'transport infrastructure', 'share of villages having water and

sewerage networks', 'area under forests' (each indicator 3.6%). The indicator 'number of agro-touristic board-houses' scored the lowest (2.2%) since the interest for that type of development came rather from private investors than from authorities.

For *processors* stakeholder group, the results were unexpected and difficult to explain. The main indicators were linked to '**natural resources**' function ('areas under land reclamation' and 'area under forests' - each indicator 29.3%), while the least important indicators were 'sales of animal products (1.9%) and 'sales of crop and vegetables products' (1.4%). From the plenary discussions it resulted that processors do not see (yet) the small size farmers as reliable suppliers of raw materials, mostly due to the low commercial orientation of these farms.

The *NGO-s* stakeholder group selected as main indicators 'number of agro-touristic boarding-houses' (36%), 'transport infrastructure' (24%) and 'animal production' (22%). These results are in line with the NGO-s' activity in the Nord-Est region of Romania, which focused on diversification of activities (such as agro-tourism) and promoting among farmers the choice for higher-value products (animal production, on-farm small scale processing and new opportunities for sale of traditional and higher quality products). For these development directions, transport infrastructure is essential. On the other hand, indicators representing '**biodiversity & habitat'**, such as such as 'share of areas benefitting from agri-environmental subsidies' and 'quantity of pesticides used' scored the lowest (1.5%, and 3.0% respectively).

5.2   Indicator performance

The scoring of performance was the highest for 'Subsidies' indicator (mean=4.4), because subsidies were evaluated as very important for bringing incomes for small farms at a reasonable level (Figure 4). Yet, *government stakeholders* and *processors* perceived it as performing better (mean=5.0, and 4.7 respectively) as compared to *farmers* (mean=4.0), which consider that "(quote: *…subsidies are very important, but not paramount…").*

Indicator 'sales of crop and vegetable products' is the second important (mean=4.1). *Government stakeholders* and *farmers* scored it high (mean=4.3, and 4.2 respectively), but, surprisingly, lower by *processors.*

The indicator 'management of agricultural waste' is interesting, because it is highly ranked by *government stakeholders*, but very low rated by *farmers*. In the discussions it was indicated that *government stakeholders* are aware of its importance for function '**maintain natural resources**',

but *farmers* from the region see it as an obstacle (e.g. minimum compulsory distances to the manure platforms are in general longer than the actual space available in the farms).
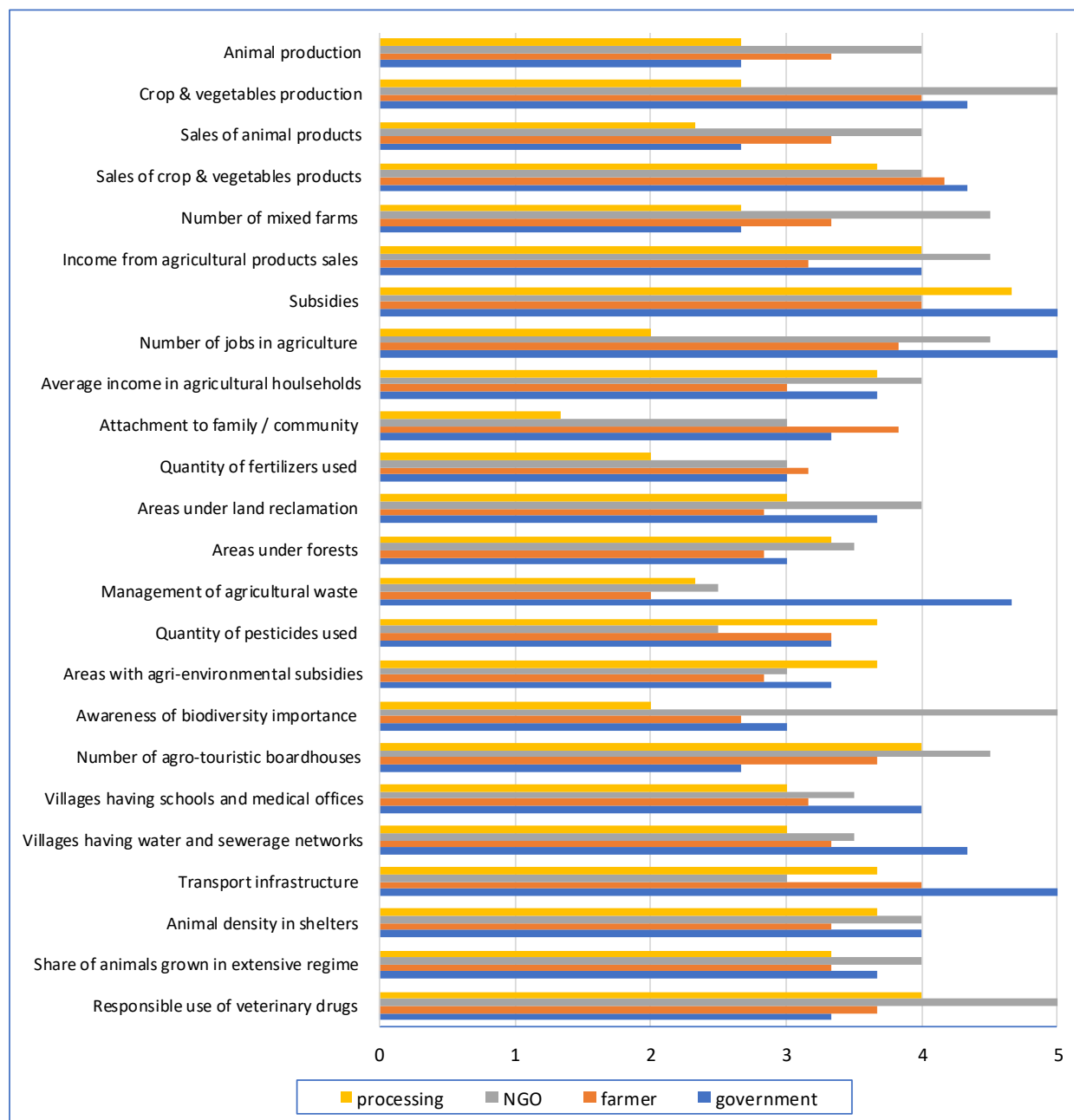

Figure 4. Bar graph with **scoring of performance per indicator** (from 1 to 5), aggregated by stakeholder group (averages)(n=14)

[Tables with means and standard deviations, aggregated by stakeholder group, can be found in Appendix B (Table A2, Table A 5).

The indicator '*awareness of biodiversity importance*' (total mean=2.9) was seen very differently by the stakeholder groups: *NGO-s* scored it at maximum (mean=5.0), since one important goal of their activity is precisely to raise awareness of environment protection and maintaining biodiversity. *Government stakeholders* and *farmers* considered that the indicator has a moderate performance in representing the function (mean=3.0; 2.7 respectively), knowing that in the current and future financial exercise of CAP, the greening measures are becoming increasingly important. Only *processors* scored it as having a low performance (mean=2.0). For the rest of the functions, at least one indicator representing a function was subject of disagreement.

Indicators 'quantity of fertilizers used' and 'management of agricultural waste' (for function 'natural resources'), were scored almost equally low by all stakeholder groups. The indicators for the function '**attractiveness of the rural area'** induced the highest degree of disagreement among the stakeholders; *government* scored them at the lowest, *farmers* and *processors* scored them moderately, while *NGO-s* scored them highly.

Figure 5 shows the average total performance of the indicators: most of them performed rather well (means between 3.0 and 4.0). By far, indicator 'subsidies' performed the best, all stakeholders acknowledged its importance in the analysed farming system, given that in small farms, subsidies may cover up to 30% of the production costs. Only few indicators (3 out of 24) scored moderately on the total (means between 2.7 and 2.9): 'awareness of biodiversity importance', 'quantity of fertilizers used' and 'management of agricultural waste'.
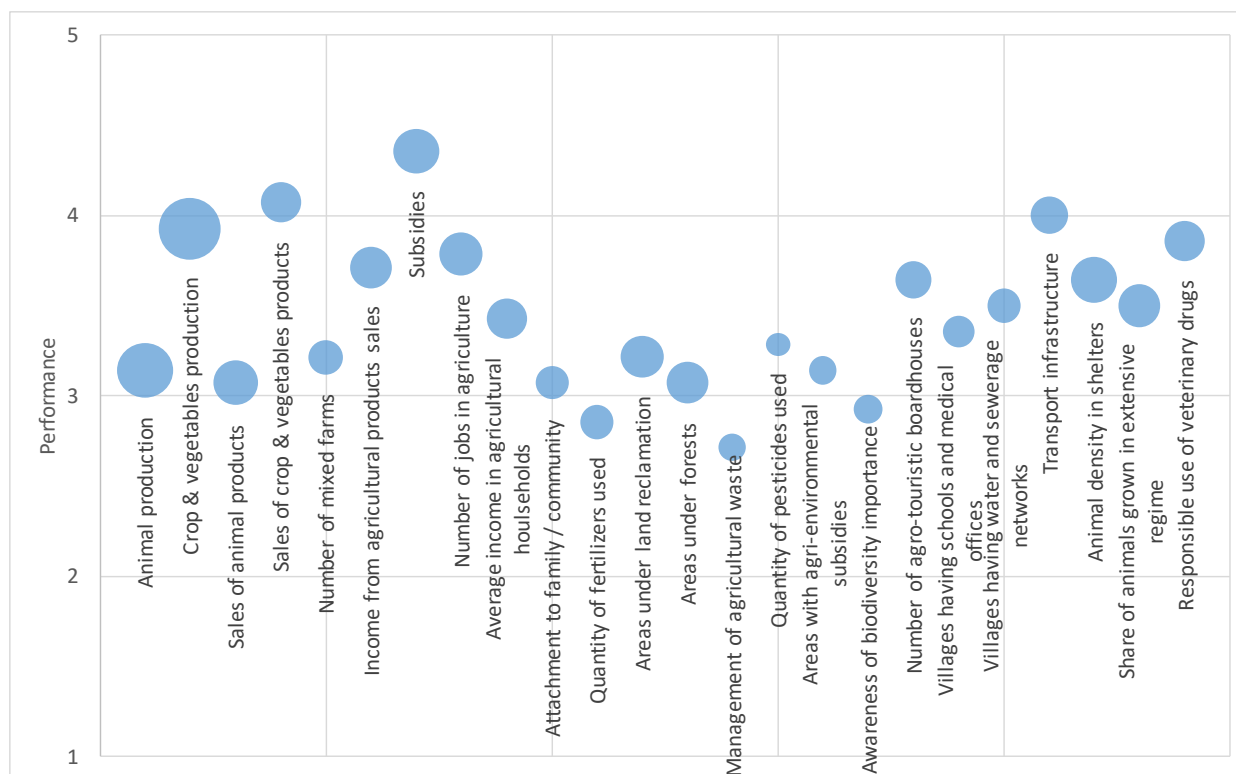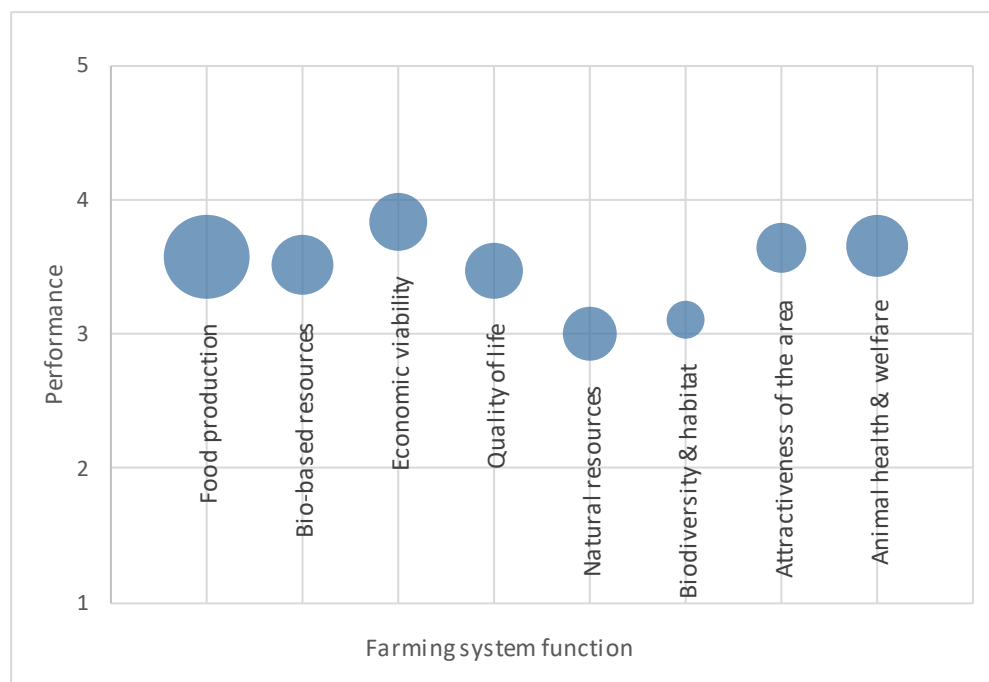
Figure 5. Bubble graph presenting averaged scores on **performance of indicators** (from 1 to 5), while also indicating their importance (size of the bubbles), relative to each other (n=14)

If we consider again the functions, '*economic viability*' was perceived as being the best performing function (in terms of average scores), followed closely by '*food production*' and '*animal welfare*'. The last two functions are to be expected to be seen as essential, since the farming system is about mixed farms (various crops and livestock) (**Error! Reference source not found.**).

