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Long-term vision of rural areas in Hungary, focusing on foresights

Abstract: *The Horizon 2020 SHERPA (Sustainable Hub to Engage into Rural Policies with Actors) project has made a contribution on behalf of 20 different Multi-Actor Platforms (MAPs) to the preparation of a new long-term vision for rural areas initiated by the European Commission. The Hungarian MAP – one of the groups of science-society-policy actors – chose the Agricultural Knowledge and Innovation System (AKIS), more precisely digitalisation, as its flagship topic due to the fact that it is a horizontal issue and it is embedded even into the Common Agricultural Policy's (CAP) strategic planning process. Thus, the development of AKIS requires close and intensive cooperation of policy makers, researchers and farmers or – in broader context – the society with various stakeholders. The aim of the Hungarian research team was to identify the current and likely trends for the Hungarian rural areas and to point out key challenges, opportunities, enablers and barriers in rural development in terms of digitalisation up to 2040.*
The methodology used was the Delphi technique. In the first phase, a review of key trends, main challenges and opportunities and a summary of existing foresight regarding digital agriculture was written. Then AKIS experts were asked to talk about their experiences and opinions in the framework of interviews, a focus group meeting and a survey. In the end, results of the survey were discussed in a consensus meeting.
Among the results, it is worth mentioning that digitisation and digitalisation will fundamentally change how rural areas operate including economic, environmental and social dimensions. The main enablers of a promising future vision are capacity building for knowledge transfer, adaptation for job creation and offering better quality of life, stronger community building for collaborations, deeper government involvement, and last but not least, strengthening the local identity in rural areas. ocial responsibility and this makes a promising background for further research.

Keywords: *Digitalisation, Rural areas, Agricultural Knowledge and Innovation System (AKIS)*

Introduction

In 2020, the European Commission initiated the preparation of a new long-term vision for rural areas, the first step of which was the launch of a public consultation. The Horizon 2020 project under the title SHERPA – Sustainable Hub to Engage into Rural Policies with Actors – intended to contribute to this consultation as well. This project financed between 2019 and 2023 is aimed at gathering knowledge from science-society-policy actors that contributes to the formulation of recommendations for future policies relevant to the EU rural areas. In the context of policy development, SHERPA provides inputs for the design of future research policies, with a focus on the preparation of work programmes under Horizon Europe, it supports the implementation of policies relevant to rural areas in the 2021-2027 programming period and it contributes to setting the direction of rural policy in the future.

The groups of science-society policy actors called Multi-Actor Platforms (MAPs) – altogether 20 of them in the first round – were invited to discuss their vision for the future of their territory over the next 20 years (SHERPA, 2020). One of the Multi-Actor Platforms is the Hungarian MAP. Its focus was narrowed down to the Agricultural Knowledge and Innovation System (AKIS). The topic of AKIS is embedded into the CAP strategic planning process. Member States' CAP strategic plans will combine a wide range of targeted interventions in relation to 9 EU-level specific objectives touching upon environmental, social and economic challenges and a cross-cutting objective on knowledge, innovation, and digitalisation, while contributing to the Green Deal.

AKIS itself covers a wide range of issues, but our research focused only on digitalisation. The reasons behind this decision are presented below.

Digital solutions can help to use resources more efficiently, reduce production risks, reduce losses, increase productivity, traceability and quality assurance, and address labour shortages in some areas. Increasing the efficiency of production also has a positive effect on the environment and the climate. However, the lack of information on new technologies, the lack of digital skills, and the limited availability of reliable cost-benefit analyses for the application of technologies pose a challenge for the deployment of digital applications. The transformative impact of digital technologies on markets is summarized by FAO (2020) "Digital technologies are rapidly transforming all stages of the value chain from the farm to the table. Their adoption is improving efficiency, creating new jobs, generating new income streams and saving resources. However, digital technologies can be disruptive, modifying or displacing value chain activities and products."

