

Project acronym: SURE-Farm Project no.: 727520

Start date of project: June 2017 Duration: 4 years

FoPIA-SURE-Farm 2 Case Study Report Germany

Work Performed by P12, IAMO

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Due date 31/May/2020 (part of D5.5)	
Version/Date	Final 27/May/2020
Work Package	WP5
Task	T5.3
Task lead	INRAE
Dissemination level	Public

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Please cite this report as:

Ollendorf, F, Appel, F. 2020, 'FoPIA-SURE-Farm 2 Case Study Report Germany'. In: Accatino et al. D5.5 Impacts of future scenarios on the resilience of farming systems across the EU assessed with quantitative and qualitative methods. Sustainable and resilient EU farming systems (SURE-Farm) project report.



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1 Introduction

1.1 Main indicators, resilience attributes and challenges

In the farming system of the Altmark in Germany, most of the utilized agricultural area is used by corporate mixed farms, while the highest number of farms are corporate arable farms. Yet, many smaller family farms do exist, too. Compared to other districts in the federal state, with 27% the Altmark has a high share of grassland. The soils are rather poor, and the yields of the arable crops are rather low (Bijttebier et al. 2017: 38). The Altmark also comprises almost half of the cow population of the federal state. Among the main functions of the farming system are private goods such as the provision of healthy and affordable food, the provision of bio-based resources for processing and refinement, the assurance of economic viability of farms as well as good working conditions and the provision of jobs in the rural area. Important public functions that the farming system of the Altmark fulfils are the maintenance of natural resources (water, soil, air), the conservation of biodiversity and genetic diversity, the support that rural areas become attractive places to live, and the assurance of animal welfare (Kampermann et al. 2019). Indicators that are most representative for these main functions (function indicators) are presented in Table 1. In general, function indicators are estimated to have a moderate to rather good performance level (Table 1).



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Main indicators	Current level (score 1:5)	Current level (explanation)	Current development
Cereal production (t/ha)	3.4	Relatively low yields due to poor soil quality, stress through fluctuating world market prices	Vulnerable due to increase in weather extremes
Profitability (Euro/ha)	3.1	Farms get rather little margins out of their business which affects their ability to invest	Gross margin declining over the past decade, major losses due to droughts during past two years
Availability of successors	2.4	Very low level of successors availability in the region	Trend likely to deteriorate and pose a major threat to the farming system
Availability of workers	2.4	Very low level of qualified workers and availability in the region	Trend likely to deteriorate until major investments make the region more attractive, wages increase and alternative job opportunities are created
Soil quality	3.8	Low quality, sandy soils in the Altmark don't allow for much increase in yield and production	Possible change in quality due to increase in droughts (wind erosion)
Production of biogas	4.4	Very good level of performance but dependent from public subventions	Decline of subventions puts production viability into risk
Water availability	4.1	Good quality of water but for some farms difficulties to access	During drought times high water stress and not enough irrigation schemes

Table 1.	Main indicators	and their performance	e and development.	Source: Own elabora	ition based on k	ampermann et al. 2019.
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General resilience in the area is mostly realized by the resilience attributes as presented in Table 2. During the FoPIA 1 workshop, presence of these attributes was estimated as moderate in the Altmark. A number of other attributes than presented in the table were assessed to be relevant for the resilience of the farming system, too, as for instance "reasonably profitable" or "infrastructure for innovation". However, due to their overlapping of content with some of the farming system challenges, the authors decided to not include them in the workshop.



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Main resilience attributes	Current level (score 1:5)	Current level (explanation)	Current development
Response diversity	2.9	Farmers have shown good response diversity, applying e.g. risk management strategies such as farm diversification, investment in new technologies, new marketing strategies or the improvement of value chain cooperation	Current pressures stemming from climate change and changing regulations and policies or economic pressures push farmers to their limits of response diversity
Regional infrastructure	2.4	Very low level of regional infrastructure (internet, highways, public social services)	Some important investments are being done but not widespread enough yet
Supports rural life	2.3	Rural life driven by negative demographic developments in the region, support and integration have decreased a lot after reunification, lacking social and cultural offers in the region since several decades now	No major improvements yet

Table 2. Main resilience attributes and their presence in the farming system. Source: Own elaboration based on Kampermann et al. 2019.

In order to reduce the complexity for the participants, the authors combined function indicators and resilience attributes and only presented one single list which was called "farming system indicators" to the participants (comprising both function indicators and resilience attributes).

Based on previous work in the region in the course of the Sure-Farm project, the following main challenges for the farming system in the Altmark have been identified: extreme weather events/climate change, poor soils, low margins, foreign investors, rising land prices, lack of infrastructure, low attractiveness of the region, public distrust, constantly changing policies and regulations, bureaucracy. Out of those, four have been selected by the researchers for further discussion in the workshop:

- extreme weather events/climate change,
- lack of infrastructure,
- low attractiveness of the region,
- constantly changing policies and regulations.

1.2 Participation in the workshop

15 stakeholders of the farming system in the Altmark were invited for participation in the workshop. Due to two short-dated cancellations (1 trader and 1 ecological farmer), finally 13



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persons participated. The group composition was as follows: 5 farmers (1 ecological farmer), 1 consultant, 1 member of an environmental NGO, 3 local politicians, 1 board member of a machinery-sharing cooperative, 1 member of the Authority for Agriculture and the Reorganization of Land in Saxony-Anhalt and 1 member of the State Institute for Agriculture, Forestry and Horticulture in Saxony-Anhalt.

Participants agreed with the ten proposed main indicators and the four selected challenges as presented in Section 1.1.



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2 Results

2.1 Maintaining the status-quo

2.1.1 Introduction

Participants were asked to give estimations on minimum and maximum levels of indicators and challenges with which the current farming system would be able to keep its functionality (thresholds).

2.1.2 Indicators

Cereal production

The participants expressed the thresholds for the cereal production in the Altmark mainly through the measures of average yield and crop failures. For instance, three crop failures within ten years were indicated as the functionality threshold or, similarly, it was stated that crop failures should not exceed 30%. The threshold for productivity was identified to be around an average of 4t/ha or less than 5t/ha cereal yield in the region or if the average yield over five years would lie under 70% of the longtime average.

Profitability (Euro/ha)

There was the strong argument that the equity capital formation became very problematic over the past years and that the farms' costs (as for instance for construction, technical equipment or licenses) can almost not be covered by the production gains anymore. Hence, several production strands needed to be outsourced (e.g. liquid manure) and thereby got lost from the farms' value addition.

Thresholds for profitability were expressed through different units but the gross margin serves as a central one. Here, for instance, a reduction of 10% compared to the previous financial year was identified as a threshold. Another unit applied to describe the profitability threshold is the milk price. A price drop for milk under 35ct/kg was seen as crossing of the threshold. Another participant used the general scale of 1 to 5 with one representing very low and 5 very strong and set the threshold at 1 (very low). In general, it was difficult for the participants to find good expressions of thresholds in concrete measures. Hence, there were more general expressions such as the continuing restriction of fertilizing and plant protection measures which would then lead to a crossing of the profitability thresholds.



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Availability of qualified workers

In the FoPIA 1 workshop, the availability of qualified workers has been appraised as one of the function indicators in the Altmark which is important but which shows a low level of performance. Similarly, in FoPIA 2, there was consent in the plenum that the low attractiveness of the agriculture in the region and the uncertainty towards which future the sector is heading strongly contribute to the lack of qualified workers. Most of the participants expressed thresholds of this indicator in percentages of availability. However, the appraisals strongly differ and range from less than 50% to less than 25-30%, or reversely at least 30% have to be available. Another threshold was seen when unqualified staff become more than 50%. Yet another measure that was applied is the percentage of occupied positions. One participant indicated a threshold at 10% non-occupied positions and another participant located it at more than 20% of non-occupied positions.

