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FoPIA-Surefarm Case-study Report Bulgaria

Work Performed by Partner No. 14, UNWE

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1 Abstract

This report presents the analysis and results from the stakeholder workshop organized in the Bulgarian CS relevant for the large-scale crop production in North-East Bulgaria. The report is focused on the past and current resilience and sustainability of the farming system, assessed according to the Framework for Participatory Impact Assessment of SUstainable and REsilient EU FARMing systems (FoPIA-SureFarm). In the introduction part the general description of the CS area with the identified main challenges is provided as well as brief details on the workshop performance are given. Next sections explain the farming system delineation adjustments according to the stakeholders' suggestions and the stakeholder perceptions and ranking of the importance of its functions as well as the current performance of the selected indicators for these functions. The 5th section provides information about the dynamics of the main indicators in the period of 2000-2018 explained by stakeholders (either the challenges that caused these dynamics and the strategies that taken place to deal with them). Section 6 presents the analyses of the level of implementation of chosen strategies and their contribution to robustness, adaptability and transformability of the largescale crop production farming system linked with the current performance of resilience attributes. The discussion part highlights through which functions (and indicators) the identity of the farming system is perceived, concludes that adaptability is revealed as the main resilience capacity of the largescale production in North-East Bulgaria. Also, a summary is given on possible options mentioned during the workshop and relevant to the future improvements of the system resilience. At the end the workshop challenges and improvements are described. The workshop assessments and results showed that the most important functions are "Food production" those related to the conditions in the area. In contrast to the low rating of the importance of the "Economic viability" function it is scored as the best performing. From the assessment of the importance and performance of indicators reveal different preferences of the stakeholder but among all of the them the highest rates are given to the "Nutritional quality" ("Food production" function) and "Net farm income" ("Economic viability") which together with "Productivity", "Cost of production", "Nutrient balance" and "Soil erosion" have been chosen for further analysis to define the main strategies. Among the four defined strategies the two considered as highly implemented are: "Changes into production technologies and modernisation" and "Preservation of the current marketing of the products". Both of them contribute to the farming system adaptability according to the stakeholders' assessment. The adaptability of the system is revealed also by the scoring of the resilience attributes and the general conclusion is that the main resilience capacity in the CS area for the large-scale crop farming system is adaptability.

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2 Introduction

2.1 Case study area

Crop production is important and has a long tradition in Bulgaria. North-East Bulgaria (CS region), where the research area is located, is known as "the granary of Bulgaria" and is of crucial importance. The landscape relief is varied with semi-mountainous areas, river valleys and lowlands; the climate is with well-defined four seasons; the soils are among the most fertile in the country, suitable for growing cereals, sunflower, industrial crops, fruits, vegetables; agriculture (in particular grain production) is an important economic sector; on average the agricultural land amounts to 80-82%. In 2016, the total arable land in Bulgaria increased to 3 480 991 hectares, 40% of which is located in the CS region. 97% of the total number of registered holdings in plant production in the country are physical persons who manage 32% of the agricultural area. The share of the sole traders and corporate companies is 2,5% and they cultivate 51% of the area. In addition, 22,3% of the total number of holdings in Bulgaria (244 594) are set up in the CS region. In the CS region, areas are cultivated that account for 43% of the cereals, 42% of the oleaginous and 17% of industrial crops in the country. The share of the CS region in the total crop production of the country by crops is as follows: 48% of wheat, 45% of barley and 56% of maize.

North-East Bulgaria is a well-developed agricultural region as the production capacity results from the natural conditions on the first place. Historical developments and transformations which have taken place also define the production capacity. In this regard, several facts have to be taken into consideration when the results of the interviews are interpreted: 1) Agriculture during the communist regime (1944-1989) was organized in large-scale, mechanized farms, producing for national and international consumption (the process of collectivisation resulted in that over 92% of arable land belonged to the collective farms - complexes averaged between 36,000 and 100,000 hectares; private plots at very small size and share remained productive only for self-consumption). Specialisation (achieved by specialising in three or fewer crops and one type of livestock) was externally introduced not only for the production units but also for the regions. North-East region had specialised in crop production with main field crops wheat, maize, and barley. At present, these developments have been considered traditional by the stakeholders. 2) After 1990, the large production complexes are dismantled; the property rights in land returned to their initial owners prior to collectivisation (mainly to their heirs which resulted in highly fragmented agricultural land ownership and domination of small-scale farms). The sector has passed through a rapid transformation as all operations were liberalised and the

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"new" farmers (either family, cooperatives and corporate) started to learn "how to do that business". Actually, this is the beginning of entrepreneurship in agriculture in Bulgaria. All over the country as well as in the North-East region, new farm structures emerged. 3) After the year of 2000 – the period of preparation to and accession to the EU (2007) – the process of CAP implementation (SAPARD, RDPs and SAPS) has changed farmers' behaviour (increased investment opportunities) as well as the interest in farming (better profitability) and land relationships (higher competition and reduced access to main production factor – the land - in arable farming). Land prices (rent and lease) increased gradually up to several times. 4) During the communist time a process of industrialisation of the economy (together with land confiscation) and push emigration from villages to towns, played a role of disconnection of people from land management and food production. Moreover, after the changes towards market economy, the emigration process had been reinforced (collapse of enterprises etc.) and not only from rural but also from urban areas towards abroad. One of the negative consequences is a lack of labour force (in quantity and quality) for all economic sectors but much more severe for agriculture.

2.2 Main challenges in the case study area

Table 1: Challenges in the case study area

Challenges	Economic	Environmental	Social	Institutional
(Non-) permanent shocks	Price fluctuations	Extreme natural conditions	Lower pay (incomes) in comparison to urban areas	Land ownership and its regulation
	Limited use of insurance	Introduction of agro-ecological requirements (practices)	Worsened quality of services	Legislation changes
	Subsidy levels		Response to changes in consumer preferences – towards the quality of food and the way it is produced	Political instability
				International environment / influences
Long-term pressures	Functioning of the relevant markets	Climate changes	Depopulation of rural areas	International environment – embargo and other restrictions
	Capacity for adequate financial management	Pollution of ground waters and the air	Aging population of rural areas	Policy for job creation and diversification of the economy for value creation
		Monoculture and soil fertility changes		
		Limited opportunities for irrigation		

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2.3 Workshop – brief details

Workshop 1 took place on 11 January 2019 in the city of Targovishte in North-East Bulgaria. It was organised with the assistance of the local directorate of the Ministry of Agriculture, Food and Forestry (MAFF) and the Agriculture Advisory Service. A total of 14 participants were initially invited. A total of 19 participants attended the workshop. The increased number was a result of an increased number of representatives of the regional and municipal offices of the MAFF. The participants included: representatives of the agriculture advisory service; representatives of the regional directorate of the MAFF; and representatives from the offices of the MAFF at the municipal level. Other participants included the chairman of the Association of grain producers in the Popovo region (situated within the Targovishte region of the case study area) who also is a farmer, and other farmers – grain and fruit, as well as one representative of a processing company. The participants represented the regions of Targovishte, Razgrad and Shoumen from the case study area. More detail on the participants is provided in Appendix A.

The attending participants allowed identifying four groups of stakeholders at the workshop:

1. Farmers – 6 persons, including all types of farmers attending the workshop.
2. Industry – 1 person, including the processing company representative.
3. Government – 9 persons, including the representatives of the regional and municipal offices of the MAFF.
4. NGO – 3 persons, including the representatives of the advisory service.

3 Farming system

The initial farming system was presented and explained to the seminar participants by a researcher/facilitator. They could see the diagram on a large screen as well as on a printout distributed to each participant. The researcher introduced the main actors in the farming system, and how they influence each other. It has been based on the model farming system proposed in Reidsma et al. (2018) and based on Meuwissen et al. (2018). The participants inquired on the specific farm types mentioned on the presented figure. They asked why grain producers over 2000 ha have been differentiated from the rest. Some of the background of the SURE-Farm research was explained to them. In particular, the consultations with stakeholders for identifying the most common farm types in the case study area, and the aim to achieve comparability with the rest of the countries in the research by defining groups that are close to a classification at the EU level.

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Probing whether there are any additional actors not included in the inner circle of the figure led to suggestions that the beekeepers are a large group of farmers that have not been included there. Another participant mentioned the vegetable growers. These two groups of farmers have been added to the farming system as shown in Figure 1. The participants clarified that the beekeepers were more important to be part of the system than the vegetable growers.

While discussing the relevance of the different farm types to the most inner circle on the initial figure, it was mentioned that there are other elements different from these groups of farms that have much stronger influence on the behaviour of the grain producers in the case study area. The role of export markets where grain is traded internationally was highlighted:

"At present, the export markets are the main [determinant] in terms of price (farmer)."

"If the price at the export markets is good, this impacts on the output here (farmer)."

"The market is the main [source of] influence on the grain producers (government)."

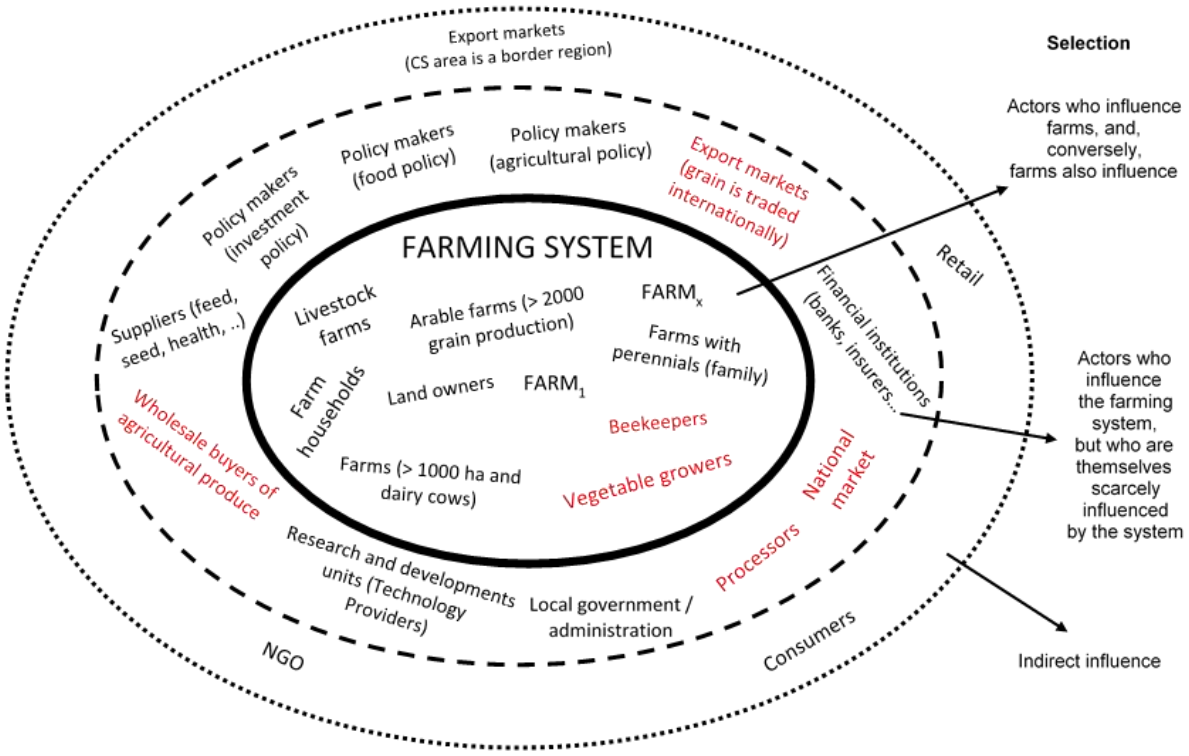

Figure 1: Revised farming system visualisation after feedback from participants.

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As a result, the participants suggested that export markets are better placed in the middle circle. Some of them insisted that it should be in the inner circle, but there was the argument that the farmers are not able to have strong influence on the export markets. The participants compared the farmers' strength of influence on the export markets with that on the financial institutions, i.e. very weak. The researchers mentioned that interviews with stakeholders have revealed that the financial institutions tailored their products to be attractive to grain producers and this was a sign for some power of the farmers over the financial institutions. The participants at the workshop did not agree that they had so much power. There also was a suggestion from a participant that if the two outer circles were joined together, there will be no need to discuss in such detail the power of different elements of the system.

Two of the participants started a discussion whether the national market has a similar role as the export markets. One of them stated that only 10% of the output of the grain farmers is sold at the national market as inputs for bread and fodder. Nevertheless, the national market was pointed out as a missing element from the system and according to the participants, it was as important as the export markets. One of the participants mentioned the wholesale buyers of agricultural produce. These actors had two roles: 1. Buying the produce of small-scale farmers, mainly; 2. Processing some of the grain produce before selling further in the food chain. The role of processors was stressed by other participants as well. As a result of the suggestions from the workshop participants, 'national market', 'wholesale buyers of agricultural produce', and 'processors' were added as direct influencers to Figure 1.

4 Essential functions

4.1 Importance of essential functions

According to the workshop results, the "Food production" function of the system received the largest amount of points by all stakeholder groups. The *industry group* had just one representative, hence, calculating average scores and standard deviations was not possible (Appendix B, Table A2). Nevertheless, Figure 2 suggests that the other functions that stand out regarding their importance, are mostly related with the conditions in the area, where the participants are living. These include: 1) "Quality of life", encompassing sources of incomes and working conditions in the place of living; 2) "Natural resources", focused on the good condition of water, soil, and air in the place of living; and 3) "Attractiveness of the area", concerned with the participants' perception of the region as a place of living.

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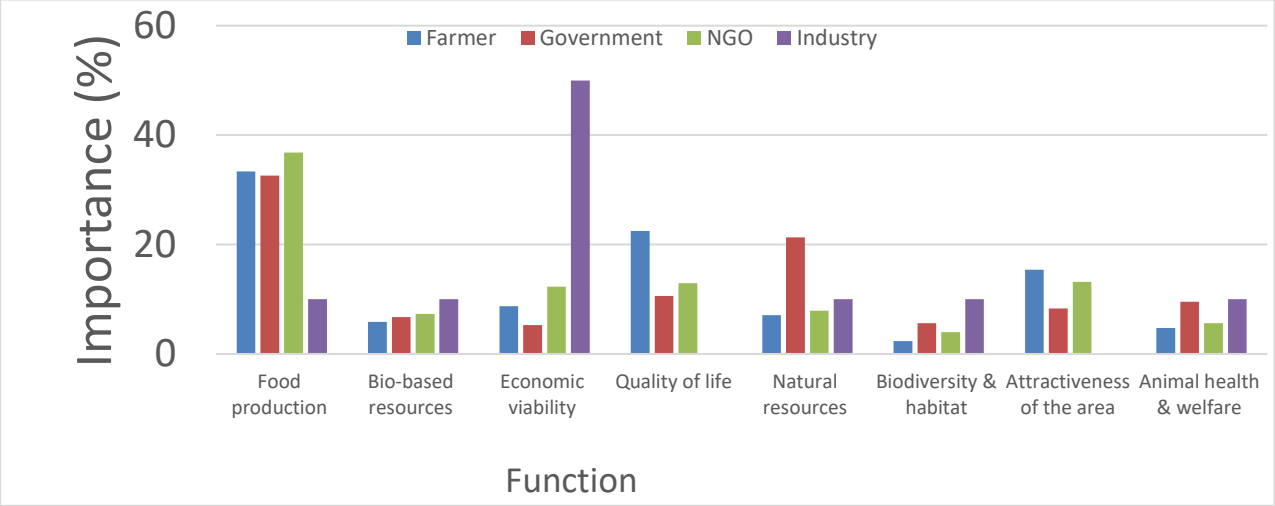

Figure 2: Scoring per function and stakeholder group. 100 Points could be divided over eight functions. (n=14)

"Economic viability" has received relatively low scores, which may be considered inconsistent with the rest of the results. Surprisingly, it has not been valued highly by the *government* representatives. The low score from the *farmers* can be explained by the general formulation of the concept where viable farms help strengthening the economy and contribute to regional development. However, such perspective is often present as justification for policy and other interventions.

The functions that can be semantically related with environment and nature have received relatively low scores. These include: 1) "Biodiversity and habitat"; and 2) "Animal health and welfare". It does not contradict the perceived high importance of the "Natural resources", because the participants may have preferences for living in an environment where water, soil and air are in good condition, but they realise that there is certain lack of overlap between developing the farming system and assigning high importance to the environment:

"The more developed is a farming system the more negatively it impacts on the biological elements. For a farm to be profitable, it needs to be intensive, it needs to have irrigation, it needs to use fertilizers, it needs to exploit, although to a reasonable extent, the nature, the infrastructure and everything. In this case, I think that the farming system does not support the development [of natural resources], rather there is a certain confrontation (farmer)."

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"Bio-based resources" also receive a relatively low score and refer to the provision of biological inputs for other actors in the economy. The result is consistent with the export orientation of the large-scale grain producers, because it suggests that they supply local processors to a smaller extent.