There are several aspects of digitalisation to be analysed, as the digitisation of agriculture and the food industry includes hardware tools (e.g. sensors, drones, robots), data assets (e.g. records, soil maps, weather data, pest and

pathogen surveys), methods and software for analysis (e.g. artificial intelligence, decision support software), corporate governance systems, e-government, e-commerce and online banking, and digital logistics solutions. Furthermore, digital technologies affecting the agri-food economy can be classified into three main categories:

1) Expected to have high impact: Internet of Things (IoT), robotics, artificial intelligence and big data. In practice, these technologies are most often used in combination and can lead to significant changes.
2) Expected to have a medium impact: blockchain, Global Navigation Satellite System (GNSS), virtual reality. These can have a big impact in the long run, GNSS can be used on small farms.
3) Expected to have a low impact: mobile broadband networks, info-communication technology (ICT) systems, digital business platforms (e-business). These are already widely present and serve as a basis for new, innovative solutions (Pesce et al., 2019).

According to Bacco et. al. (2019): "The impulse towards a larger introduction of ICT in the agricultural field is currently experiencing its momentum, as digitisation has large potentialities to provide benefits for both producers and consumers; on the other hand, pushing technological solutions into a rural context encounters several challenges."

Klerkx et. al. (2019) stated: "There is also a growing interest in the topic of digital agriculture within policy circles, including the socio-economic elements of digitalisation, and this has resulted in several policymaker and practitioner-oriented publications."

Last but not least our choice was justified by the outcome of research of a high number of MAPs (e.g. in Germany, Denmark, Spain, Finland, France, Italy, Lithuania) as they identified the development of digitalisation and smart ruralities as one of the most valuable opportunities for rural areas. The main visions shared across the MAPs relate to the use of digital technologies and solutions. The digital transition can help with service provision, job creation, and the development of new digital products or can support the creation of new ways of working. 'Enhancing smart ruralities and digitalisation' was highlighted as enabler to this vision. (Chartier et al., 2021).

Methodology

The aim of the research was to identify the current and likely trends for the Hungarian rural areas and to point out key challenges and opportunities, enablers and barriers in rural development in terms of digitalisation within the AKIS up to 2040.

The SHERPA consortium chose the Delphi technique (Cunha and Swinbank, 2009; Thangaratinam and Redman, 2005) that is aimed at predicting

and exploring "alternative future images, possibilities, their probabilities of occurrence, and their desirability by tapping the expertise of respondents" (e.g. Rikkonen et. al., 2019; Linstone and Turoff, 2002). Thus the Hungarian team used the same 6-step Delphi method[1]. It is a great advantage of the method that due to its specific feedback mechanisms results can be further detailed, clarified and harmonised. Consensus was initially essential to the Delphi method, but the consortium decided to loosen this restriction. Thus, we intended to focus on achieving stability in expert responses, obtaining an opinion, agreed at least to some extent, by a panel of experts. The predictions are basically reliable due to the selection of the experts and not because of the degree of consensus obtained (Abreu and Mesias, 2020).

In the first phase, a review of key trends, main challenges and opportunities and a summary of existing foresight regarding digital agriculture was written. Then, in terms of challenges and opportunities in the next 20 years, desirable future for 2040 and enablers to achieve the vision in Hungary, a panel of AKIS experts were asked to talk about their experiences and opinions in the framework of interviews, a focus group meeting and a survey. In the end, results of the survey were discussed in a consensus meeting.

The desk research carried out in May and June 2020 focused on 'The rise of digitalisation and smart ruralities'. Then interviews were conducted, and a focus group meeting was held. The target group was the Hungarian AKIS MAP.

The MAP's members are members of the AKIS sub-working group established by the Ministry of Agriculture with a general focus on the AKIS, recently it has been involved in the CAP strategic planning process. The AKIS sub-working group officially includes 15 members – mainly highly respected policymakers, representatives of the Paying Agency, researchers and colleagues of the Chamber of Agriculture representing all types of farmers, but occasionally – depending on the topics to be discussed – more experts are invited to the meetings. The number of the extended working group is approximately 40. Number of official MAP members is 12. As regards the stakeholder groups representing science, policy and society, equal balance of power is demonstrated among them (4-4-4 members respectively).