Availability of farm successors

The overall consent in the plenum was that availability of farm successor is an indicator with equally low performance. The need of high investments during the take-over in combination with the low level of regional infrastructure as well as the increasing challenges and negative reputation of the agricultural sector are regarded to make farm succession in the Altmark very unattractive. Most of the participants expressed thresholds through % of farms without successors. The range that comprises most frequent mentions is 20% to 25% of farms without successor.

Soil quality

There was no real discussion regarding the soil quality. In general, there is the perception that the soil quality has to be constantly improved in order to avoid approaching a threshold. One participant expressed this by using the relative measure of soil fertility value (Bodenwertzahl)and estimated that these should not drop under 20 points (scale 0 to 100). Almost all other estimations of thresholds of the soil quality applied the humus balance. However, estimations of the humus content threshold differ largely; as for example, one participant sets it at 0.4% and another one at 1.5%.

Production of biogas

In FoPIA 1, participants estimated production of biogas to be an indicator with a good performance. In this plenum, thresholds have been discussed in measures of duration until approval of a plant, cents per kilowatt hour or the average plant output. For instance, if the duration until approval of the biogas plants would exceed more than 0.5 years a threshold would be reached. Regarding the profitability of biogas production, indications differed strongly.



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While one participant allocates the price threshold for biogas at 14 cent/kWh, another one identifies it at 6.5-7 cent/kWh. One participant described the threshold for biogas production with an average plant output of 6.5-7 MW.

Water availability

The participants describe the water availability in the Altmark as generally good. However, most of them have been strongly affected by the very dry seasons and droughts of the past two years and are therefore very sensitized to extreme weather events. In that regard, it was indicated that one more following year of water stress would be disastrous for the fields. Annual rainfall was mostly used to express the threshold. Indications varied between less than 300 to 450 mm/a rainfall in the region. One participant expressed the threshold for the period of May to July where a rainfall under 100 mm would be dire. Some other general estimations where expressed as water availability less than 50% of the average water availability of the past 30 years or three or four times of extreme water stress within ten years. Yet another estimation was given by applying the scale of 1 to 5 and indicated 2, representing "little water availability".

2.1.3 Resilience attributes

Response diversity

The identification of thresholds was difficult for this indicator. Most of the participants used the 1 to 5 scale with 1 = very low and 5 = very strong. Still, appraisals differ quite strongly but can be divided into two groups. One group sees the threshold reached when the farm response diversity gets low to very low (thresholds allocated at 1 and 2). The other group already identifies the threshold at higher levels of farm response diversity (thresholds allocated at 3 and 4) indicating that the functionality of response diversity is very important and already with a small reduction of it the farming system would suffer. This shows somehow the high level of responsibility which is attributed to the farmers and farm manager by the participants. An interesting statement came from one participant who wrote that response diversity would be strongly dependent from the boundary conditions which finally determine how flexible a farmer or farm manager can act.

Regional infrastructure

Regional infrastructure is perceived as an important attribute but it wasn't so easy for the participants to qualify it with threshold figures. Hence, most of them used the 1 to 5 scale. Even if there are ongoing construction activities in the Altmark (highway) and efforts from the local government to improve the infrastructure in the region (especially internet connection), the



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current level is still very low. Accordingly, the thresholds were allocated at the lower end of the scale, mainly at 2 (= low level). Some participants indicated concrete infrastructure items for thresholds, as for instance less then 4G network, less than DSL 6000 or the absence of driveways.

Support rural live

Similarly, it wasn't easy for participants to qualify thresholds for the attribute support for rural live. Applying the scale, the participants' appraisals varied along the scale from 1 (very low) to 4 (high) but most were allocated at the lower end of the scale, indicating that the support level is perceived rather low and if it would reduce further the threshold would be reached.

2.1.4 Challenges

The discussions of the challenges were more active than for the indicators and attributes. In addition, since the statement regarding the thresholds of the challenges was demanded (compared to the indicators where participants could chose on which one they would like to comment), more input could be gathered on the post its.

Climate change

After the very dry summers in 2018 and 2019, all participants are concerned about the future of agriculture in the Altmark and possible effects of climate change and increasing extreme weather conditions. But nevertheless, the discussion about this challenge was less animated than for the other challenges, especially prices and costs or bureaucracy.

One participant highlighted the aspect that in the case that water in the Altmark would become scarce for farming, not only more efficient irrigation systems need to be considered but also the production has to be adjusted to the new climate condition. Therefore, new ideas are needed – which crops are economically and ecologically feasible for the Altmark and how can new value chains be developed? Sector-wide and inter-farm approaches are needed and a holistic concept should be jointly developed in close cooperation between conventional and organic farms.

The participants framed the thresholds mainly by estimating the numbers of droughts, floods or storms the system could survive within a time window of ten years. The thresholds for droughts were allocated to be at three or only two during ten years. This is particularly alarming since it shows that there is the perception that farms could almost not survive one more drought year in the nearer future. For floods, the threshold is even seen more critical: two participants allocated the threshold for floods at only one and another participant at two floods within ten years. For storms it varied between one and three storms within ten years. One participant noted that a



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threshold would be reached when only years with weather extremes (droughts and very wet years) would alternate with one another while almost not having any years of ordinary average rainfalls and temperatures.

Low attractiveness of the region

This challenge is regarded to negatively impact several of the above indicators, most notably the availability of qualified workers and farm successor. Yet, it was still difficult for the participants to qualify thresholds. Most of them applied the 1 to 5 scale and allocated the threshold at lower than three (= low level). Only one participant allocated the level of three (moderate) as a threshold for this challenge. Besides, one participant saw a threshold when income disparities between agriculture and trade and industry exceeds 20% or when the workload is more than 20% higher than in positions of trade and industry.

Low prices, high costs

The discussion about the economic challenges was the most vivid in the plenum. There was a broad consent that, generally, prices for farm products would be too low whilst costs are increasing. In this context, the augmentation of value addition has been mentioned several times but no clear approaches were brought up. Direct marketing is regarded as a difficult undertaking in the Altmark because of the weak demand in the region and would only work for niche products. Farms are only producing the raw materials so the major question was through which way of product differentiation farmers' share of value added could be increased. For most forms of product differentiation, there is currently no downstream sector, which hence would have to be regionally developed, too. Generally, participants saw the urgent need to improve the market power of farmers.

The thresholds of this challenge were mainly expressed through changes in costs and prices. For instance, one participant noted that with a deterioration of both above 30% the threshold would be reached. Others expressed the threshold in comparison to the previous financial year. For example, less than 20% profit or 10% more costs of the previous year would be thresholds. Another way to express the economic threshold was of prices are lower than costs over a period of three years or prices are more than 10% lower of costs. Several participants noted that the threshold is already reached or even passed and many farms had to give up or are currently about to do so. The main systematic problem would be the concentration of the trade and processing segments with respect to the farmers.



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Constantly changing policies and regulations

Bureaucracy and constantly changing policies and regulations is a challenge which is stronger discussed than the others indicating a higher degree of frustration of farmers regarding it than regarding other challenges. Most of the farmers support the standpoint that the high degree of regulations and restrictions, as for instance slaughter, would destroy many projects and attempts to diversify or impede investments. One topic that has been brought up in this regard is the fertilization ordinance which is seen very controversial by German farmers. It was argued in the plenum that it would be highly too complex and not giving clear answers to individual problem areas.

Several aspects have been applied as thresholds. For instance, if there would be more than three supervisory authorities per farm, or more than three new regulations or laws per year, thresholds would be reached. Another threshold would be reached if there changing laws and regulations would lead to an additional workload of more than 10%. Similarly, if laws and regulations do not even hold for ten years or if the efforts and costs of new regulations and laws would exceed 25% would be the thresholds.