The "Food production" function of the faming system, which has received the highest scores has also the highest standard deviations by stakeholder group and for all participants together (Appendix B, Table A2). Indeed, all participants have assigned it some points, but the scores vary from 10 to 90. The highest fluctuations are present in the *NGO* group.

"Attractiveness of the area" has a high standard deviation for the *NGO* group. They are engaged as advisers of farmers and other rural businesses and this function of the farming system is among the justifications for their work. However, the fluctuations suggest that they evaluate its importance differently.

"Quality of life" has a high standard deviation for the *farmers* group. All of them have assigned points to this function, but they vary from 10 to 40.

"Natural resources" has a relatively high standard deviation within the *government* representatives' group and the scores vary from 0 to 50. This suggests that although they largely recognise the function as important, the level of importance is not unified.

The accompanying discussion raised concerns about the low relevance of the highlighted functions to the Bulgarian situation. Participants pointed out that the presented functions of the farming system are reasonable and make sense, but they did not agree that the system contributes to most of them. One *government* representative pointed out that to some extent the large-scale grain producers contribute negatively to the implementation of the functions, because there is high level of inequality between the different types of farmers. I.e. the grain producers were more powerful and affected negatively the vegetable producers by contributing to the reduction of their numbers, for example.

4.2 Identity of the farming system

The identity of the farming system is formed around the production of grain and the business interests of grain producers. It is in the sense of producing outputs that bring revenues. The discussion of the farming system suggested that they perceive the impact of key elements of the

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system, such as export markets, very strongly. This interpretation of the identity of the farming system is in line with rating „Food production" as the most important function.

5 Indicators of essential functions

5.1 Indicator importance

The indicators representing the functions were selected from Annexe 2 in SURE-Farm deliverable D1.1 by Meuwissen et al. (2018) by considering the most relevant to the farming system and the case study area, based on the researchers' knowledge and expert consultations.

Scores per indicator and stakeholder group have been illustrated in Figure 3 and are also included in Appendix B, Table A3. It should be noted that some stakeholders have not assigned the full number of 100 points among the listed indicators per function.

In relation to the "Food production" function, the indicator with highest score for the *government*, *NGO*, and *industry* stakeholders is "Nutritional quality". However, *farmers* have prioritised "Productivity" as the most important indicator. "Loss of crops and livestock" due to pests or disease has received relatively low scores by all stakeholders. "Nutritional quality" has the highest mean among the three indicators for the stakeholders as a whole (Table A3). However, it also has the highest standard deviation reflecting scores ranging from 0 to 100.

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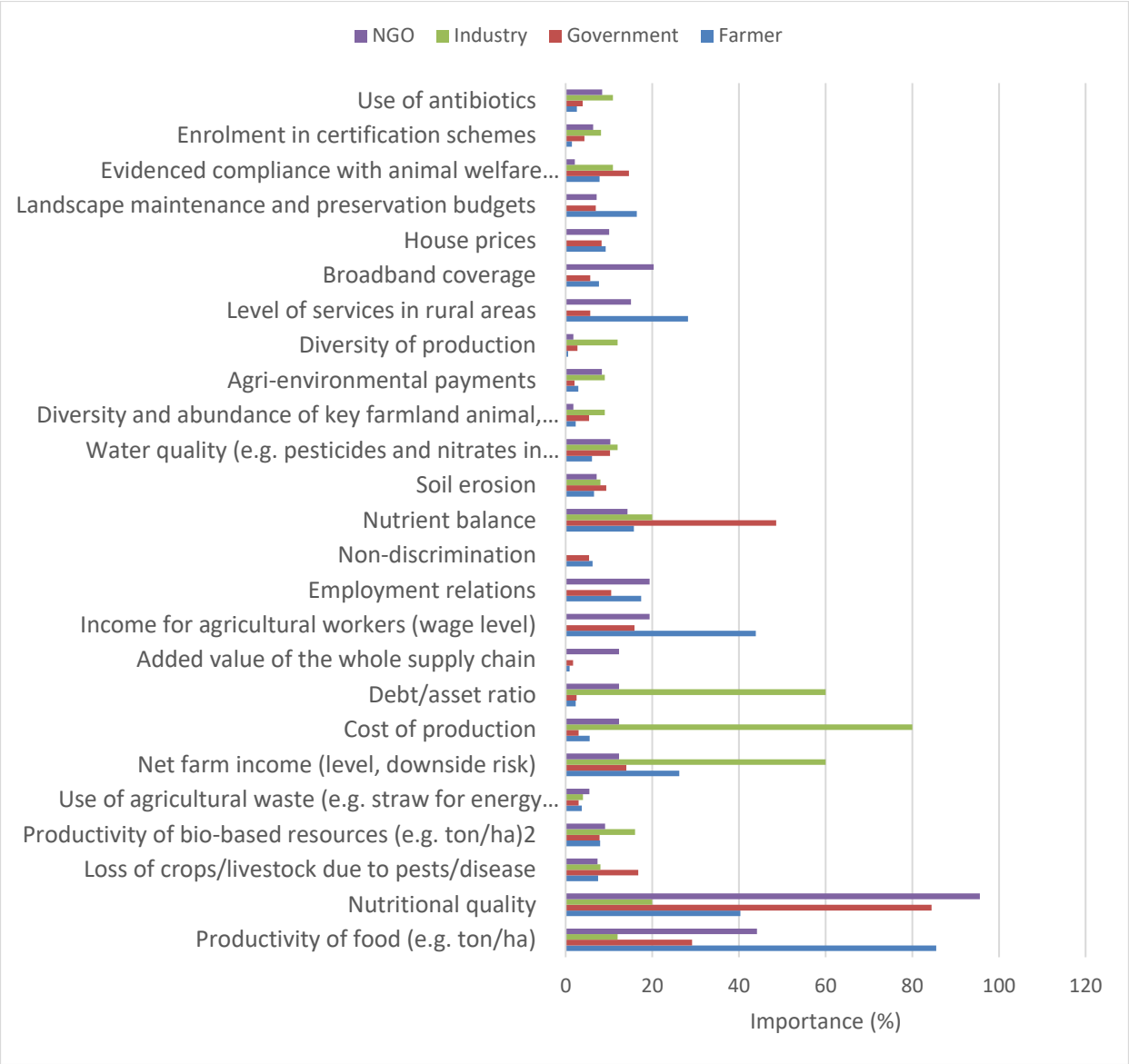

Figure 3: Scoring of importance of indicators by stakeholder group. 100 points were divided over all indicators per function. Values are transformed by taking into account function importance according to stakeholder group and number of indicators per function. This allows for direct comparison across all indicators. (n=14)

When asked directly to point out the importance of the proposed indicators for "Food production", the participants stated that "Productivity" is the most important. However, they also related it with the cost price of food, because it affected the affordability for the consumers.

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"It is important to have diversity of products for the consumers and our high specialisation of growing four crops in total, which is a characteristic for our region, and the country as a whole, is an obstacle. But it has its explanation, economic logic (farmer)"

The *farmers* at the workshop pointed out that there may be a certain contradiction between the indicators "Productivity" and "Nutritional quality":

"Regarding productivity, large part of the grain producers and other farmers turn their attention to new varieties of wheat that have high yields and the productivity is guaranteed. However, in terms of nutritional quality, part of this production is below standard (farmer)."

A representative from the *government* group supported that statement by adding that *"the quantity is at the expense of the quality"*.

In terms of indicators, the participants suggested that both "Productivity" and "Nutritional quality" are relevant and "Productivity" was more important for the producers whereas "Nutritional quality" was more important for the consumers. During the discussion the *farmers* pointed out that the diversity of products offered to the consumers also were relevant to "Food production". They were asked whether they find this as a more relevant indicator than the "Loss of crops and livestock". From their perspective, these indicators meant the same:

"If there is sufficient interest [demand] towards certain variety or breed, it will not get lost. But there needs to be sufficient interest from the population towards the products. … A producer [farmer] would never let the variety or breed get lost in such case (farmer)."

The stakeholders also pointed out that the price would be the most important indicator. They added cost price as equally important alternative to price. The indicator was added to the list for them to score at the workshop. During the discussion everyone present seemed to be in agreement about the importance of price and cost price. However, the analysis of the scores shows that the indicator has received support from the *farmers* and *government* representatives, while *industry* and *NGO* representatives have not assigned it any points. The standard deviations for the scores are relatively high suggesting that stakeholders within the different groups held differing opinions on the importance of the indicator.

The most important indicator for "Bio-based resources" is the "Productivity" of the farms and the means per stakeholder groups do not differ substantially. It also has relatively high standard deviations of above 20 for all stakeholder groups suggesting that there are differences in the views of individual participants. "Use of agricultural waste" has received much lower scores, but also

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has relatively high standard deviations although not as much as productivity. During the discussion this concept required additional explanations and examples, so that all stakeholders could understand its meaning. The participants commented that agricultural waste would have much more meaning if it was represented through its price and / or cost price. According to them, if there was no economic reasoning behind the use of agricultural waste, there was no point to consider it as an indicator.

"Economic viability" has been most strongly related with the "Net farm income" indicator. Two of the stakeholder groups – *farmers* and *government representatives* have assigned it quite important role through relatively high scores. The scores within both groups range from 40 to 100 resulting in high standard deviations. The *NGO* and *industry stakeholders* have spread their points mostly over "Net fam income", "Cost of production", and "Debt / asset ratio" in a relatively balanced way and the scores do not deviate from the mean. "Added value" of the whole supply chain has not been considered as an important indicator by any of the stakeholder groups in comparison to the other three. It is characterised by low means and standard deviations.

During the discussion, the participants pointed out that "Net farm income" is the most representing indicator for "Economic viability", because it is functionally related with the other proposed indicators.

"Quality of life" has been represented mostly by "Income for agricultural workers". All stakeholder groups assign it relatively high scores. Only the *farmers'* group has somewhat high standard deviation of the scores. "Employment relations" has been rated higher by *industry* and *NGO* representatives in comparison to *farmers* and *government representatives*. It has relatively low standard deviations across the groups of stakeholders. The "Non-discrimination" indicator has not been related strongly with the function.

During the related discussion, a stakeholder highlighted a connection between the functions by commenting that:

"The quality of life is important for economic viability, because it gives reasons to young people to stay in the area (farmer)."

"Natural resources" were most strongly represented by the indicator for nutrient balance in the soil. It has been scored high by all stakeholder groups. However, the scores range from 0 to 100 and there are high standard deviations across the groups and for the all participants together. This shows a large difference in opinions. The second in importance is "Water quality". It is

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relatively highly rated by *farmers*, *industry* and *NGO* stakeholders, but not by the *government* representatives. "Water quality" has been evaluated from 0 to 40 and has relatively high standard deviations as well. These two indicators can be easily related with the good condition of the soil and water.

The "Soil erosion" indicator has received relatively small support by the stakeholders and during the discussion there were opinions that it did not affect grain producers. This revealed that some of the *farmers* were not aware of the role of soil erosion in their business. "Waste management" has also been included among the indicators and it has received no points from any of the stakeholders who completed data tables at this stage of the workshop. It is possible that grain production is not perceived as a source of waste and the impact of waste is not well understood in relation to natural resources.

"Biodiversity and habitat" has been well-represented by "Diversity and abundance of key species" as well as "Agri-environmental payments", while "Diversity of production" has received the lowest support by stakeholders. The *NGO* representatives stand out from the other groups with their strong support to "Agri-environmental payments" as the relevant indicator for this function. This result may be related to their job as farm advisers where they emphasise this aspect of farming. All indicators to this function have relatively high standard deviations. The opinions of stakeholders seem to differ most with respect to diversity and abundance of key species, where the means are above 30. This corresponds to individual scores ranging from 0 to 100 for all stakeholders.

"Attractiveness of the area" has not been distinctively represented by any of the proposed indicators. *Farmers* have prioritised the level of services in rural areas, while *NGO* representatives have given the highest scores to "Broadband coverage". The "House prices" indicator also is relatively well supported, and *government* representatives have allocated the highest number of points to it. "Landscape maintenance" has received the lowest scores, and this is in line with evidence through the workshop for stakeholders failing to make connection between farming activities and landscape quality. The standard deviations are relatively high for all indicators across stakeholder groups. the highest standard deviations are found for the *farmers* with respect to "Level of services in rural areas" and "Landscape maintenance".

"Animal health and welfare" has been represented by most support to evidenced compliance with animal welfare regulation. It is coming from the *farmers*, *government*, and *industry* stakeholders. The standard deviations of these scores are relatively high. *NGO* representatives have given

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highest scores to the "Use of antibiotics". Overall, this function is somewhat distant to the grain production farm system. Some of the *farmers* also have livestock units, but in relation to grain production, animal health and welfare is a topic that they consider in general rather than as directly related to their businesses.

5.1.1 Impression of the discussion

The workshop participants noted that it was not clear what exactly was measured by some of the indicators. In addition, they found it hard to connect the indicators with the function:

"it is not clear what is the importance of Loss of crops/livestock due to pests/disease with food production (farmer)."

Other comments on the indicators were that there was overlap in their scope, implying that some of the indicators were not necessary. Stakeholders also noted that different indicators may be important for different groups of people in the farming system, i.e. productivity was important for farmers, while „Nutritional quality" was important for consumers.

5.2 Indicator performance

Indicator performance scores per stakeholder group (and indicator) have been illustrated in Figure 4 and included in number form in Appendix B, Table A4.

In regard to the scoring of the indicator performance the participants did not assign the score to each one of the indicators. It is more relevant to the indicators for "Quality of life", "Natural resources", "Biodiversity and habitat", "Attractiveness of the area" functions. Thus, the scoring of performance in our opinion is biased and interpretation of the results should be led by the discussion and expressed opinions by different stakeholders.

Regarding the "Food production" function, "Productivity" is the indicator that has received the highest scores by the stakeholders as a whole. It has received distinctively higher scores from the other two indicators – "Nutritional quality" and "Loss of crops/livestock due to pests/disease". Considering the means by stakeholder group, "Food production" has the highest scores among all functions, and this is in line with the perceptions of the participants about the farming system and its identity (Figure 5).

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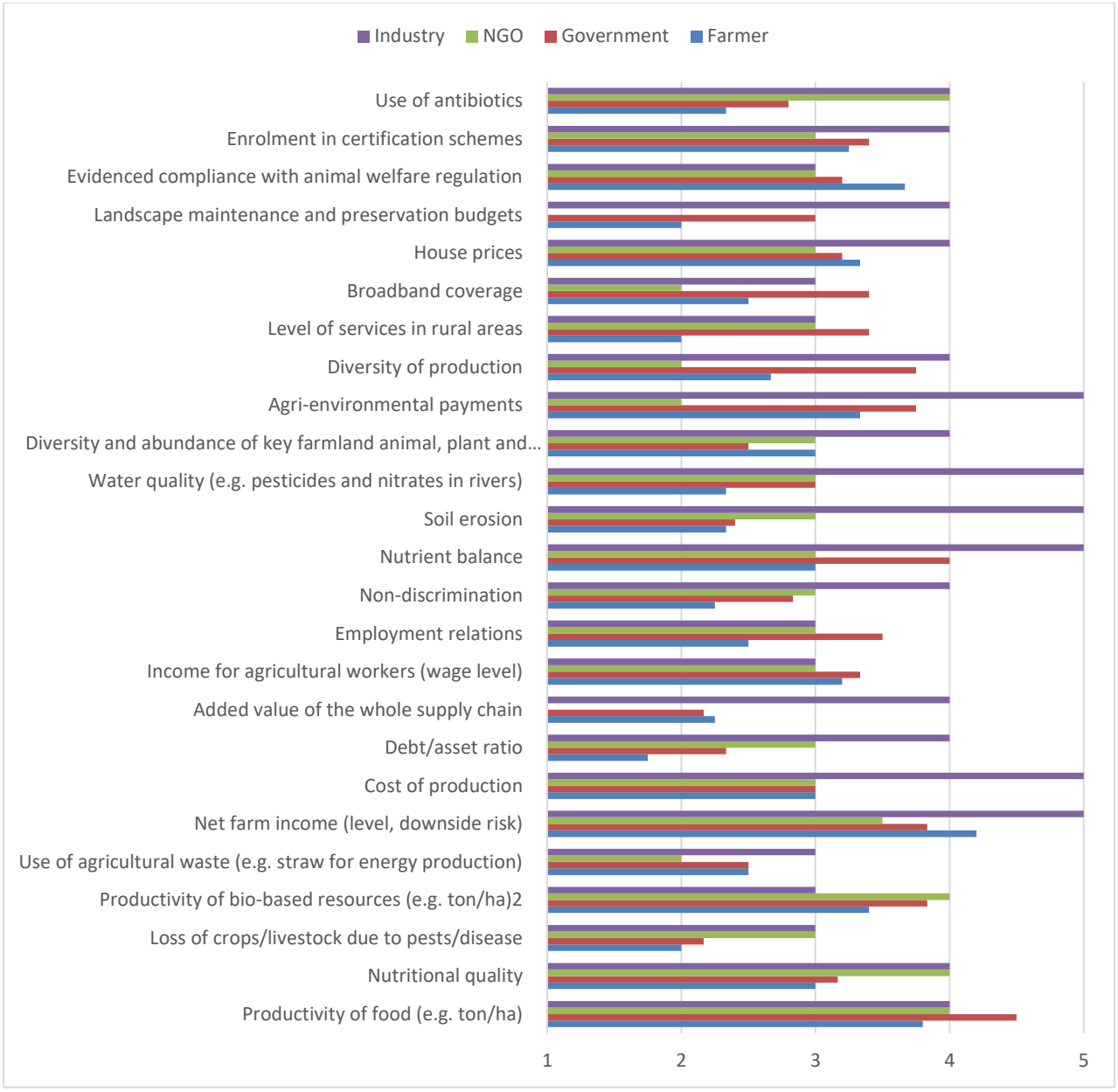