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Figure 6. Bubble graph presenting averaged scores on **performance of functions** (from 1 to 5), while also indicating their importance (size of the bubbles), relative to each other (n=14)

[The bubble graph presenting averaged scores on performance of functions, aggregated by stakeholder group, can be found in Appendix B (figure A1).]

5.3   Indicator selection

From the 24-item list, four indicators were selected to be discussed:

1) Sales of crop and vegetables products to processing
2) Subsidies
3) Awareness of biodiversity importance
4) Crop and vegetable production

Three selection criteria were considered:
- the importance of the indicator, as perceived by the stakeholders (Figure 3), and also based on the performance of the indicator (Figure 4);
- selecting indicators belonging to the main functions of the farming system, as resulting from the scoring of importance per function (Figure 2);
- also looking at an indicator which was introduced by the participants, but eventually scored less (both as part of a function, and as indicator as such).

6   Resilience of indicators

The participants were grouped in 4 sub-groups for sketching dynamics of indicators. Sub-group included at least one stakeholder from all four different classes (farmer, government, other stakeholders: processing and NGO); each stakeholder's expertise regarding the indicator which was analysed in the respective sub-group was considered as well.

The moderator presented an example on an indicator's dynamics, the challenges and strategies applied to respond to these challenges, and proposed to assign one selected indicator to each sub-group. Each participant was asked to agree on his/her inclusion in the proposed discussion sub-group, taking into account their expertise on the indicator assigned to the sub-group. All the participants agreed on their respective inclusion. Each participant was asked to express his/her agreement to join the discussion sub-groups, taking into account his/her expertise on the indicator assigned to the respective sub-group. All participants agreed to join the four designated sub-groups. Their distribution on discussion sub-groups is presented in table A1 (see Appendix C).

Each group was asked to describe the dynamics, challenges and strategies that have been applied over the last 18 years in the Nord-Est region farm system for the indicator that was assigned to it. Each group was asked to nominate a representative to present their conclusions to all participants, conclusions that were discussed by all participants. Details and photos of sketched dynamics of indicators can be found in Appendix C.

6.1   Indicator 1 - Sales of crop, vegetables and fruit products to processing

The four stakeholders who participated in the discussion group on the "Sales of crop, vegetables and fruit products to processing" indicator (at the level of small mixed farms) showed that the volume of these deliveries was relatively constant before Romania's accession to the EU (Figure 7). After EU accession (2007), subsidies for agricultural producers, as well as the CAP support for investment in processing units led to an increase in the volume of deliveries of agricultural products for processing. In the plenary discussion, all participants agreed that, after 2010, the contribution of the small mixed farms in the NE region to the flow of agricultural raw materials to processing plants decreased continuously. The general trend of this indicator is steep downward because the small farms that are not included in associations / cooperatives are not able to meet the requirements of the major processing companies that are increasingly replacing the small local processors.
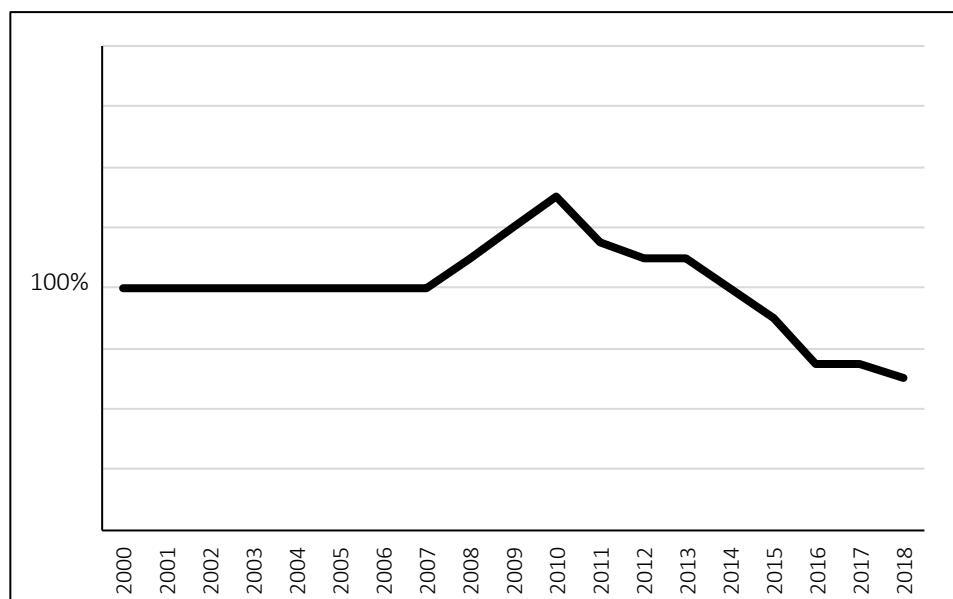
Figure 7. Digitalised graph for selected indicator **"Sales of crop, vegetables and fruit production to processing"** (see photo of the original graph drawn by participants in Appendix C)

The challenges identified and discussed by the participants were:

- **Increasing demand for agricultural raw materials for processing**, as a result of encouraging and financially supporting (through CAP) investment in local processing units (since 2007). This challenge highlighted by the participants in the workshop is explaining one of the economic challenges set by experts in the preparatory phase, namely: "poor integration of small farms in agri-food chains". Consequently, the participants pointed out that the poor integration of small farmers in the NE region is caused by the absence of integrators (processing units that would take over small quantities of raw materials produced by small farms);

- **Competition from large corporations** (suppliers and processors of crop, vegetable and fruit products); they tend to outcompete small suppliers of raw materials and small processors, due to economies of scale. This challenge is in line with one of the long-term economic challenges identified by Romanian experts in the preparation phase of the study, namely: "import competition" (Table 1);

- **The disappearance of the village fairs** – traditional places where supply and demand for <u>small quantities</u> of crop, vegetable and fruit products meet;

- **Labour shortage** (for labour intensive farming activities – animal husbandry, vegetable crops, fruits), due to social assistance measures. Thus formulated, the challenge highlighted by the participants in the workshop provides an explanation for one of the social challenges already identified in the preparatory phase of the study, namely: labour shortage. Participants argued

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that social protection measures (in the form of guaranteed minimum income) are strong disincentives for participation in the labour market.

Strategies:

- The commercial orientation of a certain part of the small-mixed farms in the NE region, which have responded by increasing the size of their production, as well as their presence on the market;
- The emergence of marketing cooperatives established by small-size farmers; as a response to the requirements of large processors (of raw crop, vegetables and fruit products) which do not make contracts with small suppliers of raw materials;
- Orientation of the production structure of small farms to niche products - of high quality, addressed to small processors specializing in the production of high quality agri-food products;
- The reduced activity of small farms due to the (un)availability of labour - has led to a decrease in the volume of raw agricultural products delivered to processing units.
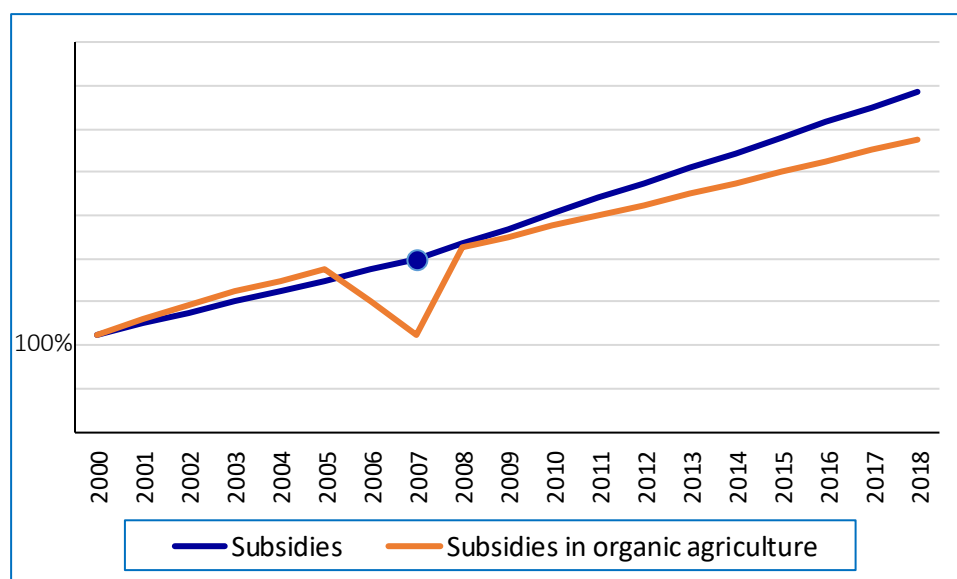
6.2   Indicator 2 – Subsidies

In the perception of the three participants who analysed the "subsidies" indicator, its dynamics has an upward trend throughout the analysed period. During the pre-accession period (2000-2007), the support for agriculture (in the form of subsidies) was granted by the Romanian state. After EU accession (2007), most of the financial support for the farming system comes from the CAP (Figure 8).

Although the level of subsidies has increased steadily, the participants signalled the existence of challenges with impact on beneficiaries' access to subsidies during the analysed period.

During the period 2000-2007, the financial support for the farming system in the Nord Est region increased, being justified by the need to ensure the viability of the farms. During this period, the subsidies were granted by the Romanian state.

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Figure 8. Digitalised graph for selected indicator **"Subsidies"** (see photos of the original graphs drawn by participants in Appendix C)

The moment of EU accession (2007) and the post-accession period posed **challenges** for all actors involved in the implementation of the financial support programs for agriculture, such as:

- **Changing the rules** for granting subsidies to farmers in line with EU regulations. In the discussion, the participants (especially the farmers) emphasized the permanent changes of the conditionalities (ex. the agro-environment requirements), that farmers have to comply with in order to receive financial support;
- **Organizational restructuring** imposed by the need to comply with European rules, both at the level of the institutions responsible for the implementation and control of the grant programs, as well as at the level of the beneficiaries themselves;

These challenges are converging with institutional shocks defined by "Changes in CAP support" initially considered by the research team (Table 1).

During the group discussion, the participants pointed out that each type of subsidy posed specific challenges. Thus, when the support measures from CAP for organic farming were initially launched, the number of beneficiaries was reduced due to the lack of information of the beneficiaries and the non-compliance with the measure's requirements. The following year (2008) the number of requests increased as information campaigns reached their goal.

Another example concerns access to grassland subsidies to which, since 2007, access has been granted to livestock associations only. Such associative structures had a reduced territorial

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coverage in 2007, which limited access to grassland subsidies. Subsequently, such breeders' associations were set up and the access to grassland subsidies increased.

Strategies:

- Information campaigns for potential beneficiaries on the new grant rules and the need for organizational restructuring after EU accession;
- Establishment of the new paying agencies, at national level, and their territorial structures;
- Changing the legal status of farms (registering them as authorized natural persons, individual enterprises, cooperatives, etc.) so that farmers can access subsidies;
- Advice and support to the beneficiaries, in order to help them properly prepare the subsidies application documentation (i.e. to comply with the grant rules and avoid rejection of their applications).

6.3   Indicator 3 – Awareness of biodiversity importance

The dynamics of this indicator had, in the participants' view, two phases: before 2005, when the level of awareness was low and declining due to the fact that small farms were only concerned with finding solutions to increase their productivity, regardless of whether the means used for this purpose affect the environment.