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2.2 System decline

2.2.1 Introduction

In small groups, participants discussed one challenge and its impact on main indicators and resilience attributes, in case thresholds would be exceeded. Not in all groups or for all indicators the performance level after the passing of thresholds could be assessed in numbers.

2.2.2 Performance of indicators and resilience attributes

Climate change and extreme weather events

In the case that climate change becomes more severe, participants expect almost all indicators and attributes of the farming system in the Altmark to be affected negatively, either in a direct or indirect way. The most direct effect that has been expected is on the availability of water which is expected to reduce significantly. Due to the assumed weather instability, soil quality and cereal production and biogas production are considered to be affected. The effects on the soil are difficult to forecast but one participant drew the scenario of strong rainfalls, high temperatures and increased wind erosion which might increase stress on the soil. Weather instability and extreme weather events are regarded to have a negative impact on cereal and biogas production in the area. This in turn is expected to have a strong negative effect on the profitability of production. Some group members saw the risk that banks might become more reluctant to provide loans in times of very low profitability and, hence, see the possibility of a reduced liquidity of farms. This in turn is seen to reduce the flexibility of farms' response diversity. The group agreed that the whole farming system most likely would be negatively affected by a reduced quantity of production. Once the profitability of the farming system declines, negative impacts on other system functions are expected. Participants expect a chain effect stemming from a reduced profitability of agriculture and hence a less attractive sector which is guessed to lead to a further decline in the availability of qualified workers and farm successors which then would further weaken the performance of farms. Finally, participants also expect a negative effect of a reduced profitability on institutional functions such as regional infrastructure and support for rural life.

Constantly changing policies and regulations

In general, the effect of policies and regulations, and particularly when they are changing frequently, was seen as ambivalent. Some group members rather follow the ideals of free market and its self-regulation and see the risk of overregulation for an efficient system. Some others didn't share this view and highlighted the protective and supportive roles of policies and regulations. Of course, this general discrepancy of standpoints is difficult to bridge in a group discussion. But what worked well for this group was the focus on some particular topics. For



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instance, the effect of constantly changing policies and regulations was discussed regarding biogas production. Thus, it was agreed that it depends on the direction of the policy whether there is a positive of negative effect. Initially, the German Renewable Energy Sources Act (EEG) had a very positive effect on the biogas production and encouraged the creation of many new plants in the Altmark. Anyhow, as practice of the participants has shown, if there are too many requirements and regulations, as for instance a very high frequency of controls, the level of performance is affected negatively and shrinks. In terms of performance numbers on a scale from 1 to 5, where the performance before the crossing of the threshold was at 4, participants see the risk of a decline to the level of 3 due to changing and high policy and regulation demands.

One group member pointed to the ongoing efforts to improve the regional infrastructure. Other members agreed that much effort has been done but criticize it as not being fast enough, as for instance when it comes to the construction of the highway. These infrastructure assets were seen as very important for the overall attractiveness of the region and therefore are regarded to have an indirect effect on the availability of qualified workers and successors, for instance. The effect on the profitability of farms has been discussed most controversially. All group members allocate a strong link between the two. However, whether it is positive or negative is controversial. While some participants see a protective function of regulations, others condemn them as restrictions.

Low prices / high costs

In the plenary discussions, there was already a broader consent that prices are getting too low while many costs are continuously increasing. In this vein, group members anticipated that, if prices would still be becoming lower and/or costs still higher, the effects would be negative on almost all indicators. The strongest negative and immediate effect is expected for the profitability of farms. Furthermore, a strongly reduced profitability of farms is regarded to have several indirect negative effects on other indicators such as the support for rural life or the response diversity of farms. For instance, if the profitability of a farm is very low due to low prices and high costs, its ability to experiment with new technologies or methods might be drastically reduced. Or, simultaneously, the costs of diversification might simply be too high. Nevertheless, if profitability becomes too low and the survival of the farm is seriously threatened, participants see farmers still obliged to react and implement diverse responses even if their scope of action and investment would be very small. Another negative effect of a reduced profitability is assumed to result for rural support initiatives of farms. Due to the low profitability of the farm, the latter might be struggling with its core business and not be able to engage in activities of rural support. While low prices and high costs often lead to low or



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insufficient profitability of farms, the whole agricultural business suffers from a loss of attractiveness. The group members identify the risk of a twofold negative effect: On the one hand, farms which are challenged by a low profitability might face more problems to hire qualified staff since they are not able to effort attractive salaries. On the other hand, less young people might decide to pursue a sector relevant education since the future perspectives are not profitable. This in turn might lead to an even bigger problem of recruiting qualified workers. Similar dynamics are expected to evolve for the succession of farms. With a too low profitability, farming doesn't appear as a safe future business plan and potentially interested successors might be discouraged by the hard work and time consuming low-profit business.

Further negative but rather very low effects are expected to appear for the availability of water and the quality of soil. For instance, if the prices are too low, farms don't have enough liquidity to invest into new irrigation technologies such as sprinkling which would negatively impact the availability of water for the farm. Similarly, when farmers are financially limited, their investment into soil treatment, as for example with chalk or basic fertilization, might reduce and have a negative effect on the soil quality. Almost no effect is expected for the production of cereals. Even if prices are very low, due to the absence of alternatives, farmers cannot easily diversify and most likely would continue the production of the same cereals during very bad price seasons.



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2.3 Alternative systems

2.3.1 Introduction

One participant in the workshop mentioned that the most likely future situation would be a state where not only one single future direction of agriculture was followed but several developmental streams would occur simultaneously and parallel to each other. This statement reflected somehow the general consensus of the plenum. Still, the collection of post-its with ideas for alternative future farming systems yielded three different groups of visions for alternative systems: organic farming, better societal appreciation, and intensification. While participants didn't expect major changes for system indicators under the scenario of organic farming, they saw a very positive effect in the alternative state of better appreciation and a moderate improvement of indicator and attribute performances in an intensification scenario. Shared boundary conditions among multiple alternative systems are the presence of a good regional infrastructure and strong internet connection, an improved cooperation with research and development, a better societal perception of agriculture accompanied by a new societal contract and more dialogue, as well as the ability of farms to independently create their income.



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Table 3. Current perceived performance of main functions and presence of resilience attributes (FoPIA-SURE-Farm 1) and their expected change in future systems. \rightarrow implies no change, \land implies moderate positive change, \uparrow implies strong positive change, \lor implies moderate negative change, \downarrow implies strong negative change, V implies that a boundary condition is relevant for a future system. Arrows and tick marks in bold font are results obtained in the workshop. Arrows and tick marks in normal font are deductions from what has been said in the workshop.

Indicator	Current level	Status quo	System decline	Organic farming	Better appreciation	Intensific ation
Cereal production (t/ha)	Moderate	ב א	ל ע	<u>لا</u>	<i>→</i>	<i>→</i>
Profitability (Euro/ha)	Moderate	א >	ל ע	\rightarrow	↑	7
Availability of successors	Low	Ы	ע ע	→	↑	7
Availability of workers	Low	И	ע ע	\rightarrow	Ť	7
Soil quality	Moderate	→	→	→ 7	÷	÷
Production of biogas	Good	\rightarrow	ע ע	\checkmark	÷	\rightarrow
Water availability	Good	Ы	ל ע	\rightarrow	÷	7
Response diversity	Moderate	\rightarrow	ל ע	\rightarrow	я	\rightarrow
Regional infrastructure	Low	\rightarrow	ל ע	\rightarrow	Ϋ́	↑
Supports rural life	Low	\rightarrow	ל ע	\rightarrow	↑	\rightarrow
Boundary conditions	Domain					
Demand	Agronomic			v		
Labelling (certificates and standards)	Agronomic				v	
Agglomeration areas	Economic			v		v
Independent generation of income (without subsidies)	Economic					v
Political incentives	Institutional	V		V		v

Labelling (certificates and standards)	Agronomic			V	
Agglomeration areas Independent generation of income	Economic		V		v
(without subsidies)	Economic				V
Political incentives	Institutional	V	v		v
Research & Development	Institutional			V	v
Educational system	Institutional			V	
Consistency of regulations	Institutional	V	V		V
infrastructure	Institutional	v		v	v
CAP has to set right incentives	Institutional				v
De-bureaucratization	Institutional			v	
Culture of trust Improved societal perception of	Social			v	
Agric.	Social			V	V
Societal dialogue / new social					
contract	Social			V	V



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2.3.2 Organic farming

Only one organic farmer participated in the workshop so it was interesting that organic farming was chosen as one of the most desired alternative systems. Yet, in the group discussion, no broader positive impact on the performance of the indicators and attributes was recognized. Having the closer look at the current performance levels, the group couldn't identify bigger effects, even if boundary conditions were favorable. The small number of organic farmers in the workshop has to be taken into account when interpreting the results. At the same time, the fact itself that only one organic farmer was present (one cancelled participation short-dated) is characteristic for the population of the farming system in the Altmark.