Figure 4: Scoring performance of indicators aggregated per stakeholder group, n=14

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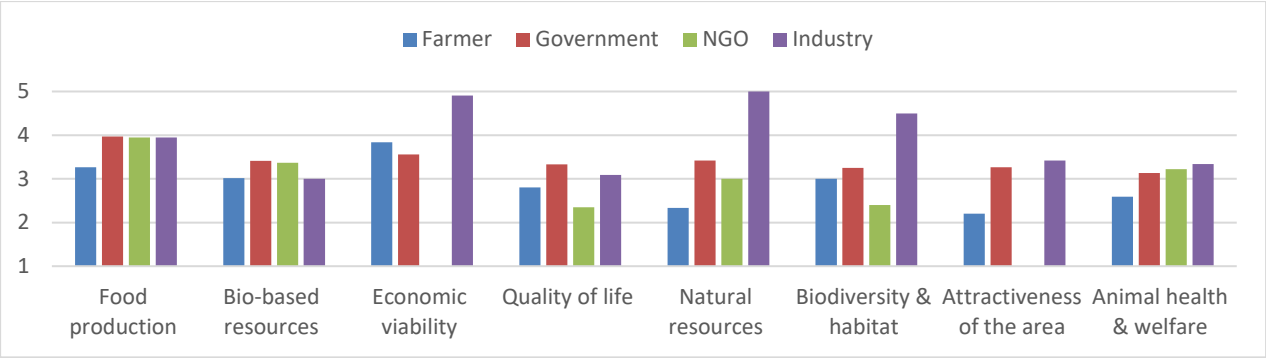

Figure 5: Scoring performance of indicators aggregated per function and stakeholder group, n=14

Relatively low level of importance but with high level of performance is rated the "economic viability" of the system (Figure 6).

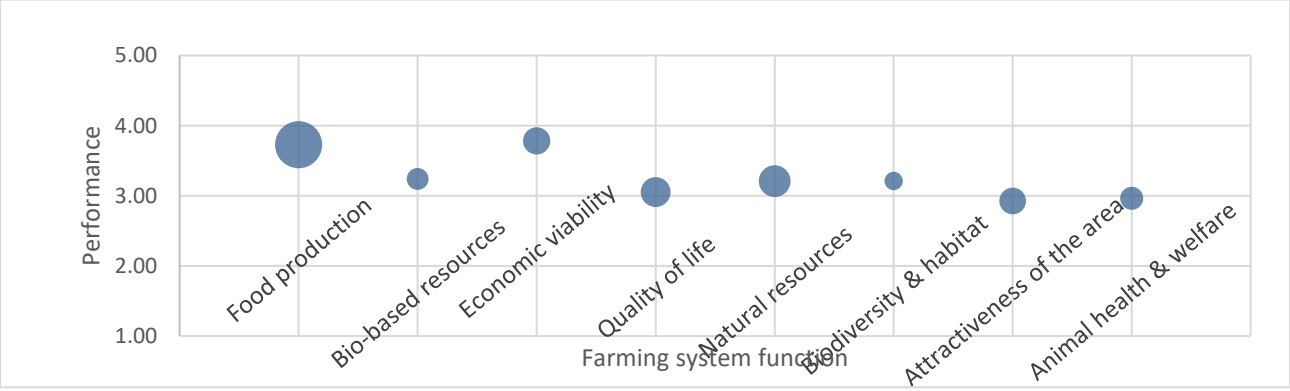

Figure 6. Bubble graph presenting averaged scores on performance of functions (from 1 to 5), while also indicating their importance (size of the bubbles), relative to each other, n=14

The other functions tend to average around the middle score 3 as far as the means per stakeholder group and total are considered. "Animal health and welfare" shows scores that are somewhat above 3 for all participating stakeholder groups. *Farmers* have assessed below 3 the functions "Quality of life" and "Attractiveness of the area". During the discussions, they have recognised the importance of these functions for the case study area. However, when encouraged to think from their perspective, these general indicators do not seem as important as the ones that can be associated with their businesses more directly.

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5.3 Indicator selection

Six indicators emerged as most important during the workshop:

1. Productivity (e.g. ton/ha)
2. Nutritional quality
3. Net farm income (level, downside risk)
4. Cost of production
5. Nutrient balance
6. Soil erosion

These indicators reflect the identity of the farming system. They are related to three functions – "Food production", "Economic viability", and "Natural resources". "Productivity" and "Nutritional quality" received the highest scores within the "Food production" function. "Net farm income" and "Cost of production" got similar results in the "Economic viability" function. The indicator of "Productivity in the bio-based resources" was highly rated by stakeholders, but it was in a contradiction to the expressed opinions overall during the workshop as most of the highest rates are coming from the *NGO* and *governance* representatives. Next, the "Agri-environmental payments" from the "Biodiversity and habitat" function has received relatively high score but due to the high rates given mainly by the *government* stakeholders ad also *farmers'* statements that it is not a priority for the grain farmers. All of them consider these payments as not effective in the way of their implementation (in regard to achieving environmental goals) and they preferred to focus on the indicators that have direct relation with the economic performance of their enterprises. Several other indicators (e.g. "Evidence of compliance with animal welfare regulation" and "Income for agricultural workers"), apart from those selected, received a high score but we preferred to continue with these indicators which are related to the farming system, have a relationship with the other highly regarded indicators from the perspective of the stakeholders.

"Productivity" and "Nutritional quality" were widely discussed by the stakeholders. They perceived them as mutually exclusive and important for different groups of stakeholders. I.e. "Productivity" was important for the *farmers*, whereas "Nutritional quality" was important for the consumers. The *farmers* pointed out that they would sacrifice nutritional quality at the expense of productivity if that was associated with higher revenues. Similarly, "Net farm income" and "Cost of production" were considered important by them. However, they perceived the two indicators as strongly related and complementary, so additional explanations were required to clarify that increase in "Net farm income" does not depend solely on the decrease of costs of production.

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Nutrient balance and soil erosion also were commented as possibly related indicators. Additional explanations on how they could change independently of each other helped considering them separately further in the discussions.

6 Resilience of indicators

After introducing the concepts of sustainability and resilience, the participants were encouraged to think of the direction of change in each of the selected indicators throughout the period 2000-2018 and the factors that caused it. Some of them commented that 2000 was too far in the past and they would not remember. They also mentioned that it was pointless to consider the years before 2007 when the accession to the European Union happened and the farm subsidies were introduced. The latter suggested that they recognised a major change in the context for the sector that has happened at that time. They were told that it will be valuable to recall as much as possible.

Initially the participants were divided in three groups and were going to be assigned two indicators per group. However, some of them stated that they would not be able to complete the assignment on their own. As a compromise, they agreed to work on each indicator separately with the help of the moderator, who was recording the necessary information from their opinions on a hand-drawn graph in front of all participants. When a certain direction of change was revealed, the moderator encouraged sharing of additional opinions on the change and this helped tracing the development of the indicator. In order to introduce a benchmark for the historical change, the year 2000 was presented to be equal to 100% for all discussed indicators. This allowed identifying any changes upwards or downwards, as well as giving the change some quantitative form.

6.1 Productivity

The participants were unified around the opinion that between 2000 and 2007 productivity in the grain sector has been relatively low. One *government* representative remembered drought and excessive rains during 2004-2005 – they clarified that the drought was in 2004 and in 2005 there have been floods. This was associated with decreasing yields per hectare around 2004. Official data from the MAFF show that during 2000-2007 the productivity of wheat has varied from 2.2 t/ha to 3.4 t/ha. It has dipped in 2003 rather than 2004. The decrease in 2005 compared with 2004 is relatively small and could be related with the reasons mentioned by the participants.

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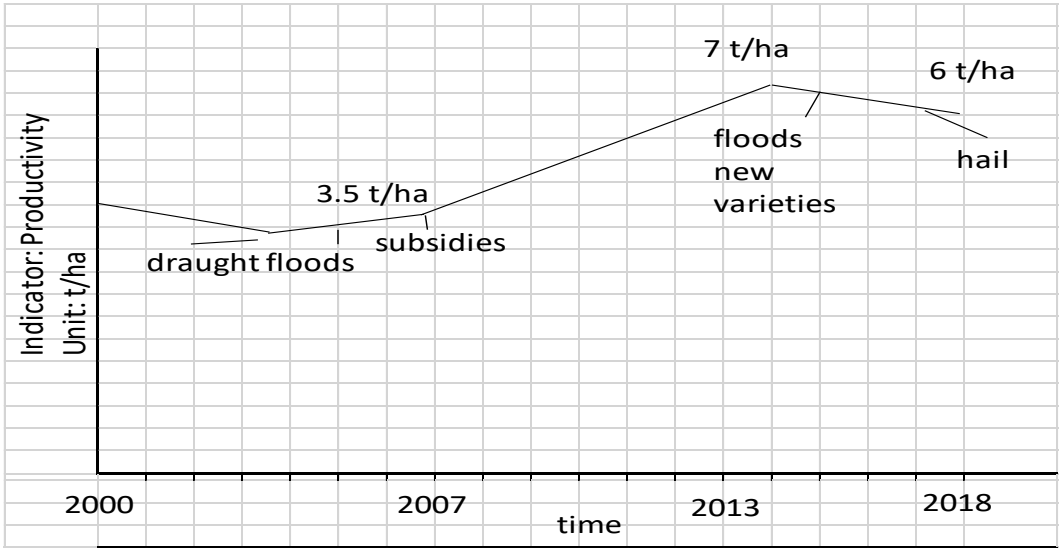

Figure 7: Historical change in productivity as sketched by participants.

In 2007, the farmers started to receive subsidies as part of the Common Agricultural Policy. After 2007, the yields started to rise. Some *farmers* mentioned that by 2013 they have changed from about 3.5 t/ha to about 6-7 t/ha for wheat. This is not in line with the official data at the national level (Figure 8). It is possible that the average yields at the national level are lower because of the other regions in the country. Nevertheless, there is an overlap between the reported trends of change by stakeholders and the observed trends in the data.

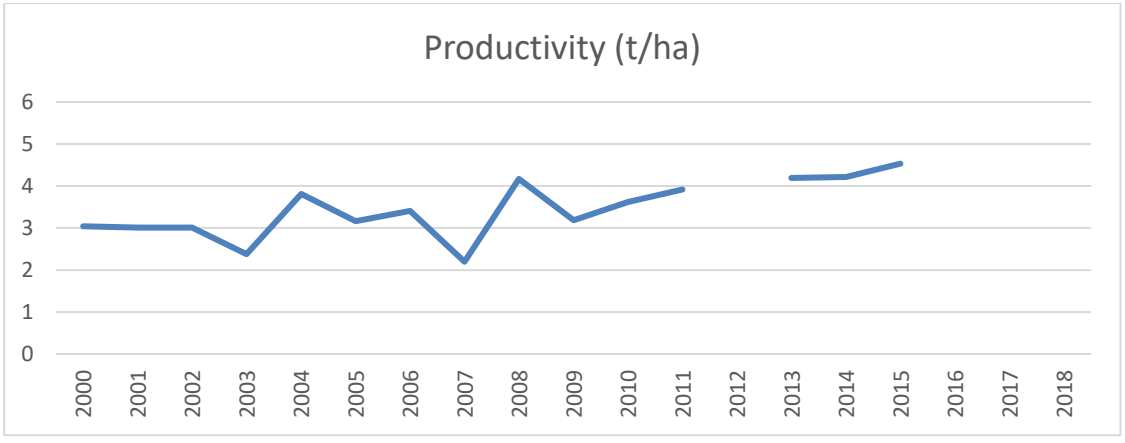

Figure 8: Average productivity for wheat, Bulgaria (2000-2018). Sources: Ministry of Agriculture Food and Forestry (2001, 2004, 2008, 2011, 2014, 2015, 2016, 2018, 2019)

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There was a discussion whether the subsidies have contributed to the growing yields. Further comments revealed other changes, mainly in technology, that have taken place during the same time. These are discussed in more detail in the next section as challenges. For the period 2013-2016 the stakeholders stated that there have been very little changes in productivity, possibly downwards. However, official data suggest that it has continued to improve. The discussions of the other indicators revealed that there have been factors affecting farm incomes negatively during that time, and this may have influenced the perceptions of the participants regarding productivity.

Four main challenges emerged from the discussion: natural conditions, policy support, increased competition in the agricultural sector, changes in the standard of living in rural areas.

Different natural conditions associated with extreme weather have impacted the farmers negatively and lowered their productivity during the respective years.

Policy support that influenced productivity was represented by two main mechanisms – support for investment in agricultural machines, and area-based annual subsidies. Investment measures have allowed the grain producers to buy new machines. This has contributed to the increasing yields.

Several opinions indicate increased competition in the agricultural sector as a whole. After the introduction of subsidies for agriculture, the sector has become more attractive for business. The size of farms has increased. In addition, the farm holdings have become more diverse, for example young farmers have entered the sector because of policy measures. As part of the same trend, the demand for land has risen. This has led to utilising some of the fallow land and has also increased the rents.

"In 2007, the rent [per decare] was 15 BGN, now it's 40-50 BGN, so actually the subsidy is covering the rent for the land (farmer)."

Another farmer clarified that the rents have had influence only the first few years after the subsidies were introduced. After that, they have stopped rising and were stable since then.

During the discussed period the wages of agricultural employees have increased as well. They have been related with an overall increase in incomes in the country. However, the opportunities for higher wages in other sectors have impacted negatively the quality of available employees in agriculture and this has impacted productivity indirectly.

Strategies with respect to productivity (later disccused as "changes into production technologies and modernisation"): The main strategy used by grain farmers is related to changes in the technology of production. This strategy has been implemented with the aim to increase revenues. The changes in production are represented by:

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- Selecting varieties that bring higher yield;
- Replacing existing machinery with new;
- Using more fertilizers and chemicals, because of the new varieties.

During the period of increase in productivity, the farmers have started to use new varieties of the crops that have led to higher yields. This has become more common around 2014-2015. They also recalled that there have been other technological changes, including some changes in the use of fertilisers and chemicals, while the costs for these inputs have increased parallel with productivity. It is the option that famers consider when the possibility to increase the cultivated land is exhausted.

There was a passive reaction to natural conditions, as the participating *farmers* have not started to use insurances despite the natural disasters like drought, floods, and hail that they have experienced.

6.2 Nutritional quality

A *government* representative mentioned that the factors that have impacted negatively on productivity during the period 2000-2018, have also impacted negatively on the nutritional quality of the grains. However, the participating *farmers* saw nutritional quality mainly from the perspective of what they produced and how it related to human consumption. The moderator differentiated between nutritional quality for the people and for the livestock. A farmer pointed out that for the livestock nutritional quality has increased, while for the consumers it has decreased. Figure 9 depicts the change in the quantities of bread wheat as representation of the change in „Nutritional quality".

Considering the major influences on the sector that have started in 2007, the period 2000-2007 was taken as a separate stage in the analysis of nutritional quality, similar to productivity. For the period 2000-2007 the stakeholders did not perceive much change in the nutritional quality. After 2007, they said that large part of the wheat for human consumption has been replaced by wheat sold for fodder production. This has resulted in a current ratio between fodder and bread wheat of 80/20 according to the *farmers*. Several participants explained that in the same time the fodder varieties of wheat achieved better yields and their price was similar to the price of bread wheat at the port of Varna (meaning the price, at which the wheat was exported).