Since 2005, with the establishment and implementation of a set of cross-compliance rules and once the negative effects of past actions have begun to be felt at farm level in the NE region (such as floods, landslides caused by uncontrolled deforestation), the level of awareness of the importance of biodiversity among small farmers in the NE region has increased (Figure 9).
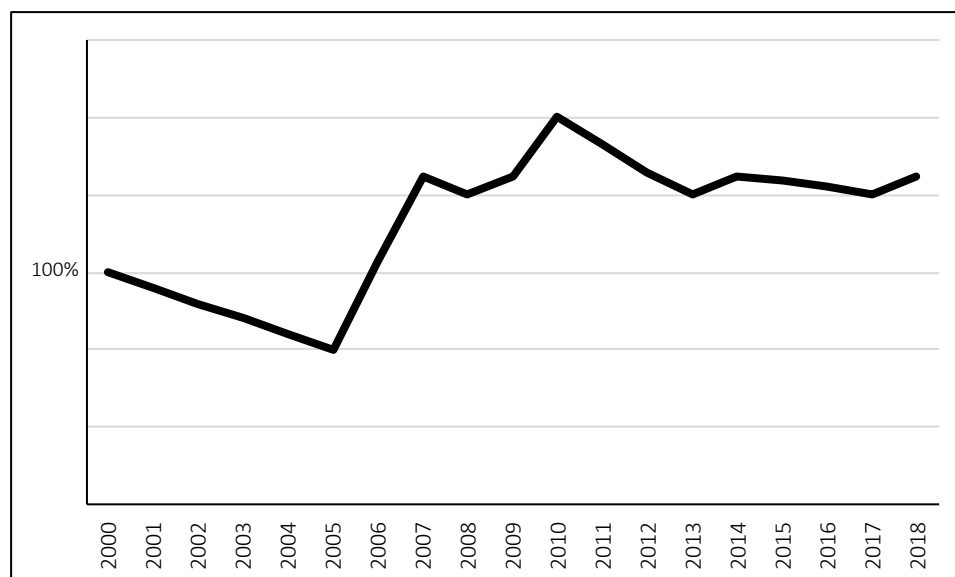
Figure 9. Digitalised graph for selected indicator **"Awareness of biodiversity importance"** (see photo of the original graph drawn by participants in Appendix C)

The fluctuations recorded by the indicator after 2007 were explained by the participants in the workshop through the actions of challenges such as:

- **Changing the cross-compliance rules** resulted in a decreasing level of compliance diminish in the immediate aftermath of these changes. This challenge is consistent with those set by the expert group in the preparatory phase of the study as "environmental regulations";
- **Climate shocks (drought, floods)** made small farmers more aware that preserving the environment and the biodiversity in the region can help mitigate the effects of climate change. Extreme weather events are a challenge that has been identified by experts in the workshop preparation stage. During the workshop, the participants pointed out that the manifestation of these climatic hazards had an effect in raising the awareness of the importance of preserving biodiversity;
- Similar to climate shocks, the **occurrence of diseases and pests** in the region made small farmers more aware of the importance of complying with cross-compliance rules.

Strategies to deal with these challenges were:

- **Information campaigns** on new cross-compliance rules among small-scale farmers in the NE region;
- **Awareness campaigns** on the role of biodiversity and the negative effects of its destruction on agricultural activities;

- **Applying sanctions** to farmers who do not comply with the cross-compliance rules so that compliance levels would increase.

6.4   Indicator 4 – Crop, vegetables and fruit production

The general trend of the "crop, vegetables and fruit production" indicator is, in the view of the participants in the workshop, an upward one, but there are large variations from one year to the next, caused mainly by climatic conditions (Figure 10).
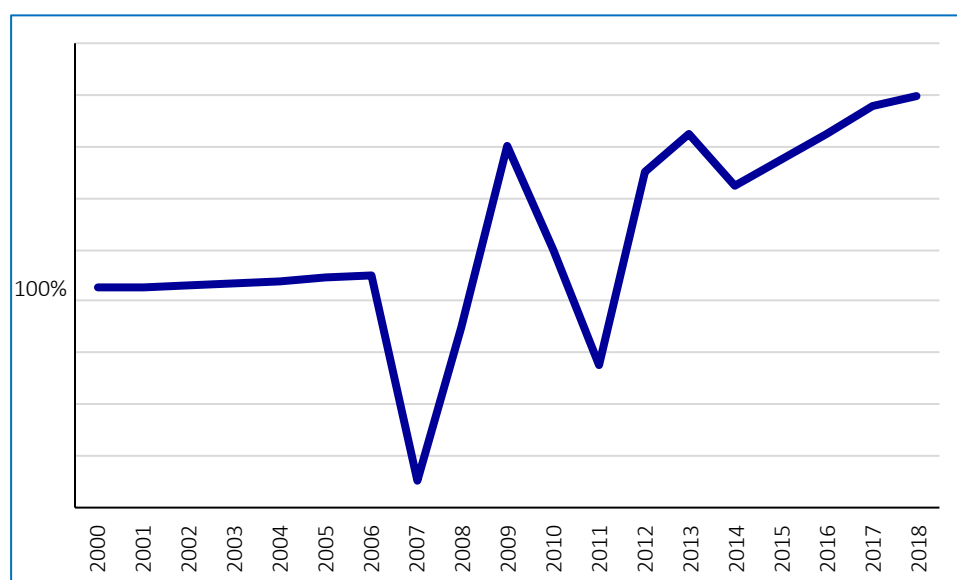
Figure 10. Digitalised graph for selected indicator **"Crop, vegetables and fruit production"** (see photo of the original graph drawn by participants in Appendix C)

The main challenges the indicator has been subjected to over the past 18 years were:

- **Access to the EU Single Market** (since Romania's accession in 2007), has stimulated the crop, vegetables and fruit production in those farms in the NE region which had a larger market for their products. On the other hand, the free movement of labour in the EU community space has led to the loss of a part of the young labour force in the NE region through emigration. The emigration of the young labour force has been one of the social risks also considered at regional level by the research team in the workshop preparation phase (Table 1);
- **Climate shocks** (especially drought) affected severely the volume of crop, vegetables and fruit production in 2007 and 2011;

- **The new CAP** (post 2014), which supports small farms as well, represented an opportunity for consolidation, technological gains and association of small farms;
- Among the consequences of the **economic crisis** was the decrease in farm gate prices, resulting in diminished income for farmers.

The strategies identified by the participants were:

- **Increasing the physical size of farms** through land consolidation, in order to obtain higher production;
- **Investments in farm technology (machinery)** (stimulated by CAP subsidies after EU accession) – they were a response to labour shortages, and at the same time they resulted in increased productions;
- **Investments in the irrigation system** of the NE region, to fight against the effects of drought:
  - Restoration of the *irrigation system* built in the communist period, benefiting mainly to large farms producing cereals;
  - Investments in new *individual irrigation systems*, built mainly made at the level of small vegetable farms;
- The new CAP stimulated the **association of small farmers** and facilitated their **access to technology**, which contributed to the increase of productive performance of small farms in the region;
- A government measure applied to mitigate the effects of the economic crisis on small farmers was the **VAT reduction** for agricultural fuel (from 19 to 9%), that generated lower production costs.

7   Resilience attributes

Participants were asked to choose one of the strategies discussed in the discussion group they were part of in the previous exercise. Each respondent chose a single strategy. Consequently, not all identified strategies that were mentioned in the previous chapter were assessed. On average, 2 respondents provided answers for each of the seven strategies outlined below in Figure 11. The participants grouped two different strategies ('land consolidation' and 'technologization') because they considered that for the analysed farming system (small mixed family farms), the two strategies should go together: technologization is not cost-efficient on small plots of land; and, on the other hand, larger plots of land must be operated mechanically, taking into account also the lack of (manual) labour force.

7.1   Case-study specific strategies

The highest level of implementation appeared to be for the indicator '*Subsidies*', and both strategies are perceived as very important by all stakeholders (Figure 11), given that in small farms, subsidies may cover up to 30% of the production costs.
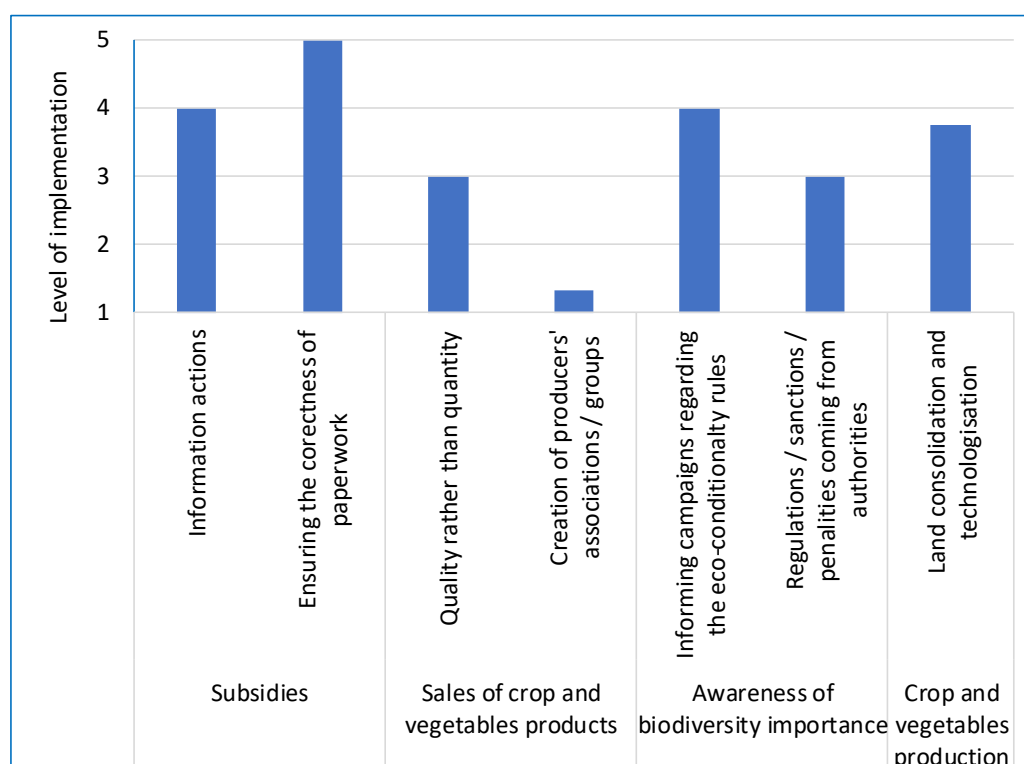

Figure 11. Bar graph showing **level of implementation of strategies** [1 = not applied, 2 = slightly applied, 3 = moderately applied, 4 = adequately applied, 5 = perfectly applied] (n=13)

Although among the farm system functions **"biodiversity & habitat"** was scored the lowest, yet, '*awareness of biodiversity importance*' is linked to two strategies with a high level of implementation, since it is important for the farming system to be properly informed about and apply the eco-conditionality rules, thus avoiding any sanctions that might affect it financially.

'Creation of producers' associations /groups has the lowest level of implementation among the selected strategies – the reluctance of the Romanian farmers to participate in any form of association is well known (distrust and fear of old bad practices resurrection).