The effects on the soil quality and water availability were regarded to be minor. For the quality of the soil, a slight positive effect was anticipated which would stem from an increased organic matter and more living organisms in the soil. This improved organic matter could then also bring a slightly positive effect for the availability of water in the region. However, no bigger changes in performance were expected here.

Negative changes were expected for the performances of cereal and biogas production which both are regarded to reduce. On the one hand, organic farming rather applies less intensive varieties since many of them are more resistant to plant diseases and need fewer pesticides. On the other hand, they are more optimized to more moderate nutrient levels. Another aspect that contributes to the lower performance is the need of longer crop rotations. Since organic farming needs to intercrop with leguminous plants, it is not possible to cultivate cereals or corn every year.

Group members are particularly skeptical towards the quota system that government plans to introduce. If regulation would fix a certain percentage of land that needs to be used for organic farming, they fear that the supply might exceed demand and prices would collapse. Furthermore, participants agreed that it would be product specific whether organic farming would become profitable or not. Anyhow, participants did not see a clear relationship of running an organic or a conventional farm with the ability of response diversity. According to them, whether the regional infrastructure would benefit from this alternative system would mainly depend from the existence of respective value chains. If there were profitable value chains for organic products and their processing at the regional level, then a positive impact on the regional infrastructure could be imagined. Similarly, organic farms and local (artisanal) processing could be a source of attraction and improve the support for rural life.

Boundary conditions that have been identified that would be needed in order to establish a broader system of organic farming in the Altmark than it is today were the following three:



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agglomeration areas, political incentives, and consumer demand. It was argued that one of the main challenges for organic farming in the Altmark is the weak potential market. There are not many bigger towns in the area where the typical consumer groups for organic food are located. The region is a low-income area and direct marketing is almost not an option here. These structural obstacles would need to be overcome if organic farming was to grow. The link to markets in agglomeration areas would need to be improved and supply and demand come to a better equilibrium. As another important condition to implement this desired future state participants mentioned political incentives. Participants perceive a lack of transparency and state difficulties to figure out all the existing funding and support programs. They therefore see an improved and more transparent bureaucracy with clearly communicated political incentives as an important prerequisite for the transition to a system with more organic farming in the Altmark.

Besides these boundary conditions, a number of distinct strategies were brought up in the discussion. Regarding political incentives, new support programs and financial means would need to be provided for the transition period. Nevertheless, organic farms still need to be profitable and funding should only be provided during transition. Research and development should play an active role when assessing the practical feasibility of organic concepts.

Another important pillar is an improved cooperation along the whole value chain. Traders and processors finally would need to sit down with farmers and search together for best structures of value chains that lift organic production out of the niche position in the Altmark. At the same time, consumers must get better informed about the social and ecological advantages of organic farming in order to trigger demand. In general, there is the major challenge to change unhealthy consumption patterns. This again is a broader task which needs efforts from politics (educational system), media, consumer groups and other civil society organizations.

2.3.3 Better societal appreciation

Many farmers in Germany have experienced a strong social pressure over the past few years and became very sensitized to it. In many cases, media reports draw a very negative and often undifferentiated picture of conventional agriculture practices which became somehow the scapegoat for climate change. Many of the participating farmers see that intense livestock farming or monoculture cultivation are increasingly criticized by consumer groups or environmental activists. In their opinion, farmers are urged to change their practices while the factual economic constraints they are facing would not be taken appropriately into account. Currently, the frustration level among German farmers is very high and is increasingly openly



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expressed in public. During the summer 2019, in Germany, many farmers united in the movement "Land schafft Verbindung" (land connects, translation by authors) and became political activists. One of their main matters is the wish for a broader public appreciation of the importance of their work.

This desired future state of a better societal appreciation has been discussed in one of the three groups during the workshop. In contrast to the working group on organic farming, many positive effects on the performance of indicators and attributes were expected here. The strongest positive effects are expected for the availability of qualified workers and farm successors. If there would be a generally higher societal appreciation of farming and its importance for the supply in the country, participants imagine that many more people would be attracted by a profession in the farming sector. The high importance that group members allocate to the improved appreciation becomes most visible while looking at the performance scores: The current performance levels of both indicators are at two. Participants allocated a performance level in the desired future state for qualified workers at four and for the availability of farm successors even at five. Very high scores in the new system are also allocated to regional infrastructure, profitability, and support for rural life (which all increased by two points from the current system). Since farming becomes more attractive because of its better societal recognition and gain of respect, participants expect more people to look for employment at a farm and move to the rural sites in the Altmark. Subsequently, villages would become more dynamic and lively again which would also trigger many improvements in the regional infrastructure. Under a scenario of a better social appreciation farmers and employees are expected to be more motivated again. This is regarded to have a positive effect on the profitability of farms and also improves their ability of response diversity.

The boundary conditions that group members see to be needed in place in order to achieve such a desired state mainly concern institutional aspects. A particular importance is ascribed to the educational system and which kind of knowledge on farming is distributed. They argue that more information of farming and its diverse processes needs to be spread and more transparency be created. Therefore, farmers should use their ties they have to the local governments and suggest the information which they think should be included into the school curriculum, for instance. Group members highlight the influence of media on the public. They see media often pushing negative single cases and thereby generating currently existing culture of distrust. Therefore, an important boundary condition is the realistic portrayal of agriculture from media but also from other educational bodies and farmers themselves. Consumers are increasingly interested in origin and process qualities of their food products but the plenitude of certificates and seals makes it difficult to create more trust in products. Thus, group members see a reduction of certificates and seals and the creation of a simplified certification scheme



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which clearly shows the origin and standards of the ingredients as an important condition to reduce the currently perceived culture of distrust. Another boundary condition that group members mention is an improved cooperation with research and development. They see the responsibility of the different governmental levels to create the institutional conditions required to establish cooperation platforms. Being backed by scientific knowledge and other inputs, agriculture should further be able to gain better societal appreciation.

Strategies that are regarded as most appropriate to achieve these boundary conditions mainly concern media reporting, labelling systems and image cultivation of agriculture. In order to achieve a more appropriate factual reporting by media, the government should introduce penalties and sanctions for wrong or strongly biased reports. But for the general more realistic representation of agriculture in the society, educational institutions, individuals, and particularly farmers themselves would play an important role. Hence, an improved communication between all actors is a strategy and objective at the same time.

2.3.4 Intensification

Group members approached the alternative state of intensification from the angle of cost leadership which they hoped the Altmark can achieve. While the increase of output is rather limited in the Altmark, intensification measures provide potential to reduce production costs and improve farm profitability. Measures of intensification which were discussed include improved plant protection, digitization of cultivation techniques and precision agriculture or site appropriate species and varieties. Group members allocate the highest potential for intensification with conventional farming (as compared to organic farming) and expect a strong positive impact of intensification on cost leadership for the future.