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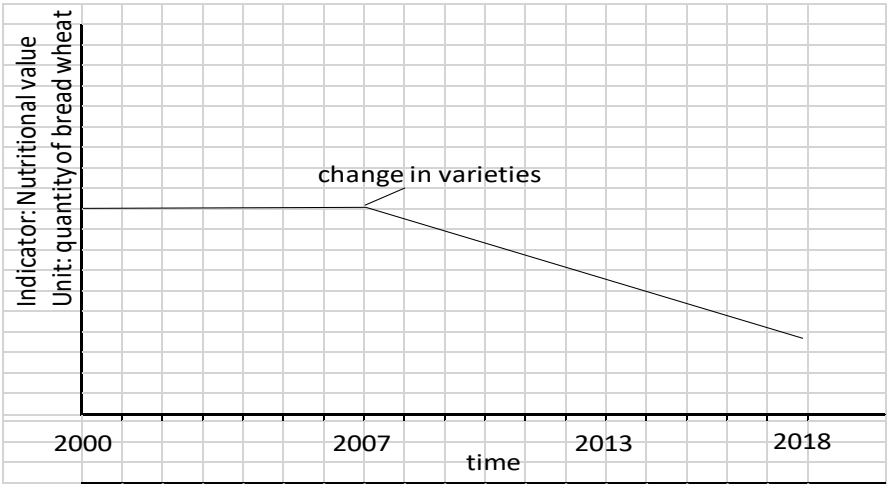

Figure 9: Historical change in nutritional quality for bread wheat

Official data do not provide information on the shares of bread and fodder wheat within the total production for the analysed period. However, they show that prices of wheat for fodder and for human consumption follow similar trends of change and the difference between the price levels is relatively small at 2%-4% (MAFF, 2008). For the period 2016-2018 the difference has increased to about 5%-6% (MAFF, 2019). In addition, between 75% and 80% of the wheat produced in the country is exported, so the change in preference towards production of more wheat for fodder may reflect some change in demand globally. Alternatively, the Bulgarian wheat output may be better placed for fodder purposes if the farmers are less competitive in producing bread wheat at a required level of standard.

Challenges: During the discussion of changes in „Nutritional quality", the stakeholders explained that soon after 2007 the varieties of wheat have started to change from those suitable for bread for human consumption to varieties that are mainly used in animal feed. This information differs slightly from the discussion regarding productivity, where the change in preferred varieties was mentioned in relation to a later point in time.

Strategies with respect to „Nutritional quality" (discussed as "application of good farming practices"): The changes in nutritional quality provided by grain farmers have been directly related to the strategy for changing technology. Recognising the income-generating benefits of new varieties have helped choosing to produce more wheat for fodder at the expense of bread wheat. Their concerns for nutritional quality are entirely related to the opportunities for improvement of incomes from farming that they recognise. Furthermore, nutritional quality does not have any major influence on their decision-making regarding their farms.

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6.3 Net farm income

Net farm incomes for grain producers has not changed much between 2000-2007. However, it has varied because of changes in the natural conditions, like droughts and floods that have affected negatively the quantities of outputs. The main fluctuations from these influences have taken place between 2004 and 2007 (Figure 10).

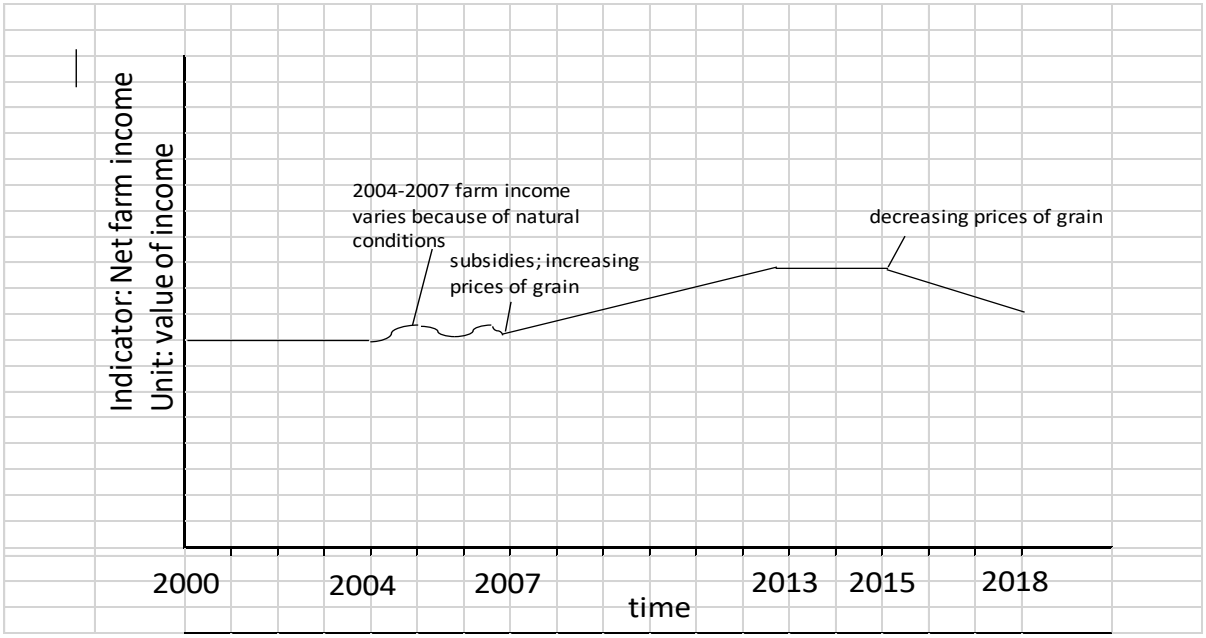

Figure 10: Historical change in net farm income

The introduction of agricultural subsidies in 2007 has been accompanied by growing international prices of grain. This has led to an increase in "Net farm income" and according to the participating *farmers*, it has increased constantly from 2007 until about 2013 reaching a 30%-40% increase. Between 2013 and 2015 net farm income has remained relatively stable, depicted by a flat line. From 2015 onwards it has started to decrease, reaching up to 20% lower levels.

Challenges: There is a great extent of overlap with the challenges to productivity and the discussion of this indicator revealed additional details. As an additional challenge the international prices of grain was identified. The increases and decreases of international grain prices have been

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directly related with the incomes from farming with the acknowledgement that the farmers were price-takers in the relationship, i.e. farmers had "*zero influence*" on the prices they would get.

Strategies with respect to "Net farm income" (discussed as "preservation of the current marketing of the products" strategy since farmers realize the need to adapt to market change if at least they want to keep the level of their net farm income): Changes to technology of production are the main response to the challenges influencing net farm income. To some extent, the farmers have reacted by increasing the costs of production, i.e. offering better wages to skilled workers. However, their aim was to increase revenues and decrease costs. Thus, some *farmers* pointed out the importance of markets and the knowledge how to be successful on a market like the grain market. It is an international market and the information (and the ability to understand and interpret it) about the trends in the so called price-makers countries, is crucial for the farm's income. Last years, the implementation of different market instruments (e.g. futures) shows the ability of the farmer to not only be a successful producer, but also a successful entrepreneur.

The participants have observed change in the competitive pressures in the agricultural sector, as the decreasing net farm income has made agriculture less attractive to some of the actors who entered the sector during the introduction of subsidies in 2007. Only the more committed farmers have continued.

6.4 Cost of production

For the period 2000-2007 the farmers have been waiting to see what will happen after the accession to the EU. The cost of production has not changed much in any direction. It has been slightly variable rather than a flat line (Figure 11).

After 2007 the costs of rent, employees, seeds, fertilizers, and chemicals have increased. When the farmers have started to use new varieties, they have increased the use of chemicals, because the varieties have required it. The participants explained that the increasing cost of inputs are correlated with external trends outside the farming system. The prices of these products have increased internationally. Another increase has been experienced from 2015 onwards, especially in the price of fuel and fertilizers.

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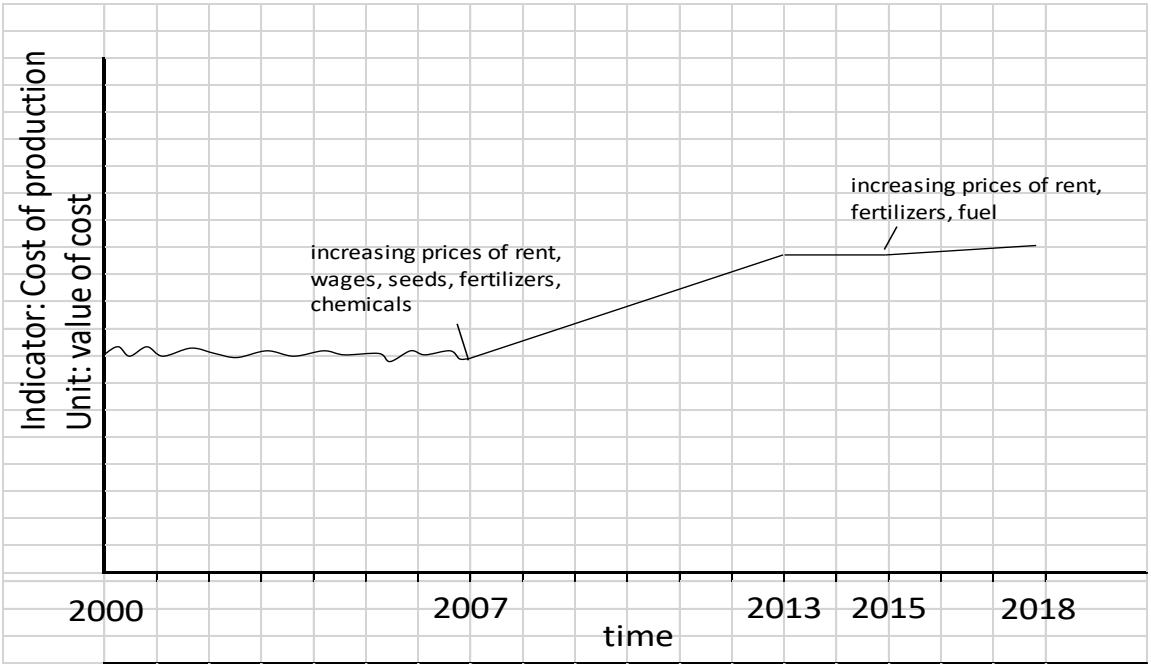

Figure 11: Historical change in cost of production

Challenges: All main costs of inputs have been increasing for most of the analysed period. This included seeds, fertilizers, chemicals, and fuel. In addition, the prices of rent and employees' wages have also increased. The participants also acknowledged increases in the cost of investment items like agricultural machines.

Strategies with respect to cost of production (related with the "increase of the farmed land" as the way to optimize the scale and related to the higher competition to land as a production factor as described in the introduction): In regard to the challenges influencing cost of production *farmers* pointed out that the main response and action they take is undertaking changes of production technology. Thus, the large scale producers take the advantage of production scale to optimize their costs. Use of new varieties of crops has been related with increase yields and revenues but also with higher costs of inputs. The main part of the strategy to respond to the challenges has been the investment in new agricultural machines. But for some of the farmers the only option to invest has been related to credits which impose additional risk and challenges for them as well as increase the cost production including interest rates payments.

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6.5 Nutrient balance and soil erosion

The two indicators were discussed together because they were equally rejected by the participating *farmers* as relevant to the farming system presented to them at the beginning. Initially, the participants were wondering how they, as farmers, could influence nutrient balance and soil erosion. Their role did not seem obvious to them (or at least they do not recognize their role as important as it is). After starting to elaborate on the questions they showed that they have considered the issues, but it was not from the perspective that the workshop was seeking. Nevertheless, they saw nutrient balance as almost constant throughout the analysed period (Figure 12).

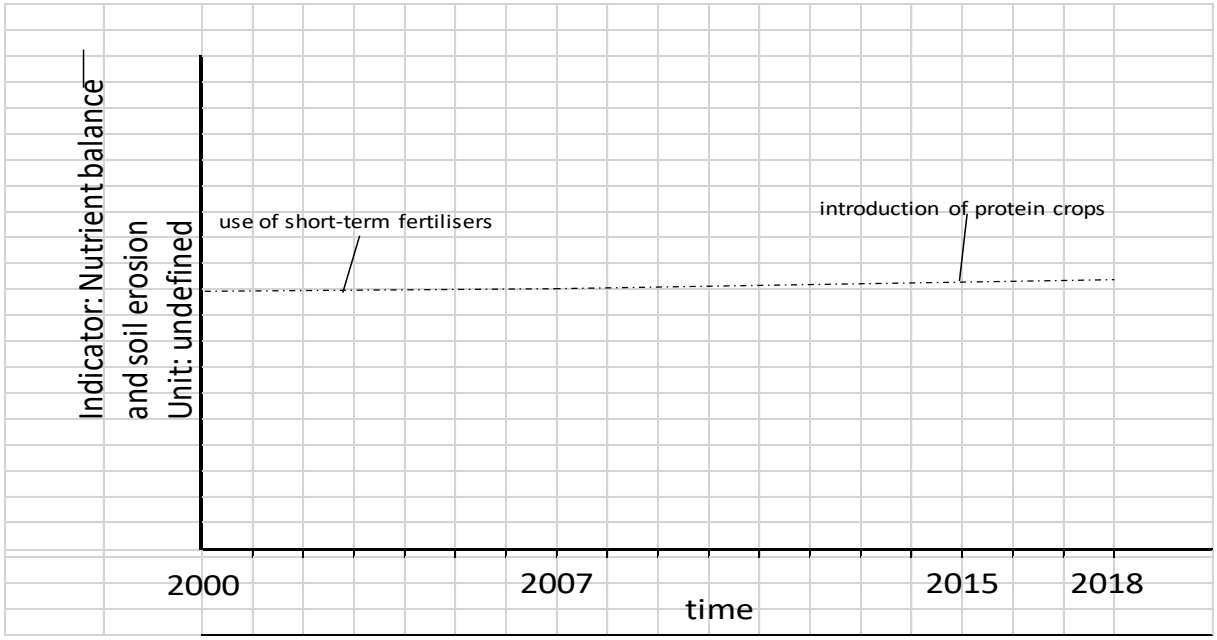

Figure 12: Historical change in nutrient balance and soil erosion

For the period 2000-2007 there was no use of fertilizers with long-term effect. This may be related to the short-term arrangements of land tenure. The possibility for a land owner to change their mind and rent their land out to a different farmer the next year has stopped the farmers from spending on this type of fertilizers, but it has also affected the nutrient balance of soil.

For the period 2007-2018, the farmers have maintained good condition of the soil through the use of fertilisers. Around 2015 protein crops were introduced.

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Monoculture of grain, where wheat or barley has been grown on the same land for several consecutive years, has not been practiced in the region since long time. However, some participants mentioned monoculture of maize and sunflower, while others rejected the existence of such practices. Overall, the stakeholders were reluctant to discuss monoculture practices, and this may have been related to the introduction of agri-ecological payments that contradict such practices.

The participating *farmers* acknowledged that there was some evidence of soil erosion on specific fields scattered across the region. However, the affected areas were insignificantly small. They could not provide information on the changes in levels of soil erosion during the analysed period. Water quality was pointed out as a more relevant indicator for the region, because it is a nitrate vulnerable zone. However, this has not been revealed through the scoring of the indicators during the workshop.

No specific challenges to these indicators have been identified through the discussions. The participants demonstrated knowledge on the possible drawbacks related to nutrient balance and soil erosion, but they have not paid special attention to these indicators. Issues like monoculture were not present in the area. Introduction of new crops as part of the turnover, i.e. protein crops, has had positive effect on soil fertility.

Strategies with respect to nutrient balance and soil erosion (discussed as “application of good farming practices”): The concerns for the natural resources were inherent to the production concerns of the participating *farmers*. They did not use any information that would allow them to assess the nutrient balance of the soil or presence of soil erosion. However, they acknowledged that the use of fertilisers helped overcoming nutrient deficiencies of the soil and led to higher yields.

7 Resilience attributes

7.1 Case-study specific strategies

After the discussion described in previous section, the stakeholders agreed to continue the further assessment and discussion with four main strategies which fully encompass the actions undertaken during the studied period (2000-2018) and which actions lead to substantial changes into the farm developments and to the current situation in the region. It should be mentioned

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that each of the chosen strategies can be related to several different challenges, which is the case when the stakeholders' responses during the discussion are analysed. The four strategies agreed as comprehensive to all workshop participants are:

1. Increase of the farmed land – the challenge associated with this strategy is the land ownership and its regulation since in Bulgaria the historical development of the economic forces and the transformation from planned to market economy defined the complicated land relationships. The overall result from the transformation is very fragmented land ownership which increases the level of insecurity and/or rental/lease prices.
2. Changes into production technologies and modernisation – in general it is perceived as a strategy to overcome the extreme natural conditions in a long-term perspective
3. Preservation of the current marketing of the products – the associated challenges are price fluctuations and inability of the farmers to influence it. Price fluctuations are partially the results of weather conditions, but the importance of political interventions (e.g. Russian embargo) should also be considered. Application of good farming practices – it is a crucial point in the framework of current introduction of agri-environmental requirements as a main challenge imposed by the policy in the sector. But it is also has been mentioned as a main strategy applied by the farmers to overcome (or at least to decrease the level of negative influences) of climate change.