When the participants were asked to score the effect of the above selected strategies on the three forms of resilience of the farming system, the results (Figure 12) showed that: subsidies and production are the core elements having a strong positive relationship with robustness, adaptability and transformability in the farming system. Both strategies regarding the 'subsidies' are seen as having positive effects on all three forms of resilience.
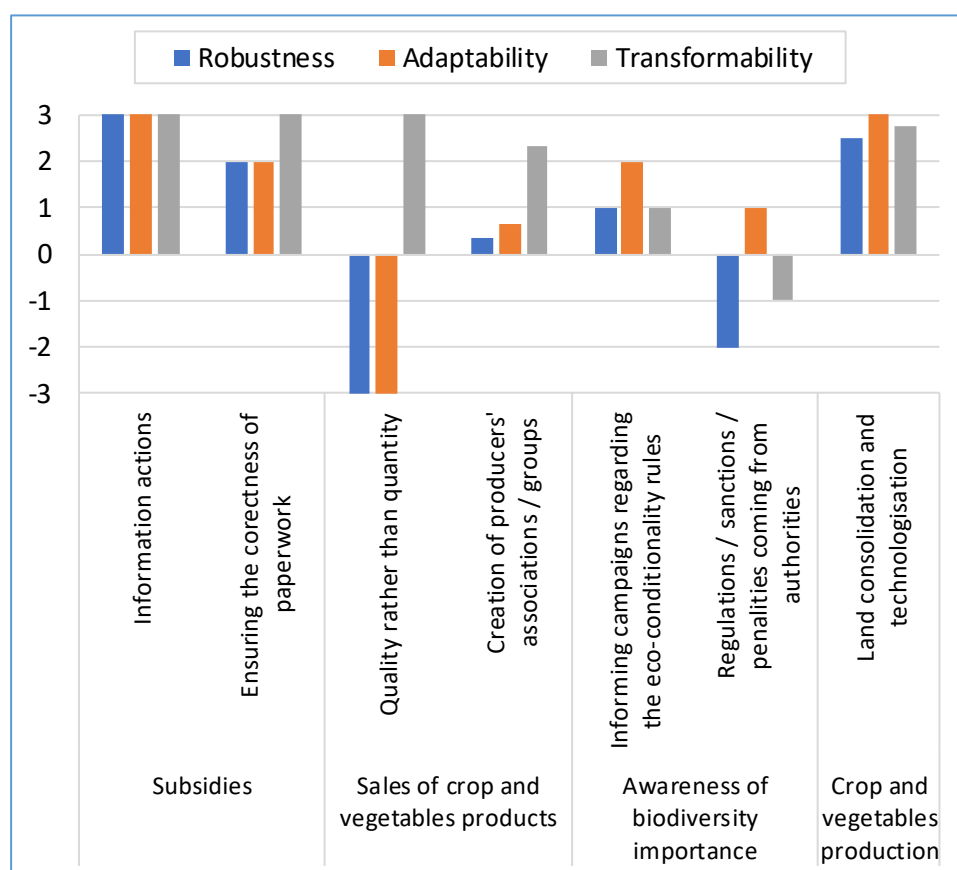

Figure 12. Bar graph showing **average scoring of effect of strategy on robustness, adaptability and transformability** of the farming system. A '0' implies no relationship, a '1' or '-1' a weak positive or negative relationship, a '2' or '-2' an intermediate positive or negative relationship, and a '3' or '-3' is a strong positive or negative relationship (n=13)

Land consolidation appears to be essential – in the Romanian farming system, the average size of a farm is 3.74 ha UAA (and 2.70 ha in Nord-Est region) (Romanian Farm Structure Survey, 2016). The strategy of introducing more technology is also essential for any agricultural development effort in the case-study area. Increasing farm size in combination with more technology is assessed to positively contribute to all three resilience capacities. In the discussions on the historical dynamics of indicator (1) – 'sales of crop, vegetable and fruit products to processors' and indicator (4) – 'crop, vegetables and fruit production', it was mentioned that in 2007, when Romania joined the EU, the emigration phenomenon affected in a significant way the agricultural production: the lack of labour due to intense and sudden emigration resulted in the need for land consolidation and investment in agricultural machinery.

Sales of quality products is perceived as a strategy having a negative effect on robustness and adaptability. It diminishes the current turnover – the price difference between 'regular' and 'high quality' products is not very important; since the regular consumers' main driver is low price and not quality of products, high quality products are still seen as 'niche products'. The demand for high quality products (more expensive) is low due to the consumers' modest purchasing power; hence lower income as compared to those from sales of regular products. The strategy is assessed to have positive effects on transformability only -complete re-orientation of the farm to niche products or vertical integration of farm activities (from production to processing and sales). Consequently, for this strategy a trade-off was perceived between robustness and adaptability on the one hand and transformability on the other hand.

7.2   General resilience attributes

Farmers considered as best performing resilience attributes 'infrastructure for innovation', 'socially self-organized' and 'response diversity'; while the scores were the smallest for 'functional diversity' (as an expression of lack of markets and of poor integration of small farms in the value chains) and coupled with local & natural capital (legislation) (Figure 13) – they perceive the current legislation and regulations rather poorly adapted to their needs *(quote: "… it's all for the benefit of large farms…")*.
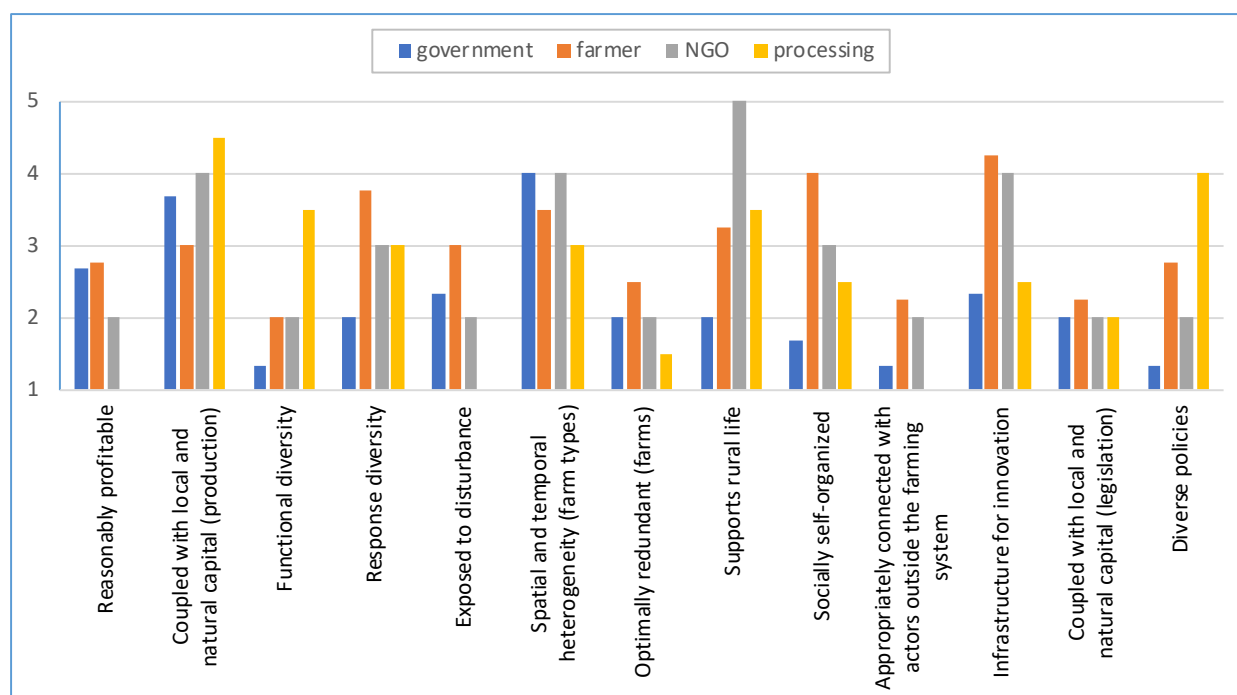
Figure 13. Bar graph showing current **performance level of resilience attributes** [performance is scored as 1 = not at all, 2 = small extent, 3 = moderate extent, 4 = big extent, 5 = very big extent] (n=10)

*Government stakeholde*rs perceived the performance of resilience attributes in the small mixed farming system as small or inexistent (11 of 13 attributes are scored below 3), while *NGO-s* and *processor stakeholders* perceived the resilience attributes as performing better.

In the Romanian case, for the small mixed farms agricultural system, the resilience attributes performed as following:

- Attribute 'reasonably profitable' is assessed to have low to moderate scores: the *farmers* which are receiving subsidies feel they depend on them; it was a real help in their farming activity since 2007 and allowed for development; but there are many of the small-size (subsistence farms), which are not eligible for subsidies.

- Attribute 'coupled with local and natural capital (production)' scored much better (performance evaluated between 3 and 4.5); the small mixed farms are generally low to medium intensive, hence a rather low use of chemicals, of irrigation water, therefore soil fertility, water resources and environment are less damaged as compared to highly-intensive commercial farms.

- Attribute 'functional diversity' was scored low (less than 2) because the small size farms indicated as their main problem finding market channels; participants pointed to the difficulty of finding available markets for production of the small farms; they also indicated the lack of diversified input sources (very few suppliers willing to work with small farms).

- Attribute 'response diversity' scored moderately, the *stakeholders* indicated that for small farms, there is no available weather insurance (especially for severe droughts which are rather frequent), and only few opportunities for flexible payment arrangements.
- Attribute 'exposed to disturbance' scored low to moderate (2 to 3); the farming system perceived the introduction of CAP as lowering the disturbance from the pre-accession period; yet, there are still present some changes, related to the rules of implementation of NRDP and all the bureaucracy involved in access to Pillar II funding programmes.
- Attribute 'spatial and temporal heterogeneity' scored moderate to well (3 to 4). The farming system is indeed small mixed farms, but their number decreased in the latest years, according to the last farm structure surveys (2007, 2013, 2016). The reduction in the number of farms is due mostly to land consolidation which resulted in an increase in the average size. Nevertheless, the farms which increase their size, generally reduce the heterogeneity; farms over 20 ha of land for instance, generally give up animal husbandry and focus on cereal crops (due to labour unavailability).
- Attribute 'optimally redundant' scored very low to low (1.5 – 2.5) because stakeholders perceived the exit of farmers as important: due to old age (and no successors in farming activity) and due to their children's emigration. On the other hand, farmers scored the attribute a little higher than other stakeholders, due to the fact that the subsidies for 'young farmers' installation' measure started to be accessed by young farmers.
- Attribute 'supports rural life' scored medium (about 3.5) – the living conditions started improving in rural areas due to investments (from Pillar II) in local water and sewerage facilities in many villages, but conditions are far from the those in rural areas in Western Member States.
- Attribute 'socially self-organized' is moderately present in the farming system. This attribute was scored better by *farmers* and *NGO-s*, which are trying to establish associations. This is an increasing trend, but at a slow pace, because in general, reluctance is still high among many farmers.
- Attribute 'appropriately connected with actors outside the farming system' scored the lowest among all attributes – stakeholders discussed about the poor inclusion / access of small farms in the value chains.
- Attribute 'infrastructure for innovation' scored rather high, because the stakeholders pointed out that young farmers are more opened to new ideas and technologies and they often seek advice or new ideas from researchers in the local research stations.
- Attribute 'coupled with local and natural capital (legislation)' scored also very low (below 2) due to their perception of the current legislation and regulations rather poorly adapted to their needs, and much more oriented to the needs of large commercial farms.

As regards the perceived effects of attributes on the three forms of resilience, results are synthetized in Figure 14.
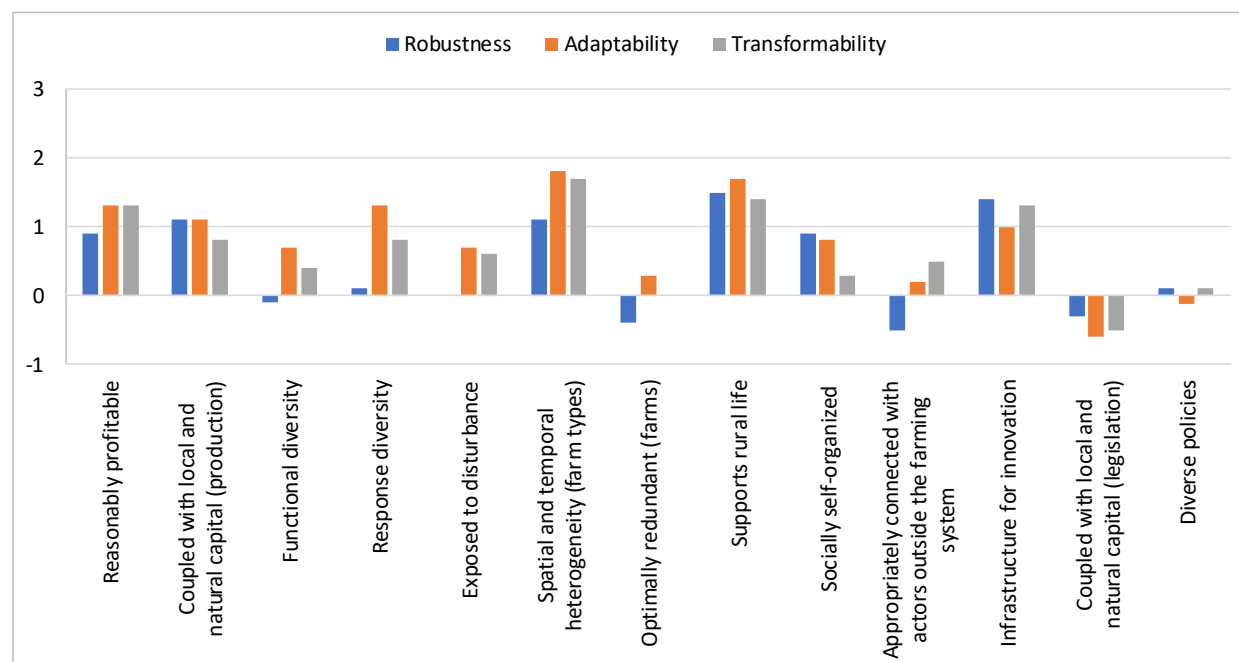
Figure 14. Bar graph showing average scoring of **perceived effect of attribute on robustness, adaptability and transformability** [A '0' implies no relationship, a '1' a weak relationship, a '2' a relationship of intermediate strength, and a '3' is a strong relationship, a '-' sign implies a negative relationship] (n=10)

Most attributes are perceived as having a positive effect on robustness (10 of 13), adaptability (11 of 13) and on transformability (12 of 13). 'Spatial & temporal heterogeneity' and 'supports rural life' were the attributes perceived as having a relative moderate (between 1 and 2) effect on all three resilience capacities (simultaneously). 'Coupled with local & natural capital (legislation)' is seen to have weak but totally negative effect on robustness, adaptability and transformability, indicating that the stakeholders in the farming system are largely unsatisfied with the current legislation and regulations. However, participants were divided in their opinion, as multiple participants also gave positive scores for this attribute (Table A3).