This point of view motivated members of this group to foresee several improvements of system indicators in the alternative state of intensified agriculture. The main improvements are expected for the regional infrastructure. Due to a tendentially increased value addition in an intensified scenario, both, upstream and downstream segments should benefit from more orders and a more dynamic value chain. Since the major goal of intensification is the reduction of costs, the profitability is expected to increase. Therefore, farming should become more attractive and farm successor would be easier to find. In the desired state of intensification, more qualified workers will be needed. But due to the improved infrastructure, this indicator was also expected to improve since more qualified stuff was expected to be attracted by the demanding work of precision agriculture. Hence, group members forecast an increase in the availability of qualified workers while the general need for less qualified workers would decrease. In general, they didn't expect yields to drastically increase but rather remain at the current level during increased challenges of climate change but while reducing production costs.



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The performance levels of cereal production and biogas production would therefore most likely remain the same. The group members estimated the quality of the soil to remain the same in the scenario of intensification since precision measures should carefully take into account the needed ecological balance. For the availability of water, positive effects were expected. This is due to both, improved irrigation techniques which use less amounts of water for the same results, and new varieties which achieve same yields with less water needs. A negative effect was expected to occur regarding farms' response diversity. Intensification is mostly coming with specialization which often reduces farms' abilities of flexible adaptation.

The most important boundary condition that participants saw was a long-term stability of the political system because intensification is regarded as a process which takes longer and which hence needs long-term investments. In addition, an improved cooperation with research and development is needed and should be publicly organized. Importantly, too, the needed infrastructure has to be established; most prominently a very strong internet connection that is needed not only for all digitization measures or block chains, but also for marketing activities of the farms. Group members consider a strongly improved perception of farming, and especially of conventional high-tech farming, as essential for its success. Therefore, an ongoing social dialogue needs to be established and a new kind of social contract agreed. For instance, positive external effects of farming, as for instance, on the landscape or biodiversity, should be taken into account and farmers should be remunerated for these external effects. Finally, to achieve the desired state of intensification, the CAP would need to set the right incentives that encourage farmers to take action, become independent from subsidies and generate enough income on their own. However, group members point to the danger that without subsidies, farms would almost not be able to pay salaries of their workers which would lead to a drastic rural structural change.

Strategies discussed in this group concerned the general problems of the current agricultural system. One of the most pressing strategies that have been identified is the image cultivation of the agricultural system. Farmers should begin to more proactively engage in their marketing strategies and use several channels of self-portrayal. The cooperation with NGOs, lobby organizations and other relevant actors is seen as a key for success. While group members allocated the major responsibility to improve the societal appreciation of farming to farmers and the closer cycle of stakeholders, politics is needed to define the right institutions to improve communication and transparency in the agricultural system. For instance, mobility from and into the region should be improved. This would support an improved exchange between rural and urban sites and help to create more understanding for each other. The life in the rural areas is expected to also become more attractive since alternative jobs to agriculture would be in a



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better reach. This should be accompanied by a creation of attractive cultural and social offers in the rural areas of the Altmark.

2.4 Strategies towards the future

The most prominent shared future vision of participants is that the status quo is not going to be kept in place and that the current system needs strong improvements. While most of the participants (mainly the conventional farmers) showed more skepticism towards the alternative system organic farming, the scenario of intensification was seen as most likely and highly desired by the majority in the plenum¹. For all future states, an improved communication and more transparency in the system were regarded as an important strategy (Table 4). Most strategies that have been discussed for the three alternative states are compatible with each other in all three alternative systems (Table 4), implying they can be understood as no-regret options. The identified strategies can be grouped into five thematic blocs: communication, attractiveness of rural areas, value chain cooperation, political incentives / agricultural policies, and climate change adaptation.

2.4.1 Communication

An improved communication was regarded as a key strategy to achieve a desired future state. In this context, communication comprises several aspects, most notably the development of a more sophisticated marketing system of both, individual farms and the whole agricultural sector. This somehow meets the identified need to improve the culture of trust, which most of the participating farmers described to experience. Recognizing the central role farmers play for the improvement of communication, it was also pointed out that media would need stronger regulations in order to avoid misreporting. Agriculture would need to re-gain sympathy by the society, which mainly lives in urban areas and has no or little connection with agriculture. In order to reverse the perceived culture of distrust, participants suggest increasing transparency. Thereby, the education system also needs to better inform about the national food system and basic agricultural processes. Initiatives which inform about single cases of good practice and show consumers the personal perspectives of farmers are regarded as very fruitful. Finally, all participating stakeholders are seen as being responsible to improve the societal communication about food and agriculture that is farmers, media, politicians, consumers and civil society organizations concerned with the topic.



¹ A result that is not surprising given the composition of the group, see p. 5.

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2.4.2 Attractiveness of rural areas

The improvement of the attractiveness of the region can be regarded as the most important "background" strategy that would benefit all discussed alternative systems. When discussing attractiveness, it was mainly with regard to infrastructures such as transport systems and the internet. But going beyond these practical needs, the existence of alternative jobs or cultural and social offers were also regarded essential for the well-being of the region and were expected to positively impact all possible alternative scenarios.

2.4.3 Value chain cooperation

Value chain cooperation has been discussed as an important strategy. Anyhow, even if participants estimated an improved vertical and horizontal cooperation as crucial for the improvement of the farming system, they see its likelihood – especially for an improved vertical cooperation – as very low. On the one hand, farmers argued that an increased value addition for farmers would be desirable but due to market power of the downstream segments (mainly retail) not practicable. On the other hand, representatives from the governmental agencies stressed their experiences from first discussions which would show that only a smaller share of farmers would prefer to abandon the freedoms of their individual marketing system and join an integrated one. Others highlighted the high degree of complexity of the value chain and the challenges to bring stakeholders at one table. Besides, farmers pointed to the dominance of the market in the whole system.

2.4.4 Political incentives / agricultural policies

In the plenum, the existing global agricultural trade system has been criticized. Some of the participating farmers find it particularly challenging that different standards are applied for national and international products. While the EU standards are generally high, the import of products with less high standards would put local producers in a weaker position within the competitive process in the market. Concrete political measures that have been mentioned comprise protectionist instruments such as tariffs and compensatory payments or an improved system of labelling local products or products containing local raw materials. Labelling and certification schemes are regarded to be over-complex and hence not helping consumers to take decisions. As an important policy measure, certification schemes should be simplified and standards better communicated to consumers.

Another aspect of agricultural policies that has been discussed is the payment of subventions, particularly direct payments. Most of the farmers agreed that direct payments which are linked to farm sizes would finally not help anyone. Farmers would rather prefer fair prices on the



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market and become financially viable instead of being dependent from subsidies. Funding should rather focus on start-up funding and any measures should follow the major objective to create conditions that farms can survive on the market. Project funding should further be oriented on local features and not have the same conditions for all EU farming systems.

Finally, bureaucracy and rigid regulations are seen as main challenges of farmers. Farmers argue that, currently, they don't see proportionality between the costs/efforts some EU controls require and the risk they should prevent. It was stated that generally, the costs of the measures should not be higher than the possible risks. There was the agreement that a debureaucratization would increase farms response diversity. Its most extreme forms should be dismantled but at the same time bureaucracy cannot be completely abolished.

2.4.5 Climate change adaptation

A central statement by the organic farmer was that the economy would have to align with its ecological environment and that resource conservation is imperative. In fact, the discussions regarding sustainability strategies were the less intense in the plenum. In several incidents, organic farming was stigmatized as ideological following a "black-and-white thinking". This attribution somehow reflects the still existing prejudices among farmers. In the plenum, conventional farmers were more concerned with the market side of production. The organic farmer suggested a shift in the cultivation system and to include more tree crops. Conventional farmers doubted the existence of demand for fruits which would not fall in the standards of size and beauty. Nevertheless, there was a broader agreement that findings from R&D should be increasingly integrated in the practice of any of both systems in order to become more climate change resilient. In addition, the existing knowledge on local varieties and climate smart farming techniques should be bundled and distributed in a more organized way. Thereby, next to the farmers themselves, consultants and R&D should play a leading role.