According to the assessment presented on Figure 13, the strategies "changes into production technologies and modernisation" and "preservation of the current marketing of the products" are recognized by all the stakeholders as most relevant with the highest level of implementation among the four (well implemented / adequately applied).

The evaluation of these strategies seems to be very relevant to the grain farming system and especially the current circumstances under which farmers operate. The overall discussion was centered on the farmers' ability to adapt their production through changes into technologies (relevant to the two major challenges associated with the weather conditions and cost effectiveness of the production) and through preservation of their market positions (increase in competitiveness and unpredictable changes into global markets, farmers are price-takers).

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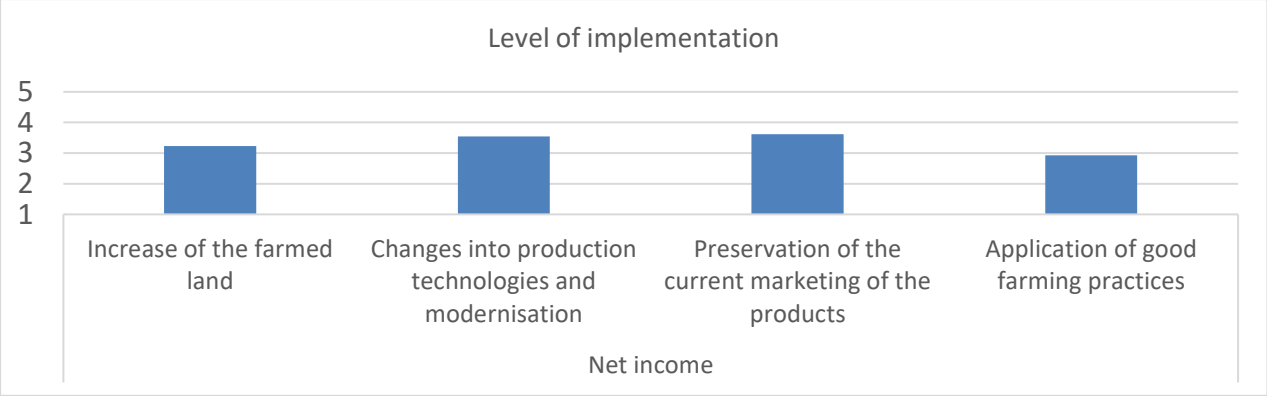

Figure 13. Bar graph showing level of implementation of strategies, n=14. 1 = not applied, 2 = slightly applied, 3 = moderately applied, 4 = adequately applied, 5 = perfectly applied

The strategy "increase of the farmed land" is higher than moderately applied (but still lower than adequately) and it is understandable due to the physical limitations of the possibility to increase the cultivated land. There are options for the strategy but it will be a game of zero sum – the strategy is applicable at farm level but not at the farming system level. The particular farm may apply it and to realize the economy of scale leading to the already mentioned results in regard to the production costs and farm net income. But it is possible only through re-allocation of farm land between the farmers which are part of the farming system in general.

The strategy with lower assessment is "application of good farming practices", rated closer but below the moderately applied. This results can be explained by the fact that in general the farmers must follow the overall agronomic requirements and in grain production it is related mainly with the crop rotation (avoidance of monoculture) and just last years farmers started to consider the good farming practices as a way to cope with climate changes. And more important is the introduction the greening measures under the last CAP reform and having in mind the scales of large crop production the greening payments serve as a very high support for them.

Each one of the four strategies has been scored in order to assess its contribution to the resilience of the farming system and the results according to the different resilience capacities are presented on the Figure 14.

According to the scoring given by the stakeholders, all of the four strategies contribute only weakly to the system transformability. It is obvious, having in mind the overall challenges and the willingness of the farmers to adapt the system accordingly, instead of looking for a new pathway

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for their businesses – during the discussion neither farmer nor representatives of the other stakeholders' groups have mentioned the possibility for fundamental changes under any economic, environmental or social pressure. Moreover, the execution of the current performance of the farming system and its functions is in conformity with that assessment. At this point, the stakeholders' assessment reveals that the grain farming system is able to provide important functionalities ("Food production" and „Economic viability"). The "application of good farming practices" will mainly improve the current performance of the system in regard to its functions, especially the ones related to „Natural resources" and the maintenance of the natural resources in good condition. Contributions to transformability and to a lesser extent adaptability are in that regard positive side-effects.

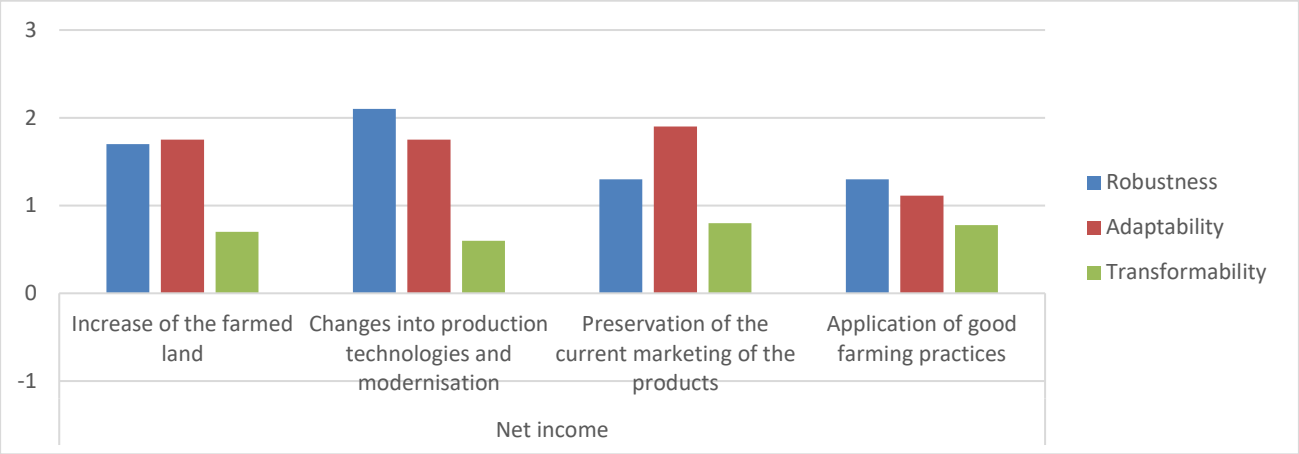

Figure 14. Bar graph showing average scoring of effect of strategy on robustness, adaptability and transformability of the farming system, n=14. A 0 implies no relationship, a 1 or -1 a weak positive or negative relationship, a 2 or -2 a intermediate positive or negative relationship, and a 3 or -3 is a strong positive or negative relationship

The strategy with highest rate in regard to its contribution to the farming system robustness is "changes into production technologies and modernisation" which may be explained by the developments of the grain farming system in the last twenty years. Despite of the challenges during this time, the farmers continue to grow and to expand their production in the same trajectory, i.e. keeping the same production structure (specialisation leading to monoculture production which has its negative environmental effects). But this assessment (and real actions) somehow contradicts the statements during the discussion that each participant in the system is looking for new opportunities through new technologies and machineries (namely innovations)

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which will better the system performance in regard to the environmental effects. The last is observed when looking at the results of the assessment on current performance of the system: the overall changes are in support of the „Food production" and „Economic viability" , as adjustments reflect system responses mainly to the external challenges, e.g. CAP implementation after Bulgaria join the EU.

The "preservation of the current marketing of the products" is considered as with highest contribution to the system adaptability. The farming system has experienced severe price fluctuations in the last 5-7 years and there are multiple drivers leading to this specific challenge (thus, it is difficult to predict all of them). This assessment reflects the perception of the stakeholders that the farming system as it is at this moment has no influence on the markets. Thus, it should follow and at least adapt their performance in order to keep the trajectory and to preserve main functions delivery, namely "Food production" and "Economic viability".

7.2 General resilience attributes

The current performance of resilience attributes results include only the assessment made by the *farmers* and representatives of the *government* because the representative of the *industry* left the workshop earlier and only one member of the *NGO*'s group filled in the tables.

According to this assessment (Figure 15), the highest rate given by the *government* is for the following three attributes: "coupled with local and natural capital (production)", "exposed to the disturbances" and "coupled with local and natural capital (legislation)". This assessment confirms earlier statements on the relatively high level of application of 1) good maintenance of the soil fertility, water resources and existing nature which is supported mainly by 2) adaptation to the standards, legislation and regulatory frameworks to the local conditions.

Only in regard to the "exposed to the disturbances" attribute the *farmers* also have given a high rate. Thus, exposure to perturbations (including economic, environmental, social or institutional disturbances) in order to stay adaptable, seems high. The practice confirms this ability of the farming system since it becomes more resilient through different adaptations in production technology and/or varieties which in the long term is considered as a way to overcome/decrease the negative effects of climate change. It is related to the risk management process considered in the SURE-Farm project.

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The next two attributes highly rated by the *farmers* are: "spatial and temporal heterogeneity (farm types)" and "optimally redundant (farms)". The first one is an expression of the farmers' willingness not to be blamed in monopolism and their views that there is plenty of possibilities for every farm in terms of economic size, specialization and intensification. The latter is relevant to the *farmers*' opinion that the system resilience could not be affected by anyone of them separately and each one of them can stop their business without jeopardizing the continuation of the farming system.

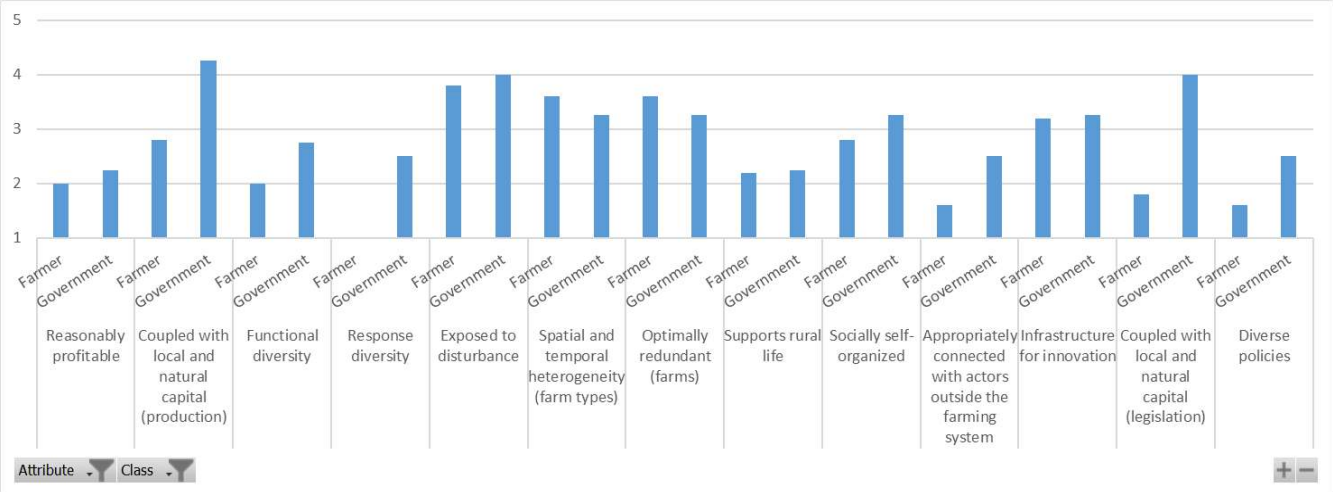

Figure 15. Bar graph showing current performance level of resilience attributes, n=14. Performance is scored as 1 = not at all, 2 = small extent, 3 = moderate extent, 4 = big extent, 5 = very big extent

The overall assessment of the four attributes (all highly rated independently by each group – *farmers* and *governance*) of the grain farming system resilience, are related mostly to the two of the four main processes considered within the SURE-Farm project: the agricultural production and the *governance*.

To conclude, the most important attribute for the resilience of the studied grain system is "exposed to disturbance" having the highest average rate for all the responses. On the next place with the same average assessment are: 1. Spatial and temporal heterogeneity (farm types), 2. Coupled with local and natural capital (production) and 3. Optimally redundant (farms).

The results of the assessment on how each of the resilience attributes contributes to robustness, adaptability and transformability of the farming system is presented on Figure 16.

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According to the stakeholders, each one of the attributes supports the adaptability of the grain farming system in the CS area, except for "Exposed to disturbance". Half of the attributes would contribute more to adaptability than to the other two capacities. These are: "reasonably profitable", coupled with local and natural capital (production), functional diversity, spatial and temporal heterogeneity (farm types), socially self-organized, infrastructure for innovation and coupled with local and natural capital (legislation). "Exposed to disturbance" is overall viewed as affecting resilience capacities negatively. However, among participants there were contrasting views on the role of this attribute for farming systems' resilience (Figure A8)

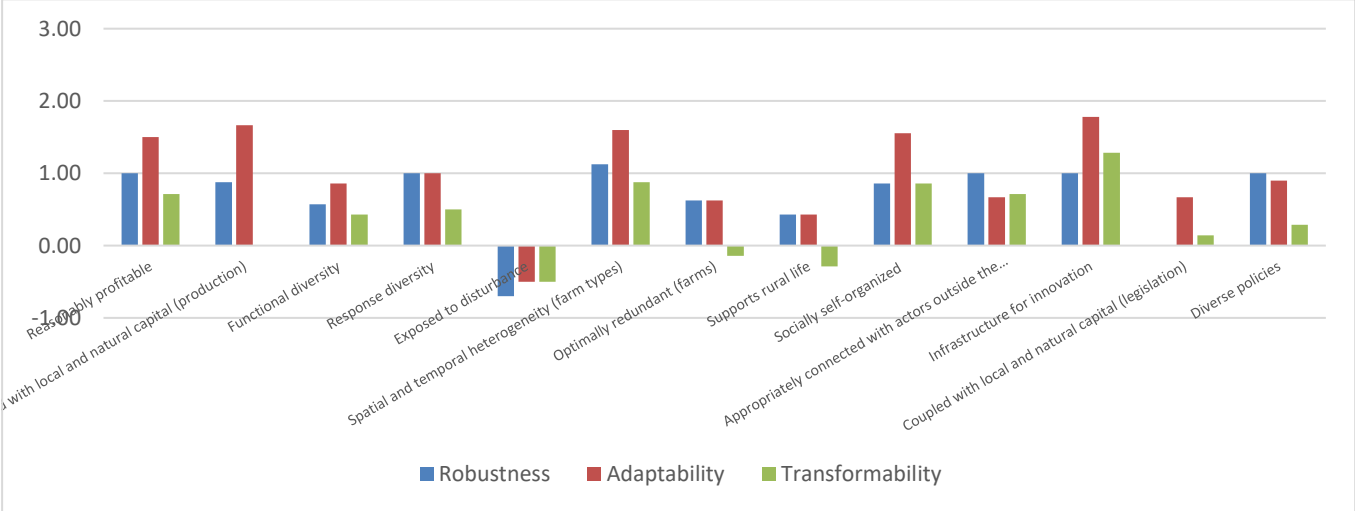

Figure 16. Bar graph showing average scoring of perceived effect of attribute on robustness, adaptability and transformability, n=14. A 0 implies no relationship, a 1 a weak relationship, a 2 a relationship of intermediate strength, and a 3 is a strong relationship

In regard to the resilience capacities the highest rates (positive) were given to the attributes as follows: 1) for robustness: spatial and temporal heterogeneity (farm types), 2) for adaptability: infrastructure for innovation and 3) for transformability: infrastructure for innovation.

The robustness would potentially be the most enhanced by the attribute "appropriately connected with actors outside the farming system" and "diverse policies" (the latter is in conformity with the findings from policy assessment and analysis as well as the opinions expressed mainly by other actors – not the farmers – that the sectorial policies stimulate and favours grain production in general and contributes mainly to their robustness)

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The transformability is not supported highly by any of the attributes. The most highly rated attribute applied to the grain farming resilience in its transformability capacity is "infrastructure for innovation". It is in consistency of the overall expressed opinion of the participants in the workshop that innovations, including knowledge and adoption of cutting-edge technologies (e.g. digital) could stimulate incremental changes into the system resulting in conditions that lead to the transformation of its identity.

8 Discussion

8.1 Essential functions of the farming system

The identity of the farming system is perceived according to the key actors in the system and the importance of functions and the relevant indicators. The results show that the „Food production", „Economic viability" and maintenance of „Natural resources" are the most important functions that determine the identity of the system. In regard to the indicators these are: the productivity of grains the economic, the net farm income and nutrient balance. The most discussed function was the „Economic viability" and indicators related to this function were chosen to assess the grain farming system performance, especially the interrelation between these indicators, namely productivity, production costs, price and respectively economic performance.

The „Attractiveness of the area" has moderate importance, but still is relevant to one of the most urgent challenges farming system faces, namely the inadequate labour force in terms of quality and quantity. Thus, the participants consider it as part of the possible solution to overcome it. Moreover, it is a function for which stakeholders consider it is possible to be influenced by the system. Even though that this function requires time and specific measures undertaken, not only by the farming system actors, but also by the overall governing institutions of the rural areas.