8   Discussion

8.1   Functions of the farming system

The main function through which the Romanian small mixed farming system is perceived is *'deliver healthy and affordable food products'*. Given that the analysed farming system is small mixed farms, ensuring the food security of the household members is a seen as a priority by all stakeholders. Also, *food production* is the seen as the main target of the whole agricultural system, and the focus should be on it, since their general perception is that at present, Romania has not achieved its full production capacity and ability to ensure the population's food security; economic viability is one of the most important way to achieve that.

This is consistent with conclusions of previous research carried on in Romania which shows that in the last 25 years, the rural areas and the small peasant household farms represented an economic and social 'safety net' against the changes and shocks generated through the process of restructuring the former socialist economy (Gavrilescu & Florian, 2007; Alexandri & Luca, 2012; Pouliquen, 2011). The small household farms in the rural areas became one of the main modalities to meet the subsistence needs of rural household members whose consumption of on-farm produced food helped them to survive and fight poverty (Davidova et al., 2009; Salasan et al., 2009; Mihalache, 2010). Moreover, by the high share of on-farm consumption in the rural households, these farms contributed significantly to the country's food security. The small farms have as well an important contribution to food security not only for the rural population, but for urban households also, due to family relationships on the basis of which foodstuffs produced in the small farms are transferred to urban relatives. Keeping that in mind, for a rural household, about half of total food consumption is represented by the value of on-farm consumption, while in the case of an urban household this share is about one-fifth of the total food consumption value (Tudor, 2015).

'Animal health & welfare' was identified as the second most important function of the farming system; *'quality of life'* was ranked also rather high by all stakeholders.

The least important function identified by all stakeholders was *'biodiversity & habitat'*, probably due to the fact that the farming system is composed of small, mixed farms, which have a highly diversified production structure and are using rather traditional-extensive or moderately-intensive technologies with low chemical inputs, thus contributing to biodiversity and natural habitats conservation.

All participants scored the **private functions** as more important than the **public** ones; in their opinion, food production is the main target of the whole agricultural system, and the focus should

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be on it, since their general perception is that at present, Romania has not achieved its full production capacity and ability to ensure the population's food security.

Stakeholders perceived quite differently the current performance of indicators in the small mixed farming system. Again, '*food production*' ranked high and was seen by all participants as the only function well represented by the selected indicators. In contrast, the chosen indicators represented poorly the function '*biodiversity & habitat.*'

The analysis of the remaining indicators' ability to represent the functions of the farming system showed important disagreements among stakeholders. As an example, indicators for the function '*animal welfare*' were scored rather high by *farmers* and *NGO-s*, and significantly lower by *government* and *processors*. Farmers already comply with the requirements for animal welfare, while processors did not internalize yet these issues, mostly because there are no such pressures coming yet from the final consumers.

In brief, it is difficult to reveal any general trends regarding the importance of indicators, given the diverse, if not conflicting stakeholders' opinions.

8.2   Robustness, adaptability and transformability of the farming system

As literature shows, small farms are revealed to be the microeconomic systems with the highest resilience in the Romanian rural area. The lack of strict production specialization allows the small farms to quickly change their production orientation according to the market requirements - that is, if they decide to sell (most of) the products obtained in the farm; the on-farm consumption is rather high (according to data from the Romanian Farm Structure Surveys). This change in production structure is possible because small farms have the minimum knowledge (based on agricultural practice), as well as technical means to produce (at a small scale) a wide range of crops, vegetable, fruit and / or animal products (both unprocessed and primarily processed). In contradiction with the general belief that specialization results in economic performance increase, the above argumentation shows that the lack of strict production specialization in the particular case of small farms is a means of ensuring economic resilience in a market where agri-food preferences change continuously (Tudor, 2017: 114).

The strategies related to subsidies and crop, vegetable & fruit production show a strong relationship with and positive effects on robustness, adaptability and transformability of the analysed farming system.

Land consolidation, together with *technologization (capital investment),* appear to be essential for all three types of resilience in the Romanian farming system. All stakeholders pointed out that the very high number of small size farms[3] is the origin of many problems in the Romanian agricultural sector. Emigration of young labour force, a phenomenon that has become stronger after Romania joined the EU in 2007, affected in a severe way the rural area and the agricultural production, as well as the construction and services sectors. These factors contributed essentially to the need for land consolidation and investment in agricultural machinery.

Most strategies are perceived as contributing to all resilience forms (**robustness, adaptability and transformability).** There are some exceptions however: the orientation of production to high quality agri-food products, as well as the sanctions and penalties for various non-compliance issues are seen as negatively influencing **robustness**. **Adaptability** is seen as negatively influenced by the orientation of production to high quality agri-food products, the latter is perceived as favourable only for **transformability**.

Most resilience attributes are seen as having a positive effect on **adaptability** and on **transformability**. Farmers considered as best performing resilience attributes 'infrastructure for innovation', 'socially self-organized' and 'response diversity'; while the scores were the smallest for 'functional diversity' (as an expression of lack of markets and of poor integration of small farms in the value chains) and coupled with local & natural capital (legislation) – they consider the current legislation and regulations rather poorly adapted to their needs, and favouring the large commercial farms.

'Spatial & temporal heterogeneity' and 'supports rural life' were the attributes perceived as having a relative moderate effect on all three resilience capacities (simultaneously). The attribute 'coupled with local & natural capital (legislation)' is considered having a weak but entirely negative effect on robustness, adaptability and transformability, indicating that the farming system expects favourable changes in terms of legislation and regulations from outside actors.

The perceived performance of attributes in the analysed farming system (small-mixed farms) points to positive contribution to *adaptability* and secondly to *transformability.* Robustness is considered the least present resilience capacity in the farming system.

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[3] the average size of a farm in Romania is 3.74 ha UAA (and 2.70 ha in Nord-Est region). In total, there are 3,342,000 farms in the country, of which 708,440 farms in the Nord-Est region (farms of all sizes) (Romanian Farm Structure Survey, 2016).

9   Conclusion

The Romanian case study is set in the North-Eastern region of the country. The studied area is traditionally dominated by small mixed farms, which are generally family run. Compared to the rest of Romania, the North-East region has the lowest total output (crop and livestock), the most rented area and a high level of unpaid labour. The farm net income and farm net value are in the low value range when compared to the other regions, and additionally, the on-farm consumption in this region is the highest in the country.

In the Romanian case-study, the main functions of the farming system relate to food production and animal welfare, while the biodiversity & habitat function was evaluated as the least important one. The private goods related functions performed better than the public goods related ones.

No general trends could be revealed regarding the importance and the performance of the indicators representing the essential functions of the farming system, due to the diverse and sometimes contradicting stakeholders' opinions.

The range of the perceived challenges is explicitly linked to the characteristics of the farming system. The strategies identified as responses to specific challenges are aiming to facilitate investments, to improve the efficiency and to increase the ability of the farms to provide reasonable income. In terms of effect on the resilience, the strategies identified and discussed by the stakeholders showed positive effects mostly on adaptability and transformability, and less on transformability.

The attributes that are best defining the studied farming system (small mixed farms) are related to having agricultural production coupled with the local & natural capital, and to spatial and temporal heterogeneity of farm types. The same attributes are contributing the most to resilience as well.

As a general conclusion, in the analysed farming system (small-mixed farms), most attributes have a positive contribution to adaptability and to transformability. Robustness is considered the least present resilience capacity in the Romanian case-study farming system.

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Appendix A. Workshop memo

1) The workshop was held at the premises of the "Gh. Zane" Institute of Economic and Social Research (Romanian Academy, Iași Branch). The room in which the workshop was held is a special conference room (maximum capacity: 30 persons), with all the needed amenities (e.g. tables, comfortable chairs, laptops, microphones, overhead projector, flipcharts, projection screen, etc.). Temperature was pleasant (about 20°C), with no exterior noises (windows were opened during all the breaks; they open to a nice garden away from street traffic). In an adjacent room, coffee, tea, water and snacks were provided all along the workshop.

2) There were in total 24 participants in the workshop: 14 stakeholders (6 farmers, 3 from government bodies, 3 from processing industry, 2 from NGOs), 6 researchers from the hosting Institute (ICES) (they were responsible for advocating a list of proposed stakeholders to IEA-AR and inviting the stakeholders selected by IEA-AR to attend the workshop, for the logistics, receiving the guests, taking pictures, helping to the preparation of the workshop) and 4 researchers from IEA-AR (the moderator, a person/secretary that took notes, a person that overlooked the recording devices and distributed the papers/tables/post-its to the stakeholders, and a person that introduced the data and answers in the Excel file).

Start time: 10.00 hours

End time: 17.30 hours

Total break time (estimation): coffee 15 min + lunch 90 min + coffee 15 min = 120 min

Table A1. Stakeholder overview

Function	Organization	Stakeholder group	Sub-group*
Counsellor	Ministry of Agriculture and Rural Development – Iasi county branch	government	2
Head of farm	Farm	farmer	2
Co-owner of company, member of NGO	SME – processing company and agro-turistic boarding house	NGO	2
Company administrator	SME – processing company (fruit, vegetables and animal products)	processing	1
Member	Association for Rural Development, Local Action Group	NGO	3
Head of farm	Farm	farmer	4
Head of farm	Farm	farmer	3
Owner	SME – processing company (oil)	processing	1

Function	Organization	Stakeholder group	Sub-group*
Project evaluator for LAG, farmer	Local Action Group	government	1
Counsellor	Agency of Payments and Intervention in Agriculture – Botoşani county branch	government	4
Head of farm	Farm (livestock)	farmer	1
Co-owner of small processing unit	Bee farming and bee-keeping products	processing	4
Co-owner of farm	Farm and processing (fruit and vegetables)	farmer	3
Head of farm	Farm	farmer	4

* For the activities S4 and S5, the stakeholders were divided in 4 sub-groups, which choose to analyse the following indicators:

1. Sales of crop, vegetables and fruit products to processing;
2. Subsidies;
3. Awareness of biodiversity importance;
4. Crop, vegetables and fruit production.

3) The workshop started with:
- a welcome address from the head of the Romanian project team (Camelia Gavrilescu) and from the head of the Rural Economy Research Group of the hosting Institute – ICES (Krisztina Melinda Dobay);
- the participants received the information notes and signed the consent forms;
- the moderator (Monica Tudor) presented the objectives of the workshop: resilience, risks, strategies, the program and the timeline of the activities;
- the moderator emphasized that the workshop is taking into account the opinions of the participants referring to the North East FARMING SYSTEM, and it does not concern the individual experiences of the participants. The participants were constantly reminded that all along the workshop;
- the participants were invited to shortly introduce themselves and their main field of activity.