The mentioned strategies potentially support the achievement of all the discussed alternative future states. However, the performance of system function indicators and resilience attributes was expected to be considerably better in the alternative systems intensification and better societal appreciation and their allocated strategies than in the alternative state of organic farming and its linked strategies. For intensification and societal appreciation, the strongest resilience effects were regarded to appear for the indicators/attributes regional infrastructure, the availability of qualified workers and farm successors, as well as farm profitability. All these were also mentioned as boundary conditions what indicates their perceived very high importance for the resilience of any of the discussed alternative systems.



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Comparing the four systems status quo, organic farming, intensification, and integration in value chain, the latter was seen as the most desirable but the less likely to happen. The reasons given were partly already explained above. The strongest skepticism towards this highly desired state comes from the perceived weak power position of farmers in the chain. The second most desired alternative state for the participants is the scenario of intensification. It ranked highest for the likelihood of becoming realized in future. Most of the participants allocate a high potential to increase profitability of farms and solve societal problems to this future state. Organic farming was ranked lowest for all three alternative states, regarding both, desirability and likelihood. Anyhow, the system with the worst scoring is the current system, the status quo. Participants see the need to pass on to a new system but, as has been brought up too, the openness towards changes, even if backed-up by scientific findings, is often rather low.



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Table 4. Current strategies and future strategies for different future systems. Current strategies are based on FoPIA-SURE-Farm 1. Bold font indicates that these strategies were mentioned during the workshop for a specific system. Normal font indicates that, based on the discussions during the workshop, it seems likely that strategies will be applied in certain systems.

		Current		r		
		system		г	uture systems	
			.	- ·	Better	
Strate av	Demain		Status	Organic	societal	Intereification
Strategy	Domain		quo	Tarming	appreciation	Intensification
Extend knowledge on local varieties and climate						
smart techniques	Agronomic			V		V
Better varieties (drought resistant)	Agronomic			V		V
Precision agriculture	Agronomic	V	V			V
Integrate knowledge from R&D	Agronomic	V	V	V	V	V
Cost leadership through cost reduction	Economic					V
Increase value of raw materials	Economic			V		V
Increase share of profit in value chain	Economic			V		
New varieties with climate services (tree crops)	Environmental			V	V	
Improve efficiency of irrigation schemes	Environmental	V	V	V		V
Improve rural infrastructure	Institutional	V	V	V	V	V
Create alternative jobs and social/cultural offers	Institutional			V	V	V
Stronger regulation of international agricultural						
trade system	Institutional			V		
Simplify system of labelling and certification	Institutional			V	V	V
De-bureaucratization (duration of approval,						
frequency of controls, paper work for new						
investments)	Institutional			V		V
Fair prices instead of direct payments	Institutional			V	V	V
Align funding with locally specific conditions	Institutional			V	V	V
Improve marketing of farms and the whole sector	Institutional			V	V	V
Improve culture of trust	Social			v	V	V
Better cooperation between all stakeholders	Social			V	v	V



This Project has received funds from the European Union's Horizon 2020 research and innovation programme under Grant

Agreement No. 727520

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3 Interpretation

3.1 Tipping points

In general, the farming system of the Altmark seems to be somewhat close to a critical threshold, where some individual farms seem to be very close to or beyond a critical threshold. Its biggest vulnerability stems from possible negative effects of climate change, most notably a frequent change between extreme weather events such as droughts and floods. The system function indicator "availability of water" is most fragile to reach its tipping point due to climate change. The soils in the Altmark are very sandy and have a lower water storing capacity. Hence, the indicator "soil quality" itself is not performing well but is also not close to a tipping point. But in times of droughts, due to its already low water storing capacity, water stress easily gets very strong in the Altmark. Generally, the "availability of water" is good but in some years, a very unbalanced distribution of rainfall over the seasons already becomes a source of stress. Therefore, an accumulation of extreme weather events would very likely make the ecological system very vulnerable so that tipping points could be easily reached. Participants indicated three to four times water stress within ten years or annual rainfalls under 300 to 450 mm/a as a threshold. Taking into account the two dry summers in 2018 and 2019 with almost no rainfall, it becomes clear how fast stability can change and suddenly a tipping point in the ecological system can be reached. Cereal production is directly dependent from water availability and currently also shows a moderate performance. Nevertheless, a decline of water availability in times of droughts must not necessarily also lead to a sharp decline of cereal production. Rather, the decline might push cereal producers to find and apply measures of adaptability. This is more likely than transformation because there are almost no alternative crops as feasible for cultivation in the Altmark as cereals are. Nevertheless, individual farms can easily pass their thresholds, as participants put it, when facing three major harvest losses within ten years due to extreme weather events. Given this serious situation for farmers, it seems somehow surprising that no real discussion on climate change adaptability came up during the workshop.

While interpreting the results from the workshop, it is important to keep in mind the subjectivity of participants' assessments. Particularly farmers might have their own farms in mind when giving estimations instead of referring to the whole farming system. This becomes clearer looking at the indicator profitability. The indicator is assessed to be very close to its threshold or to even having passed it already. It has been indicated that a gross margin loss of 10% against the previous financial year would be a threshold. This shows how little room participants allocate for deterioration. For instance, a drop in milk price under 35ct/kg has been given as a reference measure of threshold. But the milk prices have been under 35ct/kg in the past and currently (at March 2020) are exactly at this level. Still, the farming system did not collapse yet



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and also farms continue to produce. This might give us a hint that farmers rather experience a very high degree of stress for their business when profitability becomes very low. They seem to allocate a threshold where they are forced to conduct first measures of adaptation or transformation at the farm level. This, however, is not equal to causing a complete system collapse but rather might lead to a structural change towards the survival of only the most efficient farms if the current system is to be kept in place.

While looking at the forces of price dynamics and their impact on farms, the importance of a time dimension when assessing thresholds becomes apparent. While for profitability effects can roll out very fast, for farm succession, for instance, a long-term perspective is needed. Even if many participants experience the situation quite critical and don't see much room for decline, the agricultural system would only be affected in the middle-run. In contrast, the availability of qualified farm workers is an indicator with a more immediate time frame. The situation is currently already perceived as relatively bad without much room for deterioration. The assessments of participants regarding this threshold differ quite strongly but some estimate a level of 10 to 20% already as problematic. This, however, shows the strong dependency of farms from qualified workers, particularly when new technologies and other innovations are implemented.

The production of biogas in the Altmark is somehow an artificial business bubble that from the outset has been dependent from governmental subsidies. Its current performance is still very good but after the period of guaranteed payment (for 20 years after the plant was built), farmers and managers will be forced to adapt and search for more profitable ways to run their facilities.

The current performances of resilience attributes have been assessed as very low (regional infrastructure), low (support rural life) and moderate (response diversity). The threshold for regional infrastructure is perceived as already reached. The weak existence of good regional infrastructure, mainly internet and mobility infrastructure, shows its negative effects on several indicators (profitability, availability of qualified workers and farm successors) of the farming system in the Altmark. Even if there are ongoing efforts to improve the situation, many places still lag behind and have to manage without a strong internet connection. This becomes particularly problematic when administrative matters are increasingly mandatorily conducted online and the digitization of agriculture becomes standard. Very similar, the support for rural life is perceived close to its threshold even if currently several measures are going on. Efforts really need to be scaled and speeded up and be targeted more precisely to the remote areas in the Altmark. There is a direct connection to several indicators such as the availability of qualified



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farm workers and successors. After all, a more attractive rural area will benefit all system indicators and have positive impact on the functioning of the whole system.