It is important to mention that the perceptions of the current performance of the system are mostly related to the private goods provision. It is in conformity with the fact that the public goods are still not very well recognized either by the farming system actors and other players. Moreover, the results of agricultural production have been traditionally measured by the economic indicators (related to the market and goods which value easily can be calculated) and economic efficiency/profitability is presented as main motivation to run the business. Thus, it requires general changes into the societal values to associate the agricultural production with additional benefits/shortcomings and to get used to measure these with environmental and social

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indicators. Even it is more difficult with the environmental effects as public good as some of them do not have proper and commonly accepted indicators.

8.2 Robustness, adaptability and transformability of the farming system

Overall, the main resilience capacity in the CS area for the grain farming system is adaptability. However, with regard to the farming system's response to some challenges and regarding certain resilience attributes,the system shows also signs of robustness and transformability. From a practical point of view, the adaptability is the first attempt of the farming system to overcome the environmental challenges. Additionally, many of the stakeholders claimed there is always the possibility to change the system, especially under the pressure of sectorial policy, market and climate changes. Incremental adaptations could lead to transformation. For instance, each one of the participants remembered (and has been part of) the incremental changes into overall system functioning a 20-25 years ago, which is now different than before. Participants relate the current constrains of transformability to the current implementation of the subsidies (in Bulgaria the SAPS is in place):

"… currently, the profit is negative. If there are no subsidies, the production will be stopped, no one will be interested in agricultural production. Or subsidies abandonment will lead to decrease of the levels of rent and lease which will change the level of production costs, respectively the profitability… (farmer)"

In regard to the identified strategies: 1) Increase of the farmed land, 2) Changes into production technologies and modernisation, 3) Preservation of the current marketing of the products and 4) Application of good farming practices, are mostly related to the attribute "Reasonably profitable" despite it has been scored not so high because in general the subsidies are important part of the farm income. Moreover, the buffer resources for investments build up to that moment are mainly generated by the subsidies and/or with the support under the CAP pillar 2.

The four strategies are absolutely possible for application by any of the actors in the farming system and currently, all of them are associated with its robustness and adaptability capacities.

In this regard a very important factor is the demographic situation and changes happening related to both the lack of skilled labour and the time for the first generational renewal. Inevitably in long term perspective both of factors will lead to adaptation and possible transformation of the system.

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8.3 Options to improve the resilience of the farming system

Some of the possible options mentioned during the workshop and relevant to the future improvements of the system resilience (and also which are foreseen to be managed by the actors) are related to the:

- changes into the current agricultural policies, either at the national or EU level, related to the implementation of the CAP. It is crucial to assess the influence of the SAPS implementation not only as a support to the farm income but also as a driving factor for rent/lease increase, i.e. increase in production costs.

- improvements of the legislation with regard to land leasing/renting, because the current land relationships regulation is in favour of the owners and farmers have a very little space to influence the process due to the limited land availability.

- better public services offered in the rural areas: adequate to their specificities, that is realizing a differentiation of the regulations between urban and rural areas, e.g. many schools were closed due to not meeting the minimum requirement for the number of pupils and there were no alternative, innovative solutions acceptable for the educational system (introduction of online courses etc.).

8.4 Methodological challenges

Initial presentation provided by WP5 leader was very helpful and clear but just to be sure that during the workshop we will have common understanding a short introduction to the project and the SURE-Farm understanding of the resilience has been added. Next amendments to the initial guideline we made are: 1) shortening of the workshop duration and 2) instead of additional graphs the overall participants' attention was kept through figures and stimulus for discussion

8.4.1 Level of understanding of concepts and methods

Overall, the participants understood well the meaning of the farming system and the interactions between different elements in it. They contributed with relevant information. The level of abstraction of the concepts related to the system's functions and indicators required the

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participants to be taught about the meaning of the concepts before being able to work with them and provide opinions.

8.4.2 Stakeholder contributions

The workshop was attended by 19 participants. However, during the different rounds of data collection different number of them made contributions. Some were leaving the room to take phone calls. Others were taking breaks to smoke outside. There also were participants who attended the discussions but did not complete the tables, because they considered themselves unqualified to provide an opinion.

8.4.3 Stakeholder engagement during the workshop

The workshop contains a relatively large number of topics that require stakeholder contribution. However, these topics do not have immediate connection with the jobs and businesses of the participants. This makes it hard to draw their attention to the importance and benefits from their contributions.

The complexity of stakeholder contributions increases towards the end of the workshop when they were becoming less interested in participating. One major challenge was to maintain the involvement of the participants until the very end of the workshop.

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9 Conclusions

The workshop assessments and results are guided by the current status of the farming system and challenges in the studied CS area. The crop production is important and has a long tradition in Bulgaria and it is of crucial importance in the CS region - North-East Bulgaria. Last 30 years many changes have taken place: first, after the collapse of communist regime and transformation to market economy and second, adaptation after the accession to the EU. The agriculture sector has changed, especially after the CAP of the EU has been implemented in Bulgaria. The current main challenges are amongst othersprice fluctuations, extreme natural conditions, land ownership and its regulation, worsened quality of services in rural areas,aging population of rural areas..

Further, the past and current resilience assessment with application of FoPIA-SureFarm tool revealed:

1. The most important function is “Food production” while the “Economic viability” has received relatively low scores which is surprising. Other important functions, but at much lower levels are functions related to the conditions in the area, i.e. “Natural resources” and “Attractiveness of the area”.

2. Despite of the relatively low level of importance given to the “Economic viability” function, it is rated as the best performing function together with the “Food production”.

3. The assessment of the importance and performance of indicators within functions showed differences in preferences per stakeholder group. Despite of that in relation to the „Food production” function, the overall highest rate is given to the “Nutritional quality” and the lowest to the “Loss of crops and livestock” due to pests or disease both. Next, for the „Economic viability” the “Net farm income” indicator has been highly rated, especially by the *farmers* and *government* representatives. Additionally, the quality of life function has been represented mostly by income for agricultural workers. In relation to the function “Natural resources”, all stakeholder groups scored the indicator “nutrient balance in the soil” as the most important.

4. The most important indicators according to participants are: productivity (e.g. ton/ha), „Nutritional quality”, net farm income (level, downside risk), “Cost of production”, “Nutrient balance” and “Soil erosion”. The discussion on the historical dynamics of these indicators outlined the strategies that had been implemented to deal with the challenges leading to the changes. Thus, the main strategies identified are: “changes into production technologies and modernisation”, “application of good farming practices”, “preservation of the current marketing of the products” and “increase of the farmed land”.

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5. According to the assessment, all stakeholders consider as most relevant with the highest level of implementation the strategies of "changes into production technologies and modernisation" and "preservation of the current marketing of the products" (rated as well implemented / adequately applied). Both of them are also highly rated with regard to contribution to the farming system's adaptability, which is relevant also for the two other, but less well implemented strategies. Only the strategy "application of good farming practices" was assessed to contribute to the transformability of the farming system. This is because this strategy would considerably change the current performance of the system in regard to „Natural resources" function, provided it was well implemented.

6. The most important attributes for the resilience of the large-scale crop production system is "exposed to disturbance", "spatial and temporal heterogeneity (farm types)", "coupled with local and natural capital (production)" and "optimally redundant (farms)". Moreover, the stakeholder assessments of the attributes definitely are in support of the adaptability of the crop farming system in the CS area.

In conclusion, the main resilience capacity in the CS area for the large-scale crop farming system is adaptability which is in accordance with the first attempt of the system to overcome the environmental challenges and the pressure of sectorial policy and markets as many of the stakeholders claimed. During the workshop the main options to improve system resilience were discussed and all the stakeholders agreed that important changes into current agricultural policy analysis are needed. In Bulgaria it is related to the stability of the legislation in long-term perspective and progress to better balance of the different interests. Last but not least, stakeholder consider improvements of public services level in rural area will prevent further depopulation and risk of losing more labour force.

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Appendix A. Workshop memo

The workshop was organized in a conference room in a hotel which is in the centre of the city with free parking places. The room was equipped with everything needed for the workshop – projector, blank charts, screen, recorder etc. The tables were order in a rectangle form suitable for participants to see each other and to have a good view to the screen and facilitator. The sound was perfect and each one could hear anyone who was talking. The room was equipped with air-condition and the temperature has been regulated according to the participants' perception and desire. The toilet was next to the room and convenient for not to loosing time. The coffee/water with refreshments were available during the whole workshop and at the end lunch has been provided in the restaurant. The food was tasty.

In general participants were friendly despite the need to travel (for the participants from the other towns the duration of travel was up to 60 minutes) and the major group arrived on time. The workshop started at the time planned. The late arrivals were from the *farmers* group explaining the need to undertake some daily tasks. Some of the participants (from the *governance* stakeholder group left the workshop earlier due to the arrangements). Several participants did not feel comfortable to fill in all the tables and left them empty but they showed willingness to discuss the topics and took part in the discussion. The next tension that we should consider was the unwillingness of the participants to write down their name in the tables. Thus, we insisted only to mark to the which group they belong – as far as it is important in data processing and analyses.

Start time: 09,30

End time: 14,30

Total break time (estimation): 60 minutes, including lunch

Table A1. Stakeholder overview

	Function	Organization	Stakeholder group
1	Deputy director	District office of MAFF	Governance
2	Expert	District office of MAFF	Governance
3	Expert	Local (municipality) office of MAFF	Governance
4	Expert	Local (municipality) office of MAFF	Governance
5	Expert	District office of MAFF	Governance
6	Expert	District office of MAFF	Governance
7	Expert	Local (municipality) office of MAFF	Governance

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8	Expert	Local (municipality) office of MAFF	Governance
9	Senior Expert	District office of MAFF	Governance
10	Director	Advisory Services	NGO
11	Owner	Registered as physical person	Farmer
12	Expert	Advisory Services	NGO
13	Expert	Advisory Services	NGO
14	Owner	Registered as physical person	Farmer
15	Owner	Registered as physical person	Farmer
16	Director	Frumetum LtD	Industry
17	Owner	ET Agrocentre	Farmer
18	Manager	Sortovi semena AD	Farmer
19	Owner/Manager	Agroelit company	Farmer

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

Table A2: Means and standard deviation of scores per function (EF) per stakeholder group and for all participants, n=14. 100 points are divided to eight functions

	Farmer		Government		Industry		NGO		All	
Essential functions	**Mean**	**St. Dev.**	**Mean**	**St. Dev.**	**Mean**	**St. Dev.**	**Mean**	**St. Dev.**	**Mean**	**St. Dev.**
Food production	33	21	33	23	10	#DIV/0!	37	46	32	26
Bio-based resources	6	6	7	6	10	#DIV/0!	7	3	7	5
Economic viability	9	10	5	5	50	#DIV/0!	12	16	11	14
Quality of life	23	15	11	9	0	#DIV/0!	13	13	13	11
Natural resources	7	8	21	18	10	#DIV/0!	8	7	15	14
Biodiversity & habitat	2	4	6	7	10	#DIV/0!	4	4	5	5
Attractiveness of the area	15	8	8	6	0	#DIV/0!	13	19	10	10
Animal health & welfare	5	4	10	4	10	#DIV/0!	6	5	8	5

Table A3: Mean and standard deviation of importance of indicators per stakeholder group and for all participants. Per function, 100 points were divided over the indicators, n=14

Indicator	**Farmer**		**Government**		**Industry**		**NGO**		**Grand Total**	
	Mean	**St.dev.**	**Mean**	**St.dev.**	**Mean**	**St.dev.**	**Mean**	**St.dev.**	**Mean**	**St.dev.**
Productivity of food (e.g. ton/ha)	86	36	29	29	12	#DIV/0!	44	42	54	41
Nutritional quality	40	36	84	44	20	#DIV/0!	96	31	63	43
Loss of crops/livestock due to pests/disease	8	9	17	18	8	#DIV/0!	7	10	11	13
Productivity of bio-based resources (e.g. ton/ha)2	8	3	8	5	16	#DIV/0!	9	3	9	4
Use of agricultural waste (e.g. straw for energy production)	4	3	3	3	4	#DIV/0!	5	3	4	3
Net farm income (level, downside risk)	26	10	14	7	60	#DIV/0!	12	0	22	14
Cost of production	6	7	3	3	80	#DIV/0!	12	0	11	21
Debt/asset ratio	2	4	3	3	60	#DIV/0!	12	0	8	16
Added value of the whole supply chain	1	2	2	2	0	#DIV/0!	12	0	3	4
Income for agricultural workers (wage level)	44	11	16	0	0	#DIV/0!	19	0	27	17
Employment relations	17	5	10	4	0	#DIV/0!	19	0	14	7
Non-discrimination	6	6	5	4	0	#DIV/0!	0	0	5	5

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Nutrient balance	16	7	49	37	20	#DIV/0!	14	2	28	27
Soil erosion	7	3	9	13	8	#DIV/0!	7	1	8	8
Water quality (e.g. pesticides and nitrates in rivers)	6	5	10	14	12	#DIV/0!	10	3	9	9
Diversity and abundance of key farmland animal, plant and insect species	2	3	5	7	9	#DIV/0!	2	1	4	5
Agri-environmental payments	3	3	2	3	9	#DIV/0!	8	2	4	4
Diversity of production	1	1	3	4	12	#DIV/0!	2	1	2	4
Level of services in rural areas	28	21	6	5	0	#DIV/0!	15	1	16	18
Broadband coverage	8	6	6	5	0	#DIV/0!	20	8	8	8
House prices	9	11	8	6	0	#DIV/0!	10	1	8	8
Landscape maintenance and preservation budgets	16	21	7	6	0	#DIV/0!	7	10	11	15
Evidenced compliance with animal welfare regulation	8	5	15	11	11	#DIV/0!	2	3	10	8
Enrolment in certification schemes	1	2	4	4	8	#DIV/0!	6	3	4	4
Use of antibiotics	3	3	4	4	11	#DIV/0!	8	0	5	4

Table A4. Mean and standard deviation of scoring on performance of indicators per stakeholder group and for all participants, n=14. Indicators were scored from 1-5 where 1 = very low, 2 = low, 3 = medium, 4 = good, and 5 = perfect.

Indicator	Farmer		Government		NGO		Industry		Grand Total	
	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.
Productivity of food (e.g. ton/ha)	3,800	0,837	4,500	0,548	4,000	0,000	4,000	#DIV/0!	4,143	0,663
Nutritional quality	3,000	0,000	3,167	0,753	4,000	#DIV/0!	4,000	#DIV/0!	3,250	0,622
Loss of crops/livestock due to pests/disease	2,000	1,155	2,167	0,983	3,000	#DIV/0!	3,000	#DIV/0!	2,250	0,965
Productivity of bio-based resources (e.g. ton/ha)2	3,400	0,894	3,833	0,983	4,000	#DIV/0!	3,000	#DIV/0!	3,615	0,870
Use of agricultural waste (e.g. straw for energy production)	2,500	1,291	2,500	1,517	2,000	#DIV/0!	3,000	#DIV/0!	2,500	1,243
Net farm income (level, downside risk)	4,200	1,304	3,833	0,983	3,500	2,121	5,000	#DIV/0!	4,000	1,177
Cost of production	3,000	0,816	3,000	0,632	3,000	#DIV/0!	5,000	#DIV/0!	3,167	0,835

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Debt/asset ratio	1,750	0,957	2,333	0,516	3,000	#DIV/0!	4,000	#DIV/0!	2,333	0,888
Added value of the whole supply chain	2,250	0,957	2,167	0,753	0,000	0,000	4,000	#DIV/0!	2,364	0,924
Income for agricultural workers (wage level)	3,200	1,304	3,333	0,816	3,000	1,414	3,000	#DIV/0!	3,214	0,975
Employment relations	2,500	0,577	3,500	0,548	3,000	0,000	3,000	#DIV/0!	3,077	0,641
Non-discrimination	2,250	1,500	2,833	1,329	3,000	#DIV/0!	4,000	#DIV/0!	2,750	1,288
Nutrient balance	3,000	1,633	4,000	0,000	3,000	#DIV/0!	5,000	#DIV/0!	3,636	1,120
Soil erosion	2,333	1,155	2,400	1,140	3,000	#DIV/0!	5,000	#DIV/0!	2,700	1,252
Water quality (e.g. pesticides and nitrates in rivers)	2,333	1,155	3,000	0,707	3,000	#DIV/0!	5,000	#DIV/0!	3,000	1,054
Diversity and abundance of key farmland animal, plant and insect species	3,000	0,000	2,500	0,000	3,000	0,000	4,000	0,000	2,900	0,000
Agri-environmental payments	3,333	1,414	3,750	0,577	2,000	#DIV/0!	5,000	#DIV/0!	3,556	0,994
Diversity of production	2,667	0,577	3,750	1,258	2,000	#DIV/0!	4,000	#DIV/0!	3,222	1,130
Level of services in rural areas	2,000	1,528	3,400	0,957	3,000	#DIV/0!	3,000	#DIV/0!	2,900	1,202
Broadband coverage	2,500	1,000	3,400	0,548	2,000	#DIV/0!	3,000	#DIV/0!	2,909	0,876
House prices	3,333	1,000	3,200	0,894	3,000	#DIV/0!	4,000	#DIV/0!	3,300	0,944
Landscape maintenance and preservation budgets	2,000	0,577	3,000	0,447	0,000	#DIV/0!	4,000	#DIV/0!	2,778	0,483
Evidenced compliance with animal welfare regulation	3,667	1,000	3,200	0,707	3,000	0,000	3,000	#DIV/0!	3,300	0,972
Enrolment in certification schemes	3,250	1,155	3,400	0,447	3,000	#DIV/0!	4,000	#DIV/0!	3,364	0,675
Use of antibiotics	2,333	0,500	2,800	0,894	4,000	#DIV/0!	4,000	#DIV/0!	2,900	0,674

Table A5. 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, n=14.