4) One participant (farmer) left before activity S5, and other three (one farmer, one from processing and one from NGO) left before activity S6, all due to personal reasons (mainly long distance to home, all four were from the neighbouring counties).

Appendix B. Details on ranking and rating the functions and indicators

Table A2. Mean and standard deviation of scores per **function** per stakeholder group and for all participants (100 points divided to 8 functions) (n=14)

Function	Farmer		Government		Processing		NGO		All	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Food production	29	13	22	10	25	23	20	14	25	14
Bio-based resources	16	13	18	3	2	3	15	7	13	10
Economic viability	9	8	20	13	15	13	5	7	12	11
Quality of life	8	8	17	16	13	13	10	0	11	10
Natural resources	8	9	7	6	18	18	8	4	10	10
Biodiversity & habitat	2	3	7	8	12	13	5	0	5	7
Attractiveness of the area	7	9	3	3	12	13	20	14	9	10
Animal health & welfare	21	24	7	6	3	6	18	11	14	17

Table A3. Importance of **indicators** per stakeholder group; original values and transformed values to include importance of the function and number of indicators per function (transformed values allow for direct comparison between all indicators across all functions) (n=14)

Indicator	Transformed values										Original values									
	Farmer		Government		Processing		NGO		Total		Farmer		Government		Processing		NGO		Total	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Animal production (thou tonnes)	26	9	17	5	22	6	22	14	23	8	45	13	38	11	43	14	55	35	45	17
Crop and vegetables production (thou tonnes)	32	9	27	5	28	6	18	14	28	9	55	13	62	11	57	14	45	35	55	17
Sales of animal products (thou tonnes)	19	5	16	6	2	1	18	13	14	9	59	3	43	21	57	35	60	42	55	22
Sales of crop and vegetables products (thou tonnes)	13	5	21	6	1	1	12	13	12	8	41	3	57	21	43	35	40	42	45	22
Number of mixed farms	7	4	12	0	12	3	6	4	9	4	26	15	20	0	27	0	40	28	27	15
Income from agricultural products sales	9	2	20	3	19	3	3	2	13	7	33	9	33	7	42	4	23	11	34	9
Subsidies	11	4	28	3	14	1	6	3	15	8	41	9	47	7	32	4	38	18	40	9
Number of jobs in agriculture	8	3	23	3	13	6	16	5	14	7	33	10	47	0	33	7	53	18	39	14
Ratio average income in agricultural house-holds / average income in all households (%)	8	4	17	8	21	2	7	5	12	8	30	6	33	21	53	7	23	18	35	17
Attachment to family / community	9	3	10	9	5	5	8	11	8	5	37	12	20	21	13	0	25	35	26	18
Quantity of fertilizers used	8	4	9	4	10	17	8	6	9	7	24	8	35	14	13	0	25	21	24	17
Areas under land reclamation	9	3	8	5	29	0	6	0	13	9	28	8	30	25	40	0	20	0	30	12
Areas under forests	10	6	4	3	29	13	12	13	13	12	30	15	13	11	40	0	40	42	30	23
Management of agricultural waste	6	5	6	1	5	4	5	6	6	4	18	15	22	0	7	0	15	21	16	11
Quantity of pesticides used	2	0	9	8	5	8	3	4	4	5	38	6	47	7	13	0	20	28	32	17
Area benefitting from agri-environmental subsidies (% in total)	1	1	5	5	19	12	2	2	6	9	27	12	23	28	53	28	10	14	29	27
Awareness of biodiversity importance	2	1	6	6	12	7	11	6	6	6	35	10	30	21	33	28	70	42	39	25
Number of agro-touristic board houses and diversity of leisure opportunities	5	2	2	2	11	7	36	40	10	16	19	12	17	14	23	14	45	49	23	22

Indicator	Transformed values										Original values									
	Farmer		Government		Processing		NGO		Total		Farmer		Government		Processing		NGO		Total	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Share of villages having schools and medical offices in total number of villages (%)	6	2	4	0	12	6	8	0	7	4	23	6	30	0	27	7	10	0	23	9
Share of villages having water and sewerage networks in total number of villages (%)	8	4	4	1	11	4	12	6	8	4	30	6	27	7	23	7	15	7	26	7
Transport infrastructure	8	5	4	1	12	3	24	34	10	12	28	12	27	7	27	0	30	42	28	17
Animal density in shelters	27	9	9	1	2	1	11	15	15	13	44	8	43	7	17	7	20	28	34	17
Share of animals grown in extensive regime	18	3	7	1	5	3	21	0	13	7	29	2	37	0	50	35	40	0	37	16
Responsible use of veterinary drugs	17	6	4	2	3	2	21	15	12	10	28	7	20	7	33	28	40	28	29	17

Table A 4. Mean and standard deviation of scoring on performance of **indicators** per stakeholder group and for all participants (indicators were scored from 1-5, where 1 = very low, 2 = low, 3 = medium, 4 = good, and 5 = perfect) (n=14)

| Indicator	Corrected values									
	Farmer		Government		Processing		NGO		Total	
	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Animal production (thou tonnes)	3.333	0.516	2.667	0.577	2.667	0.577	4.000	1.414	3.143	0.770
Crop and vegetables production (thou tonnes)	4.000	0.632	4.333	0.577	2.667	1.528	5.000	0.000	3.929	1.072
Sales of animal products (thou tonnes)	3.333	0.516	2.667	0.577	2.333	0.577	4.000	1.414	3.071	0.829
Sales of crop and vegetables products (thou tonnes)	4.167	0.408	4.333	1.155	3.667	1.528	4.000	1.414	4.071	0.917
Number of mixed farms	3.333	1.366	2.667	0.577	2.667	0.577	4.500	0.707	3.214	1.122
Income from agricultural products sales	3.167	0.753	4.000	1.732	4.000	0.000	4.500	0.707	3.714	0.994
Subsidies	4.000	0.894	5.000	0.000	4.667	0.577	4.000	1.414	4.357	0.842
Number of jobs in agriculture	3.833	0.753	5.000	0.000	2.000	1.000	4.500	0.707	3.786	1.251
Ratio average income in agricultural house-holds / average income in all households (%)	3.000	0.632	3.667	0.577	3.667	1.155	4.000	1.414	3.429	0.852
Attachment to family / community	3.833	1.329	3.333	2.082	1.333	0.577	3.000	2.828	3.071	1.730
Quantity of fertilizers used	3.167	1.169	3.000	2.000	2.000	1.732	3.000	2.828	2.857	1.562
Areas under land reclamation	2.833	1.169	3.667	1.155	3.000	0.000	4.000	1.414	3.214	1.051
Areas under forests	2.833	1.169	3.000	2.000	3.333	2.082	3.500	2.121	3.071	1.492
Management of agricultural waste	2.000	1.265	4.667	0.577	2.333	2.309	2.500	2.121	2.714	1.729
Quantity of pesticides used	3.333	1.366	3.333	2.082	3.667	1.528	2.500	2.121	3.286	1.490
Area benefitting from agri-environmental subsidies (% in total)	2.833	0.753	3.333	1.528	3.667	1.155	3.000	0.000	3.143	0.949
Awareness of biodiversity importance	2.667	1.366	3.000	2.000	2.000	1.732	5.000	0.000	2.929	1.639
Number of agro-touristic board houses and diversity of leisure opportunities	3.667	0.816	2.667	0.577	4.000	1.000	4.500	0.707	3.643	0.929
Share of villages having schools and medical offices in total number of villages (%)	3.167	0.753	4.000	1.000	3.000	1.732	3.500	2.121	3.357	1.151
Share of villages having water and sewerage networks in total number of villages (%)	3.333	1.366	4.333	0.577	3.000	1.732	3.500	2.121	3.500	1.345
Transport infrastructure	4.000	0.632	5.000	0.000	3.667	2.309	3.000	2.828	4.000	1.414
Animal density in shelters	3.333	0.816	4.000	0.000	3.667	1.528	4.000	0.000	3.643	0.842
Share of animals grown in extensive regime	3.333	1.033	3.667	0.577	3.333	1.528	4.000	0.000	3.500	0.941
Responsible use of veterinary drugs	3.667	0.816	3.333	0.577	4.000	1.732	5.000	0.000	3.857	1.027

Note: the scores of the means are coloured as following: with 1-2 = red, 2-3 = orange, 3-4 = light green, and 4-5 = dark green.

Table A 5. Mean and standard deviation of scoring on performance of **functions** per stakeholder group and for all participants (derived from scoring of importance and performance of indicators)

Indicator	Corrected values									
	Farmer		Government		Processing		NGO		Total	
	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Food production	3.7	0.5	3.6	0.5	2.7	0.8	4.6	0.6	3.6	0.8
Bio-based resources	3.7	0.4	3.4	0.8	2.9	0.4	4.0	0.2	3.5	0.6
Economic viability	3.5	0.5	4.0	0.7	3.9	0.2	4.3	0.5	3.8	0.5
Quality of life	3.5	0.4	4.1	0.5	2.4	0.3	3.9	0.5	3.5	0.7
Natural resources	2.8	0.8	3.5	0.7	2.8	1.0	3.4	0.0	3.0	0.8
Biodiversity & habitat	2.9	0.7	3.2	0.7	3.0	1.0	3.6	0.7	3.1	0.7
Attractiveness of the area	3.6	0.5	4.1	0.4	3.4	0.5	3.6	2.0	3.6	0.7
Animal health & welfare	3.4	0.8	3.7	0.0	3.6	1.3	4.3	0.0	3.7	0.8

Note: the scores of the means are coloured as following: with 1-2 = red, 2-3 = orange, 3-4 = light green, and 4-5 = dark green (n=14)
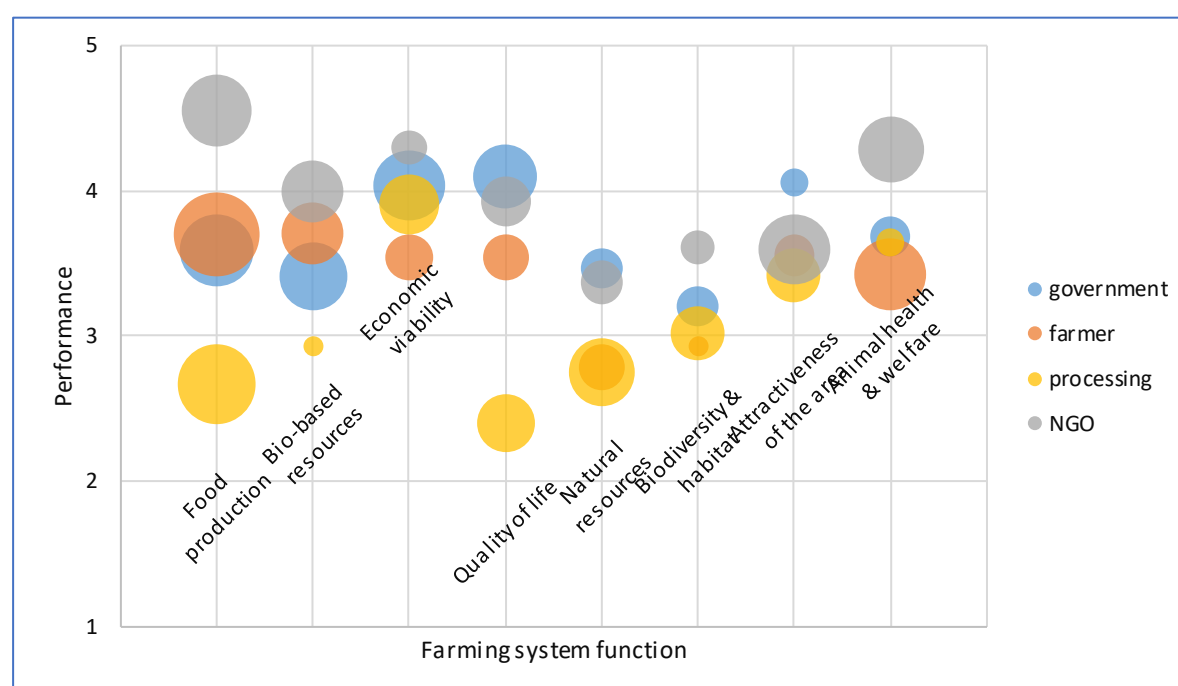
Figure A 1. Bubble graph presenting averaged scores on performance of **functions** (from 1 to 5), aggregated by stakeholder group, while also indicating their importance (size of the bubbles), relative to each other (n=14)

Appendix C. Dynamics of main indicators

Four sub-groups were formed. They chose the following indicators:

1. Sales of crop and vegetables products to processing
2. Subsidies
3. Awareness of biodiversity importance
4. Crop and vegetable production

See the digitalised graphs and quotes from the discussions in section 4.3.