3.2 Thresholds exceeded

There are several plausible causal chains of threshold exceedance interactions which might affect the farming system in the Altmark. One of the most likely major challenges is an increase in extreme weather events, particularly droughts due to climate change. An exceedance of the threshold for climate change would most likely drastically increase the water stress for cereal production in the region and might result in considerable harvest losses. The resulting reduction in yield would directly negatively impact the economic viability of farms. In this scenario of exceedance of the indicator "water availability", highly specialized crop farms might show less ability to adapt to the stress than mixed farms which also gain their income from other income sources. Hence, crop farms with a low share of farm-owned production factors (family labor, owned land) and/or no other income sources such as livestock production, tourism, direct marketing or other branches, might be less resilient (robust) towards extreme weather events because they would be hidden too strongly by the economic shock of harvest loss. The already existing challenge of low prices and high costs would be reinforced by the negative economic effects of climate change. If the farms' financial situation deteriorates further, their ability of response diversity and farm investment also reduces. Since these are important resilience attributes, their overall resilience would be further negatively affected and their capacities to adapt undermined.

Low prices and high costs generally strongly contribute to the low attractiveness of the agricultural sector in the Altmark. This might show effects on the two indicators "availability of qualified workers" and "availability of farm successors". Possibly, a further decline of the availability of qualified workers would show negative impacts on the degree of modernization/digitization of farming in the region, since the implementation is strongly dependent on availability of qualified staff. At the same time, if regulations and policies push towards the right direction and manage to increase the speed of infrastructure expansion in the area, the digitization of agriculture can serve as a trigger to attract more qualified workers to a position in agriculture. Nevertheless, the frequent changes in policies and regulations have rather shown to be a source of insecurity towards future perspectives in the sector and hence posed a challenge in the past years. Due to these insecurities on what to count for in future, workshop participants stated to be more reluctant to undertake important investments in the modernization of their farms. In combination with the weak regional infrastructure, modernization of the agricultural sector in the Altmark in the mid-run might lag behind other regions. This in turn could lead to a limited competitiveness of the farming sector in the Altmark



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with other sectors/industries. Finally, the anticipated dropout of the less robust and adaptive farms might be accompanied with a reduction in farm employment possibilities in the region.



Figure 1. Interacting thresholds in the farming system, using "climate change", the main challenge as example. Based on framework of Kinzig et al. 2006. Dashed lines indicate relationships that were not discussed during the workshop.

3.3 Alternative systems

As described in detail in section 1.2.3., indicators and attributes stay the same or improve in all three discussed alternative systems with only very few exceptions. The alternative system with the least improvements is the system of "organic farming" (remind the above described group constellation and its role for the development of the discussions). In this scenario, all function indicators and resilience attributes stay the same with the exception of production of cereals and biogas which were estimated to decrease in performance. For the alternative systems "better societal appreciation" and "intensification" an overall improvement of indicators and attributes was anticipated. These improvements are supposed to lead to a general increase of the resilience of the farming systems. Particularly the indicators availability of workers and farm



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successors were estimated to perform very well in the alternative system of "better societal appreciation" and to a lesser extend in "intensification", too. The attributes regional infrastructure and support for rural life also were anticipated to perform very well in these two alternative systems. This somehow indicates that participants perceive a high importance of the societal recognition of the preconditions for a resilient farming system.

Hence, the alternative system "better societal recognition" implies a transformation of the whole farming system with all participating stakeholders whereas the other two alternative systems rather concern the farm level of the farming system. In the alternative system of "better societal appreciation", supported by the above described strategies and measures of improved communication and networking, all stakeholders would come closer and the exchange of ideas and standpoints would improve. The thereby achieved mutual understanding would foster the societal recognition of the attributes and capacities the farming system requires in order to become resilient. That new state can therefore be considered as a transformation of the whole farming system towards a more dialogue-oriented system with improved procedures and platforms of exchange among stakeholders.

The alternative system "organic farming" also would be a transformation. While the main changes occur at the farm level and mainly concern production methods and varieties, a number of changes in both upstream and downstream segments would also occur since the inputs would change and new marketing channels would need to be established. Currently, due to the limited local demand, direct marketing is still difficult in the Altmark. But there is currently an overall increase in demand for organic and local products in Germany and the labelling of local products also helps consumers to take informed choices. In the case that infrastructure in the region would improve and a living there would become more attractive for young families, very likely organic producers in the Altmark would benefit from an increased demand for their products.

The scenario of "intensification" represents a typical case of adaptation. All major production strands remain in place but show considerable improvements regarding their efficiency. Thereby, the need for workers could be reduced and some pressure on the system removed. New and improved methods and varieties are applied but the main functions are still in place and are reoriented to respond to the most urgent challenges. With the more efficient production system, the already existing purchasing and marketing channels remain in place and the relationship with consumers remains the same (almost non-existent).



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3.4 Causal loop diagram

In the farming system of the Altmark, most of the indicators and attributes are connected in several ways and therefore, loops can start at different points and lead to similar effects. For instance, the regulatory measure of improving rural infrastructure can either directly improve cereal production through the provision of better digitization opportunities or it can shape it indirectly through a larger loop model. The reinforcing feedback loop "increase of cereal production" (R1) also has its starting point in the regulation to improve rural infrastructure. As has been argued above, an improved infrastructure in the Altmark is supposed to improve the attractiveness of the region which in turn would have a positive effect on the availability of qualified workers in the farming system. Since many farms currently experience shortage of qualified work force, the cereal production could significantly be boosted with an improved availability. The gains stemming from this production increase improve the overall profitability at the farm level which also increases the capital for investment.

Farms' improved ability to invest can trigger several loops, too. At the one hand, the reinforcing feedback look "better societal appreciation" (R2) has the capacity to lead the farming system to the transition to this alternative system. On the other hand, the reinforcing feedback loop "organic farming" (R3) improves the farms' response diversity and thereby their capability to adapt to climate change. In the R2 loop model, the investments are mainly done in the field of farm communication and public relations. The R1 feedback loop supports this since internet and mobility infrastructures are improved. The increased focus on farm communication and the allocation of resources to it helps farms to improve their connection with actors outside the farming system. The better the communication is, the greater the commitment of all stakeholders becomes what is a further incentive to institutionalize interactions in formalized platforms and networks. As described above, these continued societal dialogues foster the mutual understanding of positions between diverse actors and, in a good case scenario, lead to the alternative system of better societal appreciation.

In the R3 loop model, the investments are mainly directed towards the diversification of the farm, as for instance new organic varieties and alternative cultivation methods. As organic farms are dependent on a broader crop rotation and often combine crop and animal production, they have a greater potential to diversify their responses to current pressures. Due to their greater response diversity, organic farms are more robust against water stress and therefore more climate change adaptive. This, in turn, has a positive impact on their overall profitability.

Although being based on very different measures, ideally, the reinforcing feedback loop "intensification" (R4), also gets to such a result of improved climate change resilience and hence an improved profitability. The innovations that are needed to achieve intensification at the farm



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level are either directly stimulated by regulations or are promoted through subventions. In both cases around, one of the main achievements of intensification is a better reply to water stress through improved irrigation measures and a selection of drought resistant crop varieties. While this achievement is an important aspect of this alternative system, the scenario of intensification also has diverse effects on cereal production and the connected indicators and further feedback loops could be identified here.



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Figure 2. Causal loop diagram of the farming system in the Altmark. A + implies a positive cause-effect relationship and a - implies a negative cause-effect relationship. R stands for a reinforcing feedback loop, C for challenges, I for Indicators, A for attributes and S for Strategies.

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3.5 Linking alternative systems to scenarios

Already during the discussion of strategies for alternative systems with the participants, it was noticed that the strategies do not contradict each other (no-regret strategies) and often the same strategies apply to several or all alternative systems, such as "integrate knowledge from R&D" and "improve rural infrastructure". It is therefore not surprising that the compatibility of the alternative systems with Eur-Agri-SSPs is not significantly different for each alternative system (Table 5).