	Farmer		Government		NGO		Industry		Total	
Function	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev
Food production	3,3	0,4	4,0	0,4	3,9	#DIV/0!	3,9	#DIV/0!	3,7	0,5
Bio-based resources	3,0	1,0	3,4	0,9	3,4	#DIV/0!	3,0	#DIV/0!	3,2	0,8
Economic viability	3,8	1,2	3,6	0,8	0,0	0,0	4,9	#DIV/0!	3,8	0,9
Quality of life	2,8	0,9	3,3	0,4	2,4	#DIV/0!	3,1	#DIV/0!	3,1	0,6
Natural resources	2,3	1,2	3,4	0,4	3,0	#DIV/0!	5,0	#DIV/0!	3,2	1,0

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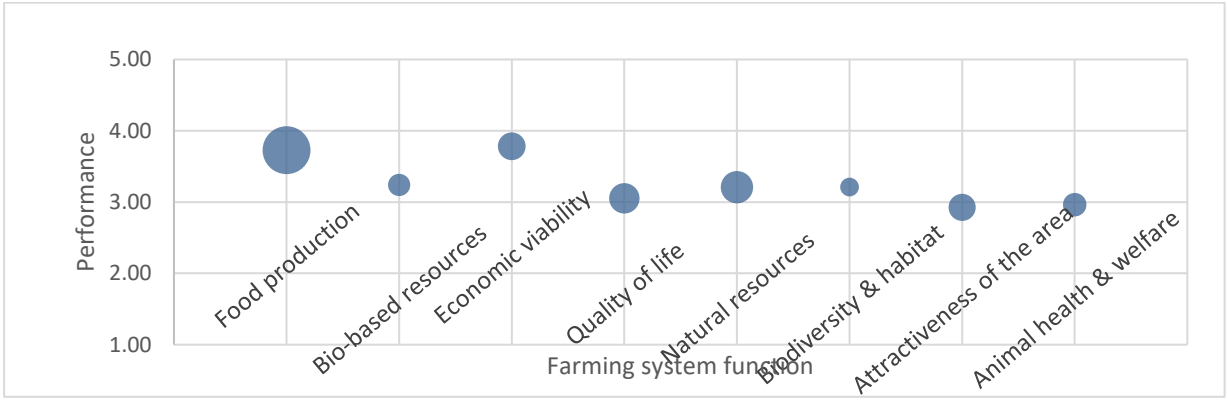
Biodiversity & habitat	3,0	1,0	3,3	0,9	2,4	#DIV/0!	4,5	#DIV/0!	3,2	0,9
Attractiveness of the area	2,2	0,1	3,3	0,5	0,0	0,0	3,4	#DIV/0!	2,9	0,7
Animal health & welfare	2,6	1,5	3,1	0,3	3,2	#DIV/0!	3,3	#DIV/0!	3,0	0,9

Figure A1. 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.



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Appendix C. Dynamics of main indicators

Figure A2 shows the output including stakeholder contributions in revealing the historical dynamics of productivity as part of the „Food production" function. The pattern of change of productivity has been market by the blue lines. It mostly reflects the change in tonne per hectare for wheat which starts at about 3 t/ha at the beginning of the period and reaches about 7 t/ha at its height. Comparison with official data suggests that the other grain crops exhibit similar patterns, although the triggers may not have influenced them in the same way due to different growing times throughout the year (i.e. maize is harvested a couple of months later than wheat and barley).

The triggers that have one-off impact on increase or decrease in productivity, like natural conditions – draught, floods, hail, or change in policy – introduction of subsidies, have been market in black. The strategic challenges throughout the analysed period have been marked in green.

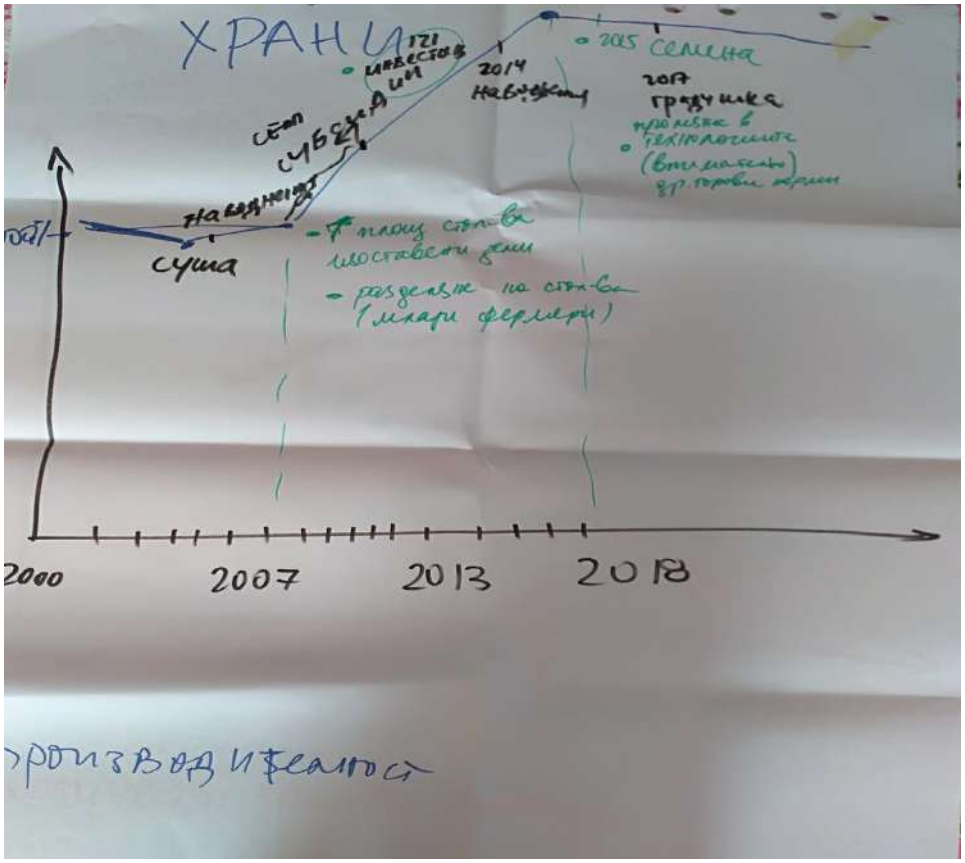

Figure A2: Historical dynamic of productivity

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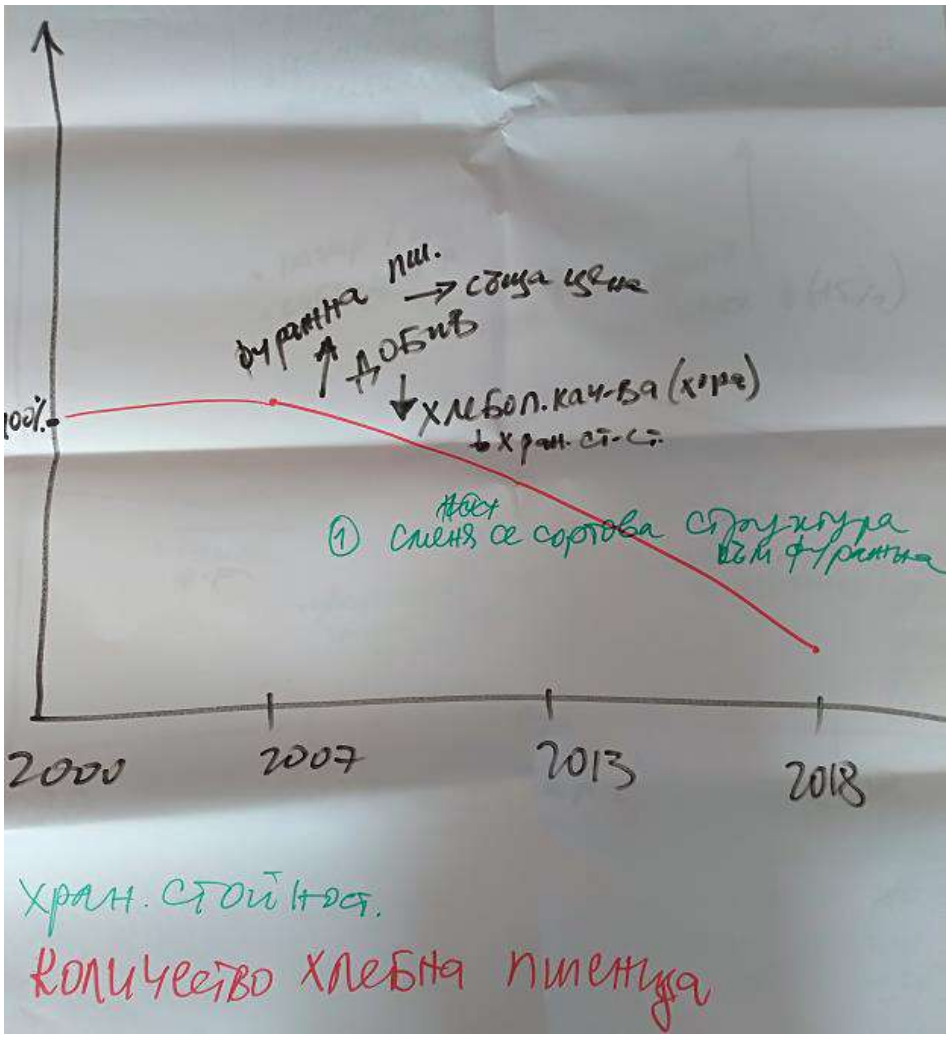

Figure A3: Historical dynamic of nutritional quality

Figure A3 depicts the change in quantity of bread wheat with a red line. There was one main trigger for the change identified by stakeholders – the change in preferred varieties, marked in black. Changing the use of bread varieties with fodder varieties has decreased the nutritional quality for humans and increased the nutritional quality for livestock.

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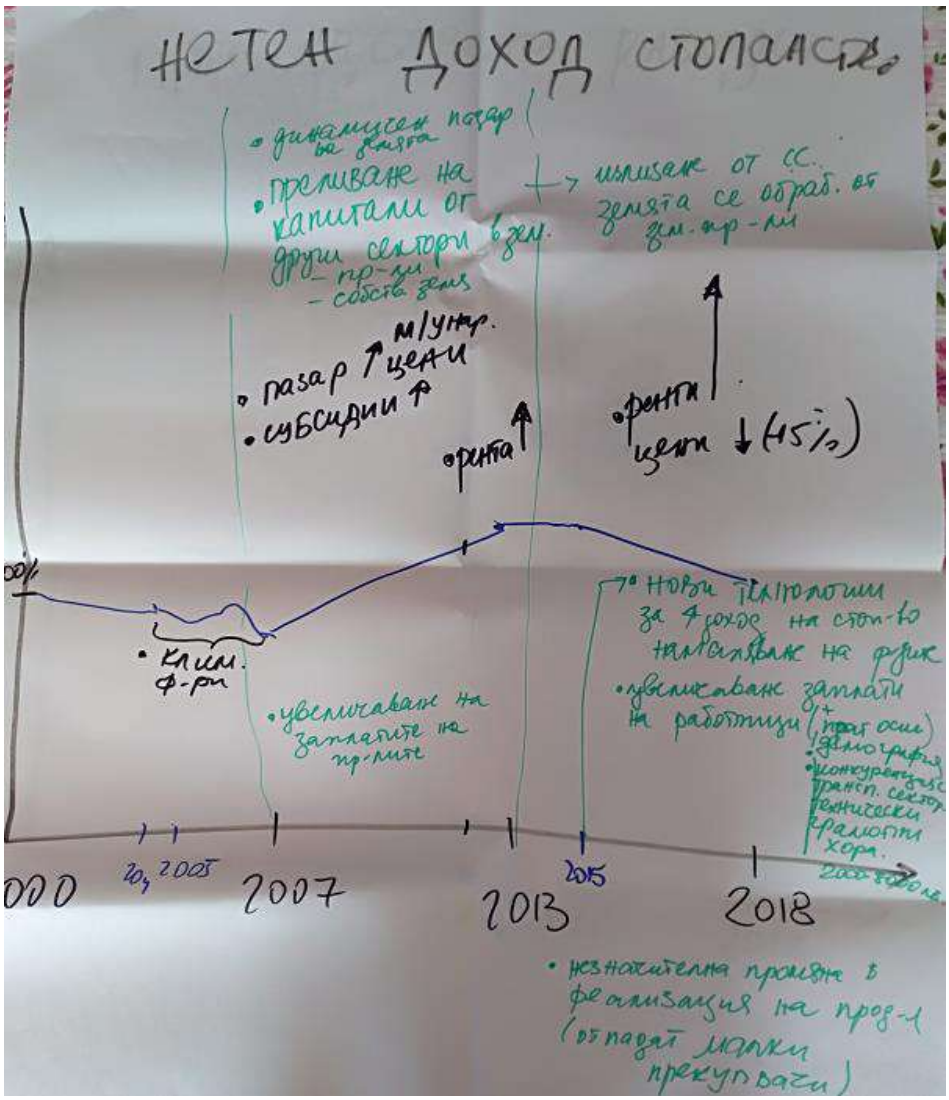