Indicator (1) – Sales of crop and vegetable products to processing
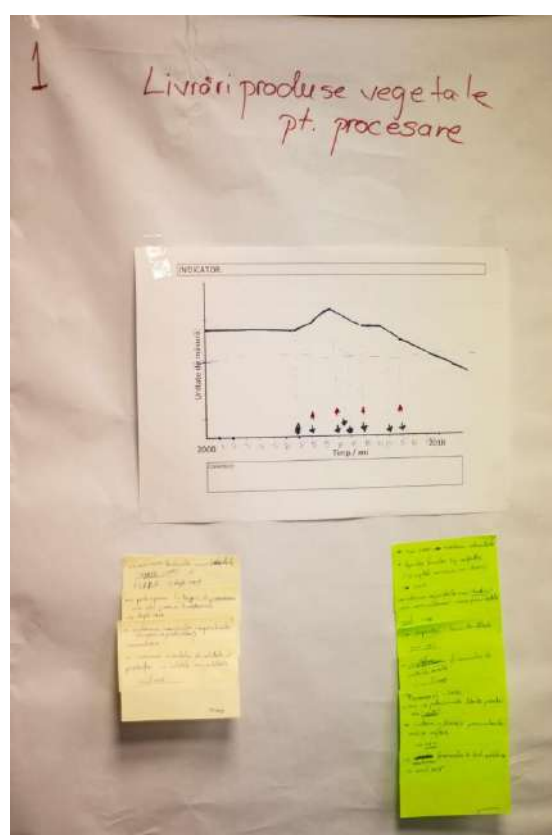
Green cards – challenges

Romanian	English
1 ian. 2007: acordarea de subvenții mai mari prin PAC	January 1, 2007: receiving higher subsidies through CAP
2008: apariția fermelor de tip corporație (cu capital românesc sau străin)	2008: corporate-type farms emerged (with Romanian or foreign capital)
2010: intrarea corporațiilor mari (traderi) care comercializează materii prime vegetale	2010: entrance (on the market) of large corporations (traders) which are selling vegetal (plant) raw materials
2010 – 2011: dispariția târgurilor sătești	2010 – 2011: disappearance of village fairs

2011: amplificarea fenomenului de asistență socială	2011: amplification of the social support (aid) phenomenon
2012: prețuri crescute datorită producției mici (secetă)	2012: high prices due to low harvest (drought)
2014: încetarea activității procesatorilor mici și mijlocii	2014: small and medium processors discontinued their activity
2015: accelerarea fenomenului de land-grabbing	2015: acceleration of land-grabbing phenomenon

Light yellow cards – strategies

Romanian	English
Accesarea fondurilor nerambursabile: - SAPARD, PHARE - FEADR după 2008	Accessing non-refundable money: - SAPARD, PHARE - EAFRD after 2008
după 2010: participarea la târguri de promovare mai ales produse tradiționale;	After 2010: participation in promotional fairs, especially with traditional products
2012: realizarea asocierilor / cooperativelor (grupuri de producători)	2012: making associations / cooperatives (producer groups)
2015: ridicarea nivelului de calitate al producției → calitate, nu cantitate	2015: increasing the production quality → quality, rather than quantity

Additions from other group members (in plenary discussion):

Challenges	Strategies
Since 2007 subsidies are covering losses in small mixed farming system	Increase of the commercial orientation
Investments in local processing units	Re-orientation of the production structure towards processing
Emergence of agricultural corporations	Processors prefer large producers
International traders enter the market (2011)	Production and market cooperatives started emerging
Disappearance of village fairs (2011) resulted in decrease of number of small processors	Sales to processors decreased

Indicator (2) – Subsidies

The analysis of the indicator "Subsidies" was made mainly for direct payments, but the participants wanted to show also the evolution of agri-environmental subsidies – hence the second graph[4] and discussed also the subsidies for grassland (but with no drawings).

Green cards – challenges

Romanian	English
2000-2007: nevoia de sprjin a fermierilor	2000-2007: farmers' need for support
2007: schimbare reguli subvenții	2007: change of rules concerning subsidies
Din 2007: acordare subvenții (PAC)	Since 2007: subsidies granted from CAP
Forma organizatorică (nevoia de a schimba formele de organizare ale fermelor pentru a avea acces la subvenții)	Organizational form (the need to change the organization forms of the farms in order to access subsidies)
Respectare condiții comunitare (condiții impuse de UE pentru acordarea de subvenții)	Complying with the Common rules (conditions imposed by the EU for granting subsidies)

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[4] Agric. ecologică (Romanian) = organic agriculture

Light yellow cards – strategies

Romanian	English
Subvenții de stat (2000-2007)	Subsidies granted by the state (2000-2007) (before accession)
Resetare organizatorică în 2007 (după aderarea la UE)	Organizational resetting in 2007 (after EU accession)
Înființare structuri organizatorice la nivelul fermelor (PFA, II, IF, etc.) care să permită accesul fermierilor la subvenții	Setup of formal organizational forms (for farms) (PFA=authorized person; II= individual enterprise; IF=family enterprise, etc.), which would allow the farmers' access to subsidies
Acțiuni de informare	Information activities
Documentație (agricultură ecologică)	Documentation (on organic agriculture)

Indicator (3) – Awareness of biodiversity importance

Green cards - challenges

Romanian	English
Reguli eco-condiționalitate	Eco-conditionality rules
Șocuri de mediu / boli / dăunători	Environmental shocks / diseases / pests
2007-2010: inițiative locale	2007-2010: local initiatives
2005-2007: reglementări UE	2005-2007: EU regulations
2018: pesta porcină	2018: swine fever
Schimbări climatice: inundații / secetă (2009, 2013, 2018)	Climate changes: floods / drought (2009, 2013, 2018)

Yellow and light-yellow cards - strategies

Romanian	English
Informare - consiliere	Informing - counselling
Conștientizare la nivelul fermierului	Acknowledgement at the farmer's level
Sancțiuni / penalizări (DSP, APIA, DSVSA)	Sanctions / penalties (DSP=county authority for public health; APIA=Agency for Payments and Intervention in Agriculture; DSVSA=

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	county sanitary-veterinary and food safety authority)
Acțiuni de combatere (a scăderii biodiversității) = împăduriri, îndiguiri)	Fighting actions (against diminishing biodiversity) = afforestation, embankments
Acțiuni de informare (MADR, APIA, Mediu)	Informing actions (MADR=Ministry of Agriculture and Rural Development; APIA= Agency for Payments and in Agriculture; Mediu=environmental agencies / ministry)

Indicator (4) – Crop, vegetables and fruit production

Green cards - challenges

Romanian	English
Emigrație	Emigration
2007: secetă severă	2007: severe drought
2007: intrare pe piața liberă (aderare la UE)	2007: entering the free market (Single Market) (EU accession)
2011: secetă	2011: drought
2014: schimbare PAC	2014: change of CAP

Yellow cards - strategies

Romanian	English
Accesare fonduri europene	Accessing European funds
2012: refacerea sistemului de irigații	2012: restoration of the irrigation system
2016: diminuarea TVA (19% → 9%)	2016: VAT decrease (19% → 9%)
Asociere tehnologizare	Association for technology

Additions from other group members (in plenary discussion):

Strategies	Challenges
Financial incentives = subsidies	2007: EU accession
Irrigation program	2011: drought
Land consolidation + technology	Emigration + climate shocks (droughts)

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Appendix D. Details on scoring strategies and resilience attributes

Table A 6. Mean (and standard deviation) of implementation scores of strategies and their potential contribution to robustness, adaptability and transformability (n=13)

Selected indicator	Strategy	Implementation score		Potential contribution to resilience capacities					
				Robustness		Adaptability		Transformability	
		Mean	St. Dev	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev
Subsidies		4.3	0.6	2.7	0.6	2.7	0.6	3.0	0.0
	Information actions	4.0	0.0	3.0	0.0	3.0	0.0	3.0	0.0
	Ensuring the correctness of paperwork	5.0	#DIV/0!	2.0	#DIV/0!	2.0	#DIV/0!	3.0	#DIV/0!
Sales of crop and vegetables products (thou tonnes)		1.8	1.0	-0.5	3.0	-0.3	3.2	2.5	1.0
	Quality rather than quantity	3.0	#DIV/0!	-3.0	#DIV/0!	-3.0	#DIV/0!	3.0	#DIV/0!
	Creation of producers' associations / groups	1.3	0.6	0.3	3.1	0.7	3.2	2.3	1.2
Awareness of biodiversity importance		3.5	0.7	-0.5	2.1	1.5	0.7	0.0	1.4
	Informing campaigns regarding the eco-conditionality rules	4.0	#DIV/0!	1.0	#DIV/0!	2.0	#DIV/0!	1.0	#DIV/0!
	Regulations / sanctions / penalties coming from authorities	3.0	#DIV/0!	-2.0	#DIV/0!	1.0	#DIV/0!	-1.0	#DIV/0!
Crop and vegetables production (thou tonnes)		3.8	1.0	2.5	0.6	3.0	0.0	2.8	0.5
	Land consolidation and technologization	3.8	1.0	2.5	0.6	3.0	0.0	2.8	0.5
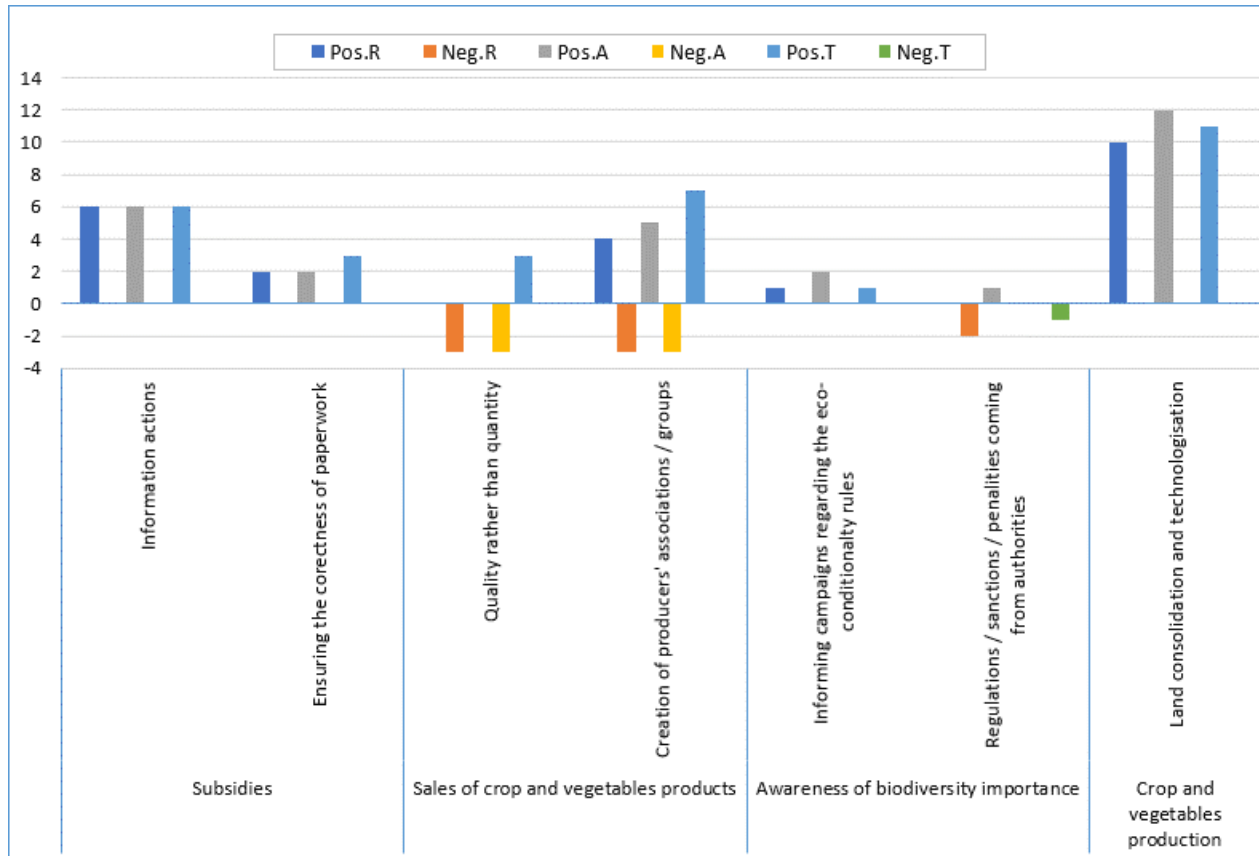
Figure A 2. Bar graph presenting total positive and negative points allocated to a strategy's contribution to robustness, adaptability and transformability (n=13)