Table 5. Compatibility of alternative systems with different Eur-Agri-SSPs (Mitter et al., 2019). Where values -1 to -0.66: strong incompatibility, -0.66 to -0.33: moderate incompatibility, -0.33 – 0: weak incompatibility, 0-0.33 weak compatibility, 0.33-0.66: m

	Scenarios					
Systems	SSP1	SSP2	SSP3	SSP4	SSP5	
Status quo	0.79	0.43	-0.76	0.24	0.46	
Organic farming	0.82	0.23	-0.76	-0.05	0.20	
Better societal appreciation	0.81	0.36	-0.69	-0.09	0.24	
Intensification	0.78	0.34	-0.75	0.13	0.36	

In the scenario "Agriculture encouraged for sustainability" (SSP1), technological development and attention for natural resources in combination with effective policies and institutions align well with the needs of all alternative Systems. Thereby, the alternative systems "Organic farming" and "Better social appreciation" would benefit most from it.

Continuing on established paths (SSP2) is not contradicting the current or proposed alternative systems. By its very nature, it is most in line with the "Status quo" of the system. Due the ongoing resource depletion, it goes least in line with the alternative system "Organic farming".

The agriculture controlled within national boundaries scenario (SSP3), undermines many of the prerequisites of the current and alternative systems. Only the expected "Relative prices of agricultural commodities" in SSP3 may have a positive impact, but this does not compensate for the expected negative influences in other areas.

The inequality path (SSP4) has positive and negative points with regard to the prerequisites of the current and alternative systems. It is not contradicting with "Status quo" and "Intensification", although the compatibility is still lower than in SSP1, 2 and 5. Especially the expected weaker "Urban-rural linkages" and the lower "Environmental awareness of citizens" would affect the alternative systems "Organic farming" and "Better social appreciation".

The technology path (SSP5) shows similar patterns as SSP4 but is expected to perform better regarding investments in infrastructure in rural areas and educational levels of farmers. These



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characteristics support all alternative systems. Overall, maintaining the current system and "Intensification" seem most aligned with SSP5 and for these systems comparable to SSP2.

3.6 Strategies

Due to time constraint at the end of the workshop, past and present strategies could not be compared with possible future strategies which participants would estimate to be most successful to achieve desired future states. Instead, the plenum discussed the strategies which participants identify as most appropriate to achieve alternative systems without taking explicit reference to former or existing strategies. Nevertheless, comparing past and present strategies which were discussed during other SURE-Farm workshops, the red line becomes clear and we can see that all strategies discussed in the FoPIA-SURE-Farm 2 workshop include aspects of already existing or past strategies.

The past and present strategies which have been identified in former workshops include the improvement of information flow and the engagement in partnerships, the diversification of farms, the increase of continuity and transparency of regulations or the overall improvement of local infrastructure. The strategies identified in the FoPIA-SURE-Farm 2 workshop to be most appropriate to achieve the desired future states could all be classified as no-regret options, meaning they are estimated to have a positive effect on all discussed alternative systems. A strong emphasis was given to the strategy to improve communication activities at the individual farm level and at the level of farming system, reflecting the strong societal pressure some of the participating farmers stated to experience. While in the former workshops communication strategies were still mainly oriented towards colleagues and value chain stakeholders, this time the focus was explicitly more strongly on improvements of communication with actors outside the farming system and the development of better public relations strategies and platforms of exchange. This trend might be explained by the political developments in 2019. With the increased climate change awareness which resulted mainly from the Fridays for Future movement, agriculture in Germany was targeted by strong critiques and its role regarding climate change became controversial. As described above, many farmers reacted by joining a farmers' movement seeking to articulate their standpoints. The two social streams mobilized many thousand supporters but a constructive form of exchange and debate was not found to date. This might be a major explanation why in the FoPIA-SURE-Farm 2 workshop, most of the participating farmers put such a high value on the improvement of communication. As has been highlighted in this report, one important leverage point to achieve the desired state of better societal appreciation is the creation and institutionalization of platforms of exchange and better networking. Similarly, platforms need to be created which provide room for sharing of best



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practices and bundling of knowledge on climate smart agricultural practices. While the former type of platform would be more on exchange between "in- and outsiders" of the farming system and improve societal relations and understanding, the latter would be an important catalyzer to bring all stakeholders from the farming system together in order to develop clear agendas and outcomes. This also plays a role for the strategy of climate change adaptation which is closely linked to farm diversification. The increased integration of expert knowledge from R&D and consultants was mentioned as an important aspect of this strategy. This can be done on a bi- or multilateral level at the farming system and concerns both alternative systems, organic farming and intensification. One of the main statements that found a broad support in the plenum was the idea that the future of the farming system in the Altmark most likely consists of several parallel systems or forms of agriculture and not only of one major approach for all farms. The discussed future strategies, that is improved communication, increased attractiveness of agriculture in the region, better value chain cooperation, simplified and more coherent policies as well as different climate change adaptation measures, all have the potential to positively contribute to such a state. Looking at the CLD, the central role of a good regional infrastructure as a leverage point to foster these strategies becomes very clear.



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4 Conclusion

The alternative systems discussed in the workshop constitute transformations and adaptations of the farming system. Particularly the alternative system "better societal appreciation" implies a transformation of the organizational level of the whole farming system where all stakeholders and their relations are involved. "Organic farming", too, implies a major transformation of the farming system. Next to the adaptations on the farm level, new local marketing mechanisms need to be established what implies the creation of a new local value chain for organic products (respectively the drastic extension and modification of the already existing one) what would embody a transformation. The alternative system "intensification" mainly relies on already existing marketing channels and innovations in the fields of already applied cultivation methods and crop varieties. Especially for the alternative systems "intensification" and "better societal appreciation", the participants anticipated major improvements of system function indicators and resilience attributes. But these results have to be taken cautiously since there was a strong overrepresentation of conventional farmers in the workshop. The indicators with the strongest expected improvements are the availability of qualified workers, the availability of farm successors and the overall profitability of farms. All of them were identified to be very close to their thresholds and an improvement of their performance would definitely lead to more stability of the system, with particular emphasis on the farm level. At the same time, all of them are important starting points for further system changes in the direction of adaptability. This becomes very clear looking at the CLD. While the availability of qualified workers can be regarded as one important asset to increase profitability, the latter is a main trigger for important investments which in turn are a precondition of adaptations and transformations in the system. As has been argued here, the increase in profitability makes several important investments possible; on the one hand, a diversification at the farm level or, at the other hand, for instance, the investment into improved communication strategies. Both developments can lead to broader system transformations (organic farming and better societal appreciation). The anticipated improvement of the resilience attributes regional infrastructure and support for rural life has the potential to play a major role in the achievement of system adaptations and even transformations, too. Both attributes are important triggers for the improvement of many main function indicators of the system, as for instance the mentioned indicators availability of qualified workers and the linked gains in profitability and resulting investment capitals. Hence, they seem to be key when looking at the most pressing challenges of the farming system in the Altmark, which are climate change and the low attractiveness of the region. An important question that will need to be addressed in near future is about the best entry points to stimulate the described causal loops which have the potential to lead to more resilient alternative systems. Which functions and attributes are pre-conditions or results of transition processes and



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at which points should strategies intervene since all aspects are strongly connected to each other? While definitely efforts have to be undertaken at multiple scales and by multiple actors at the same time, one main result of FoPIA-SURE-Farm 2 is the central role that improvements in the regional infrastructures play. They are an important starting point for the many described channels that can boost the system towards an improved resilience.



This Project has received funds from the European Union's Horizon 2020 research and innovation programme under Grant 40 Agreement No. 727520

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