Figure A4: Historical dynamic of net farm income

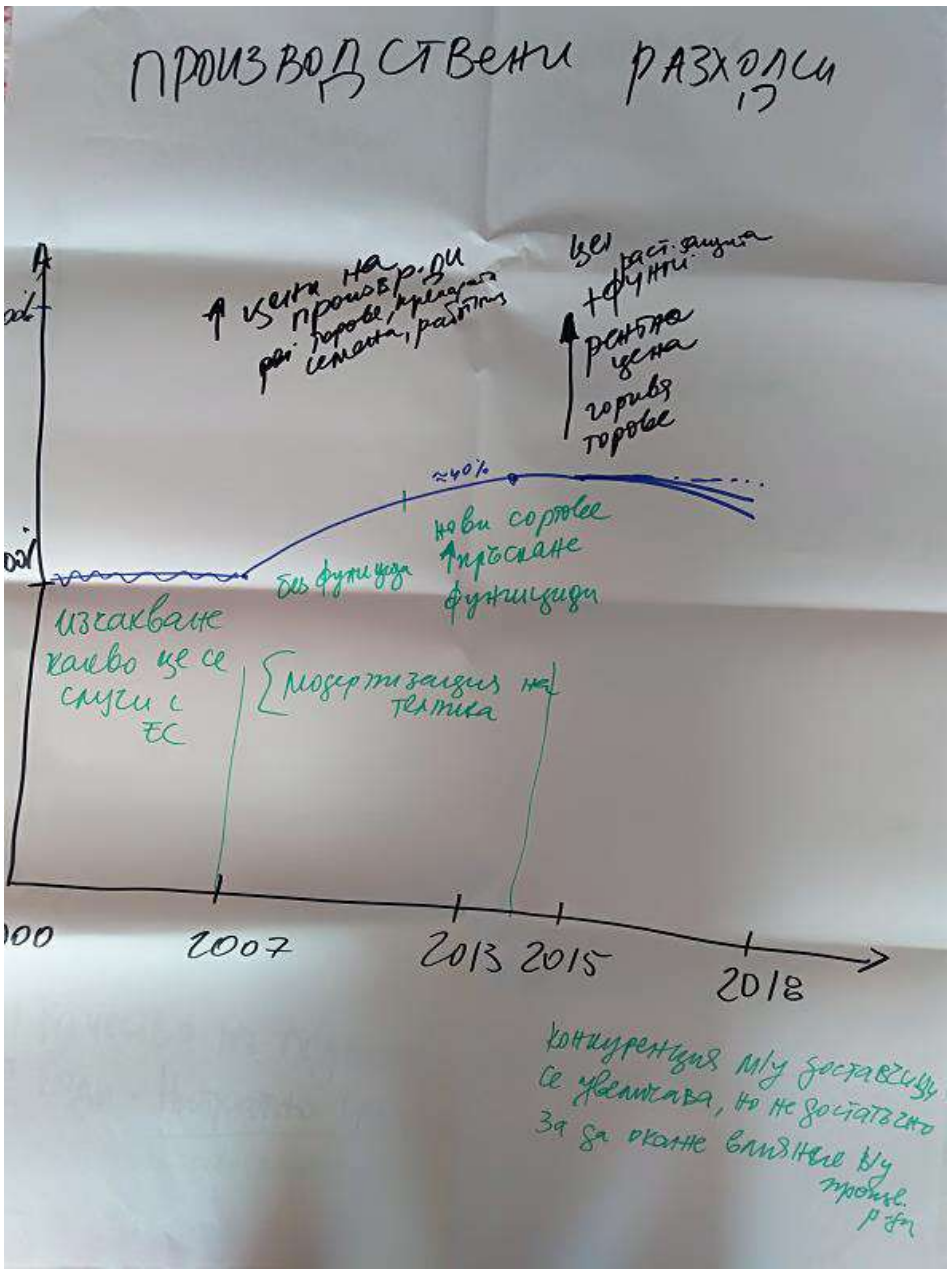

Figure A5: Historical dynamic of cost of production

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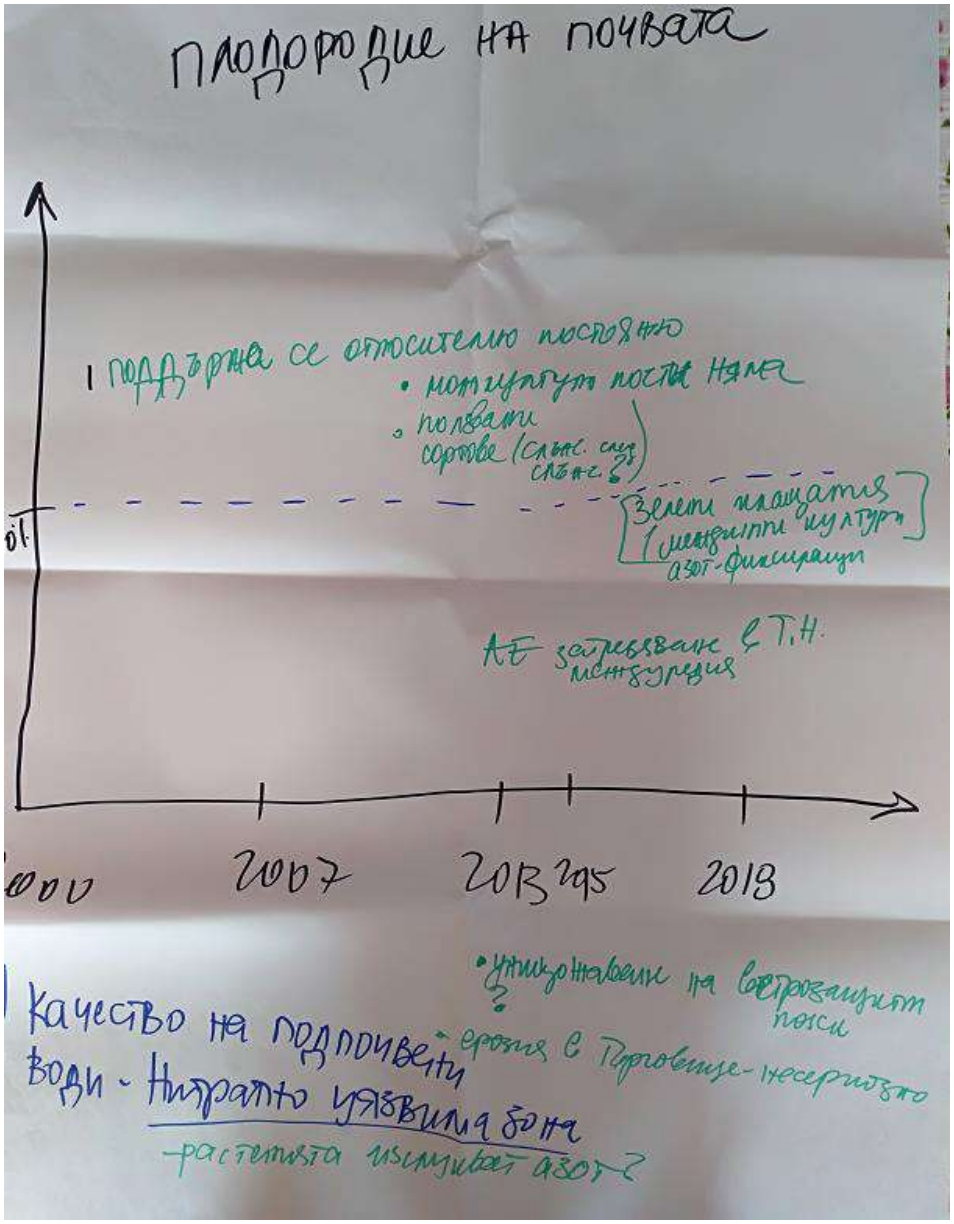

Figure A6: Historical dynamic of nutrient balance and soil erosion

No specific changes were identified for nutrient balance and soil erosion illustrated in Figure A6. Respectively, there were no specific challenges to be added to the graph. Some strategies of the farmers with respect to the two indicators have been denoted in green.

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Appendix D. Details on scoring strategies and resilience attributes

Table A6. Mean (and standard deviation) of implementation scores of strategies, n=14.

		Potential contribution to resilience capacities							
		Implementation		Robustness		Adaptability		Transformability	
Selected indicator	Strategy	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev
Net income	Increase of the farmed land	3,5	1,2	2,1	1,2	1,8	1,0	0,6	1,6
Net income	Changes into production technologies and modernisation	3,6	1,1	1,3	1,0	1,9	0,8	0,8	1,5
Net income	Preservation of the current marketing of the products	2,9	1,3	1,3	1,9	1,1	1,5	0,8	1,9
Net income	Application of good farming practices	3,3	1,2	1,6	1,8	1,7	1,8	0,7	1,8

Table A7. Mean (and standard deviation) of strategy's contribution to robustness, adaptability and transformability, n=14.

	Robustness		Adaptability		Transformability	
Strategy	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev
Increase of the farmed land	1,70	1,16	1,75	0,97	0,70	1,64
Changes into production technologies and modernisation	2,10	0,99	1,75	0,75	0,60	1,51
Preservation of the current marketing of the products	1,30	1,89	1,90	1,52	0,80	1,87
Application of good farming practices	1,30	1,77	1,11	1,76	0,78	1,79

Figure A7. Bar graph presenting total positive and negative points allocated to a strategy's contribution to robustness, adaptability and transformability, n=14.

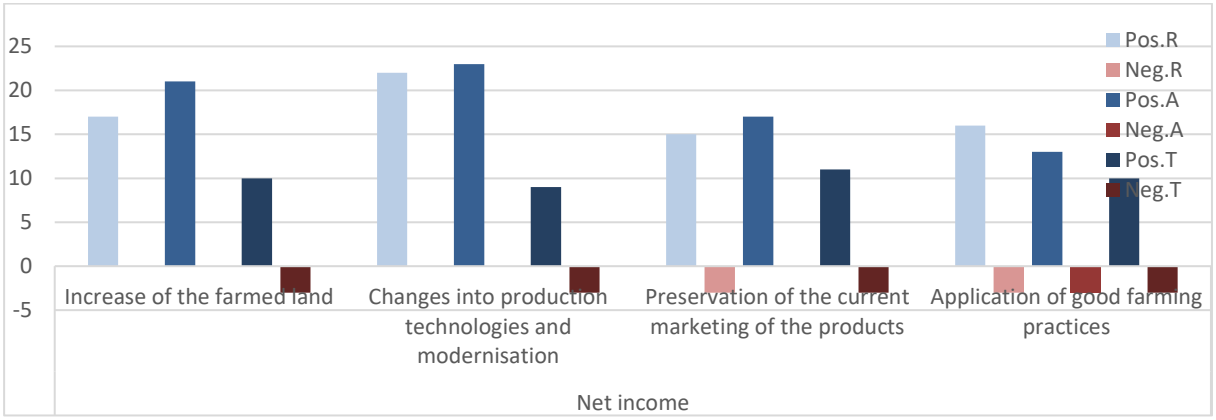

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Table A8. Mean and standard deviation of performance scores of resilience attributes. Per stakeholder group and for all participants, n=14.

	Farmer		Government	
Resilience attributes	Mean	St. Dev	Mean	St. Dev
Reasonably profitable	2,00	1,00	2,25	0,50
Coupled with local and natural capital (production)	2,80	1,48	4,25	0,96
Functional diversity	2,00	0,00	2,75	0,96
Response diversity	1,00	1,41	2,50	0,58
Exposed to disturbance	3,80	1,64	4,00	1,15
Spatial and temporal heterogeneity (farm types)	3,60	0,89	3,25	1,26
Optimally redundant (farms)	3,60	0,55	3,25	1,50
Supports rural life	2,20	1,64	2,25	1,26
Socially self-organized	2,80	1,30	3,25	0,50
Appropriately connected with actors outside the farming system	1,60	0,55	2,50	1,29
Infrastructure for innovation	3,20	0,45	3,25	0,50
Coupled with local and natural capital (legislation)	1,80	1,10	4,00	0,82
Diverse policies	1,60	0,89	2,50	1,00

Table A9. Mean of resilience attribute's contribution to robustness, adaptability and transformability, n=14.

Row Labels	Robustness	Adaptability	Transformability
Reasonably profitable	1,00	1,50	0,71
Coupled with local and natural capital (production)	0,88	1,67	0,00
Functional diversity	0,57	0,86	0,43
Response diversity	1,00	1,00	0,50
Exposed to disturbance	-0,70	-0,50	-0,50
Spatial and temporal heterogeneity (farm types)	1,13	1,60	0,88
Optimally redundant (farms)	0,63	0,63	-0,14
Supports rural life	0,43	0,43	-0,29
Socially self-organized	0,86	1,56	0,86
Appropriately connected with actors outside the farming system	1,00	0,67	0,71
Infrastructure for innovation	1,00	1,78	1,29
Coupled with local and natural capital (legislation)	0,00	0,67	0,14
Diverse policies	1,00	0,90	0,29

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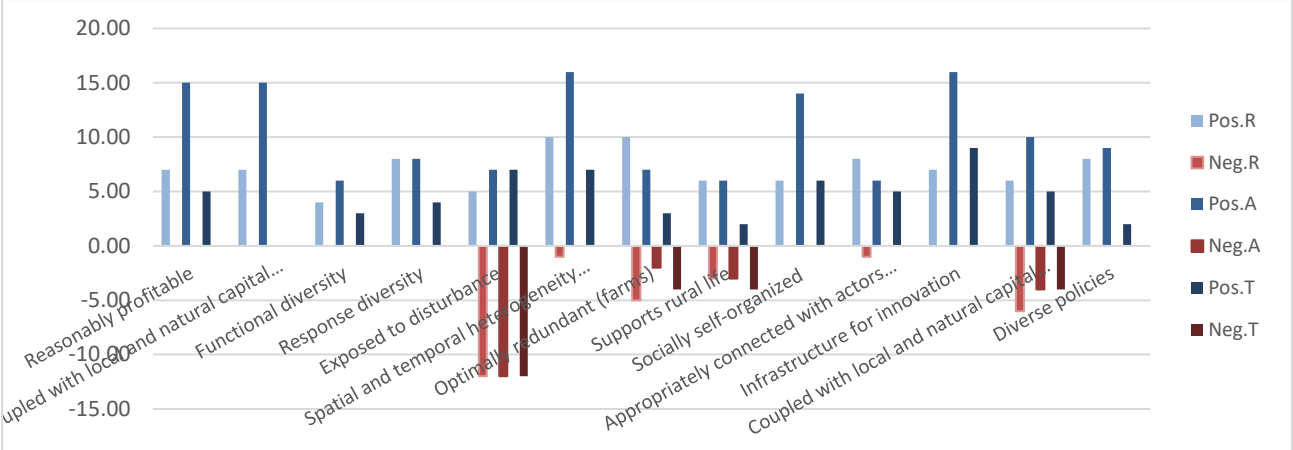

Figure A8. Bar graph presenting total positive and negative points allocated to a resilience attributes' contribution to robustness, adaptability and transformability, n=14.

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Appendix E. Workshop challenges and improvements

In general, the workshop went well even above our expectations either in number of participants (we had more than expected) and in their interest and active participation the workshop (we had the feeling that it is result of the fact that most of the participants knew each other). Even participants stated that this type of exercise was very useful although there are few such initiatives (despite they are needed especially in discussion the future policy) to challenge people to think for the overall system performance, interactions, resilience. They appreciated very much their active role in the exercise and some of them (from the *farmers*' group) asked whether they can use the approach in their work (suggestion for a collaboration with the regional grain producers' organization) as well. It was important for us to have this feedback because at the beginning of the workshop we included explanations why it is so important to have stakeholders' opinion as part of the project methodology.

In this regard it was helpful the shortening of the workshop. We reorganized it following the experience we have had before to maintain local stakeholders' attention and in our point of view the initially proposed duration of the workshop is too long. Therefore, we had a discussion within the team and reorganized the duration leaving a floor for more discussions if the participants are still interested in it; actually we finished early to avoid participants' frustration and following that some of them left and the others started to "look at their phones". The duration of 5 hours including the breaks is the longest duration that is practical for our participants and it proved to be sufficient to allow proper discussions on each item.

The participants were keen to learn something new but the graphs and tables bothered them. They expressed explicitly that despite of the fact that all of them (especially the *governance* representatives) are used to to work with tables/graphs etc. Even, in the context of being given tables to fill, where the participants had to provide answers, several of them commented that they feel like students at university again. Moreover, the excel tables and graphs were difficult to be printed out at reasonable size, even the translation enlarge the amount of the text. For some of the tables the text and explanations were too much for the participants (e.g. attributes assessment) and the introduction of these very new concepts was difficult for all of them to understand and link them. Thus, the understanding of all the concepts needed more time and more explanation (reading them when filling in the table was not enough, some common explanations during the workshop have been made). In this case visualisation materials are more helpful to explain a concept, even in our case we used examples from the previous experience we have in the region.

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Also, participants were stressed to work separately in small groups and they did prefer a common discussion. Thus, the strategies formulation was assisted by the facilitator due to the need to stick on the time. The discussion and results are reasonable but in the larger group (even more than 12-15) means 'noise in the system', sometimes the discussions started between the neighbouring participants and more 'energy' has been needed for a fruitful discussion. However, it may very well be not due to the size of the group but to the type of people that were in it.

Processing the data during the workshop using excel is time demanding and always something can go wrong with data entrance or proper file execution. Moreover, this information should be implemented in the file which is on another computer – to synchronise files and data takes time (this time should have planned activities because the rhytum should not be lost and participants cannot just wait) but it is useful to stimulate a free discussion when some comments are even more valuable.

The scoring in most of the cases do not work properly without discussion in advance. For example, the scoring of the functions required dividing 100 points on the eight functions. However, scoring of the indicators at the next stage of the workshop required dividing 100 points per indicator group according to function. This introduced some confusion among the stakeholders, and they needed additional instructions on how to complete the table. Changing the scoring into a number from 1 to 5 for the table after that, was also related with extra explanations on why the way of scoring changes, and how to apply the scoring in that case.

Using rating scales as visuals where the stakeholders can choose a number on a line would have been easier for them and would have required less explanations (Figure A9).

Figure A9: Measurement scale for collecting stakeholder data (based on Oppenheim, 1992)

It is obvious that some of the ranking could be influenced by the discussion but the level of empty cells decreases a lot when the filling is accompanied by the discussion and explanations. In this case some preliminary explanation and information could be send to the participants (it is always

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risky that they will not read the information…). Or it could be done during the engagement process and talks with them. Also, some of the exercises were easier, e.g. evaluation of the strategies compared to the functions and the attributes (both of them sound more abstract to the stakeholder compared to the strategies when they imagine the situation of themselves). Even at the end the participants got tired and they asked if could provide us only with specific examples for each single resilience attribute within a common discussion. Splitting this amount of information in two separate workshops would have helped to make it easier to take in by the participants and maintain their engagement.

As we pointed out the participants understood well the meaning of the farming system and the interactions between different elements in it but struggled to follow the concepts related to the system's functions and indicators. In order to overcome the level of abstraction of this concepts the participants were taught. While researchers are trained to adopt frameworks and think according to them, it was a new experience for the stakeholders. At least one participant was not getting on with any of the steps during the workshop.

It was also reflected through the opinion of one farmer on the presented functions:

"It is too theoretical. Maybe it is correct, but I'm a person of practice and I would like to tell you that this is too theoretical."

Later in the discussion the same participant stated that it was not clear for them what was the relationship between grain producers and tourism in the case study area. He was convinced that tourism depends on other factors that are not related to the farming activities.

In our case only the official invitation by email is not effective way to attract them. In each case we needed to contact, especially the *farmers*, separately referring to who recommended her/him.

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