Table A 7. Mean and standard deviation of performance scores of resilience attributes (per stakeholder group and for all participants) (n=10)

Resilience attributes	Extent into which attribute applies in the farming system									
	Farmer		Government		Processing		NGO		Total	
	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Reasonably profitable	2.8	0.5	2.7	0.6	1.0	0.0	2.0	#DIV/0!	2.3	0.8
Coupled with local and natural capital (production)	3.0	0.8	3.7	0.6	4.5	0.7	4.0	#DIV/0!	3.6	0.8
Functional diversity	2.0	0.0	1.3	0.6	3.5	2.1	2.0	#DIV/0!	2.1	1.1
Response diversity	3.8	1.0	2.0	1.0	3.0	1.4	3.0	#DIV/0!	3.0	1.2
Exposed to disturbance	3.0	0.0	2.3	0.6	1.0	0.0	2.0	#DIV/0!	2.3	0.8
Spatial and temporal heterogeneity (farm types)	3.5	1.3	4.0	1.0	3.0	2.8	4.0	#DIV/0!	3.6	1.3
Optimally redundant (farms)	2.5	1.3	2.0	0.0	1.5	0.7	2.0	#DIV/0!	2.1	0.9
Supports rural life	3.3	1.5	2.0	0.0	3.5	2.1	5.0	#DIV/0!	3.1	1.4
Socially self-organized	4.0	1.2	1.7	0.6	2.5	0.7	3.0	#DIV/0!	2.9	1.3
Appropriately connected with actors outside the farming system	2.3	1.0	1.3	0.6	1.0	0.0	2.0	#DIV/0!	1.7	0.8
Infrastructure for innovation	4.3	1.0	2.3	0.6	2.5	2.1	4.0	#DIV/0!	3.3	1.3
Coupled with local and natural capital (legislation)	2.3	0.5	2.0	1.0	2.0	1.4	2.0	#DIV/0!	2.1	0.7
Diverse policies	2.8	1.0	1.3	0.6	4.0	1.4	2.0	#DIV/0!	2.5	1.3

Table A 8. Mean and standard deviation of resilience attribute's contribution to robustness, adaptability and transformability (per stakeholder group and for all participants) (n=10)

Resilience attributes	Farmer						Government						Processing						NGO						Total Robustness		Total Adaptability		Total Transformability	
	Robustness		Adaptability		Transformability		Robustness		Adaptability		Transformability		Robustness		Adaptability		Transformability		Robustness		Adaptability		Transformability							
	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Reasonably profitable	2.8	0.5	2.5	0.6	1.8	1.0	1.3	0.6	0.3	2.1	1.0	1.0	-2.5	0.7	0.5	0.7	1.0	1.4	-1.0	#0*	1.0	#0	1.0	#0	0.9	2.2	1.3	1.5	1.3	0.9
Coupled with local and natural capital (production)	0.8	2.6	0.8	2.5	0.5	2.4	2.3	0.6	1.7	0.6	1.0	1.0	-0.5	3.5	0.5	2.1	1.0	1.4	2.0	#0	2.0	#0	1.0	#0	1.1	2.2	1.1	1.7	0.8	1.5
Functional diversity	1.0	2.7	0.5	2.5	0.8	2.6	-0.7	2.5	0.3	2.1	-0.3	1.5	-2.0	1.4	1.5	2.1	1.5	0.7	1.0	#0	1.0	#0	-1.0	#0	-0.1	2.4	0.7	1.9	0.4	1.9
Response diversity	0.8	2.6	1.3	2.9	1.0	2.7	-1.0	2.0	0.3	2.1	0.0	1.0	0.0	2.8	2.0	0.0	1.0	0.0	1.0	#0	3.0	#0	2.0	#0	0.1	2.2	1.3	2.1	0.8	1.8
Exposed to disturbance	0.8	2.6	0.8	2.5	0.5	2.5	0.7	1.5	0.0	1.7	-0.7	0.6	-3.0	0.0	1.0	2.8	2.5	0.7	1.0	#0	2.0	#0	1.0	#0	0.0	2.3	0.7	2.0	0.6	1.9
Spatial and temporal heterogeneity (farm types)	2.0	0.8	2.3	0.5	1.8	1.0	2.7	0.6	2.3	0.6	1.3	0.6	-3.0	0.0	0.0	2.8	2.5	0.7	1.0	#0	2.0	#0	1.0	#0	1.1	2.3	1.8	1.4	1.7	0.8
Optimally redundant (farms)	0.5	2.5	0.8	2.6	0.0	2.0	-0.7	2.5	0.0	1.7	-0.3	1.2	-2.5	0.7	-1.0	2.8	-0.5	3.5	1.0	#0	2.0	#0	2.0	#0	-0.4	2.3	0.3	2.2	0.0	1.9
Supports rural life	2.3	1.5	2.3	1.0	1.5	1.3	0.7	1.2	1.3	1.2	1.3	1.5	0.5	2.1	1.0	1.4	1.0	1.4	3.0	#0	2.0	#0	2.0	#0	1.5	1.6	1.7	1.1	1.4	1.2
Socially self-organized	2.5	0.6	1.8	1.3	1.8	1.0	-1.0	2.0	-0.3	2.3	-1.7	1.5	1.5	2.1	1.5	2.1	1.5	2.1	-1.0	#0	-1.0	#0	-2.0	#0	0.9	2.1	0.8	1.9	0.3	2.1

Resilience attributes	Extent into which resilience attribute potentially can contribute to resilience capacities in the farming system																																		
	Farmer						Government						Processing						NGO						Total Robustness		Total Adaptability		Total Transformability							
	Robustness		Adaptability		Transformability		Robustness		Adaptability		Transformability		Robustness		Adaptability		Transformability		Robustness		Adaptability		Transformability													
	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Appropriately connected with actors outside the farming system	0.0	2.2	0.8	2.6	1.0	2.7	-0.7	2.3	0.3	2.1	-0.3	1.5	-1.0	1.4	-0.5	0.7	1.5	2.1	-1.0	#0	-1.0	#0	-1.0	#0	-0.5	1.8	0.2	1.9	0.5	2.1
Infrastructure for innovation	2.5	1.0	1.8	1.0	1.8	1.0	0.3	1.2	0.7	1.5	0.3	2.1	0.5	3.5	0.0	0.0	1.5	0.7	2.0	#0	1.0	#0	2.0	#0	1.4	1.8	1.0	1.2	1.3	1.3
Coupled with local and natural capital (legislation)	-1.0	2.4	-0.5	2.6	-0.5	1.9	0.3	1.5	-0.7	2.5	-1.0	2.0	-0.5	3.5	-1.5	2.1	-0.5	3.5	1.0	#0	1.0	#0	1.0	#0	-0.3	2.1	-0.6	2.2	-0.5	2.0
Diverse policies	0.8	2.5	0.5	2.5	0.8	2.6	-0.5	2.1	-1.0	2.8	-1.0	2.8	-1.5	2.1	-1.5	2.1	-0.5	3.5	2.0	#0	2.0	#0	1.0	#0	0.1	2.2	-0.1	2.3	0.1	2.4

Note: '*#' means that the value of standard deviation is '#DIV/0!'
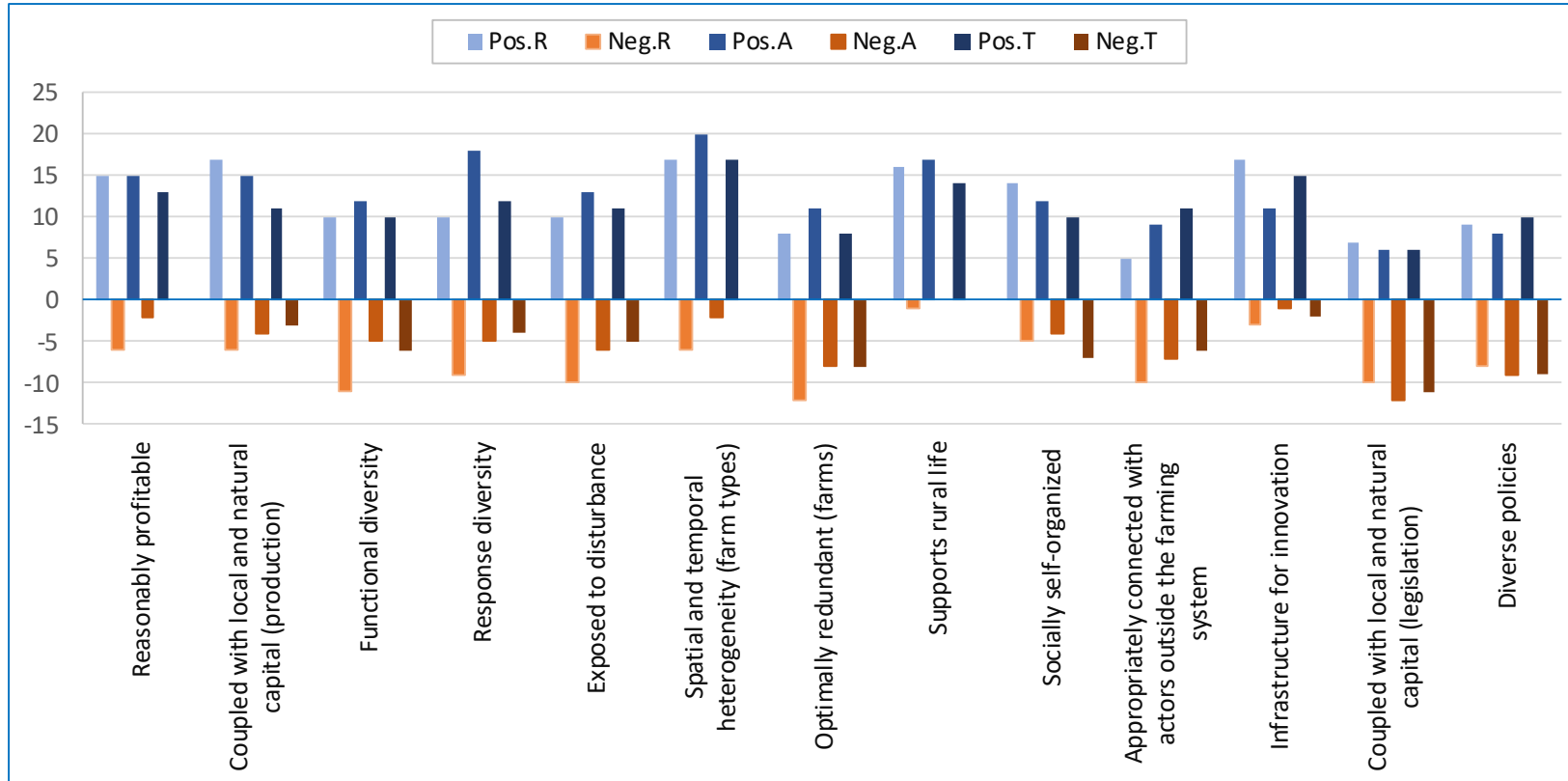
Figure A 3. Bar graph presenting total positive and negative points allocated to a resilience attributes' contribution to robustness, adaptability and transformability (n=10)

Appendix E. Workshop challenges and improvements

Comments and details about shortcomings, challenges, bottlenecks etc. of the methodology and how to improve them.

The amount of information was very large, close to the end it was overwhelming, and participants and researchers became tired.

For the next FoPIA workshop, if the same amount of exercises will remain, both participants and researchers suggested a 2-day long workshop.

Excel-sheet 'S6 attributes and FS': it was difficult and rather disorienting for participants to use on the same page two different scoring scales: from 1-5 for the first question / column in the table, and from -3 to +3 for the next question (another three columns of the table). Suggestion: either separate the two questions in two different tables, or use the same scoring scale for both questions.

Tables in text

Tables in Appendixes

Figures in text

Figures in Appendixes