Interviews were basically carried out via a phone or virtual meetings in Hungarian language due to the COVID-19 situation and, as the time available was quite short, some experts answered the questions per email either in English or in Hungarian. The questions were asked and answered through the lenses of AKIS. Six MAP members were interviewed individually, and six members participated in the focus group meeting.

[1] Step 1: Desk research and context analysis; Step 2: Interviews; Step 3: Interview analysis, writing MAP Discussion Paper and preparation of survey; Step 4: MAP survey; Step 5: Survey analysis; Step 6: Validation of results.

The AKIS sub-working group was invited to express its opinion on local challenges and opportunities as well as its vision for the future of rural Hungary within the next 20 years. The Survey under the title 'Rural development up to 2040 – Challenges, opportunities, enablers and hinderers' contained 20 mostly 'quick-click' multiple choice questions. The survey was circulated in July and August 2020. It mainly focused on inquiring about how interviewees describe living in rural Hungary, how well rural areas are prepared for and resilient to acute shocks, what needs to be done to improve resilience, how rural areas will look like in 20 years, what are the opportunities and the weaknesses in rural areas and what are the opportunities for implementing smart adaptation policies.

Responses were anonymous and confidential. They were analysed and presented to MAP as background material for the consensus meeting. All in all, 16 experts started to fill in the survey, but there were 15 answers that could be analysed. Among the respondents, the group of society was underrepresented with 3 experts, but as regards the number of the other two stakeholder groups, they were equal: 6-6 experts represented both public sector and research. Results of the survey were discussed, confirmed and amended in a consensus meeting. It was held on 2 October 2020 on Microsoft Teams with the participation of 7 experts including the monitor and the facilitator of the MAP. Other MAP members were offered the opportunity to express their opinion in a shared Excel file.

Literature Review

Review of key trends

In Hungary, global trends related to technological development, innovation, digitalisation, and the ongoing fourth industrial revolution (Industry 4.0) have just started to reach the countryside and are still at the beginning of their transformative journey. They are considered by many as unstoppable, irrevocable outside forces, pushing the rural areas towards the future. Digital economy accounts for 20 percent of the gross value added of the national economy and provides employment opportunities for 15 percent of the employees (Digital Start-up Strategy of Hungary, 2016). However, economic benefits from the digital development of agriculture are still unutilized (Digital Welfare Program 2.0, 2017).

According to the Digital Economy and Society (DESI) Index (EC, 2020a), Hungary performs well regarding high-speed broadband accessibility, but insufficient digital skills are shown on behalf of the population. The country remained one of the worst performing EU countries regarding the integration of digital technology in businesses, while poor performance in digital public services further reduces its score. It is among the leaders in the take-up of at least 100 Mbps broadband, 5G readiness, and also scores well in overall

fixed broadband take-up. It still lags behind in digital public services and in the integration of digital technologies in businesses. Majority of the agricultural producers are unable to adapt to the changing climate conditions due to technology gaps and lack of knowledge. Furthermore, available databases are fragmented and difficult to access. The most vulnerable groups are the elderly and people with low qualifications. Especially the latter group is at risk of lagging behind which can intensify social inequalities (Digital Start-up Strategy of Hungary, 2016).

The exponentially increasing amount of available data and information expands the size of the knowledge base extremely and makes the provision of 'access for all' necessary. In the agri-food sector, this will contribute to the economic, environmental, and social sustainability of production. The new information technologies radically change consumer behaviour as well. There is an increasing demand for healthy food such as quality white meat, fruit and vegetables or products without additives, environmental and animal welfare aspects as well as traceability issues are strongly emerging (Ministry of Agriculture, 2017).

Review of main challenges and opportunities

In general, it can be stated there are different kinds of challenges in the agri-food sector among technical and organizational issues, like challenges of digitalisation for researchers and firms that are ahead or fast-growing industry in general compared with the humble adopting speed of the newest technologies in the agriculture. 'Industry 5.0' is starting to grow while the agricultural sector still struggles with adopting the technologies of 'Industry 4.0'. There are concerns about the adoption speed of digital technologies within the agriculture and a lack of a clear overview about the problems that agri-food firms face (Heideveld, 2019).

The period of the Common Agricultural Policy (CAP) 2021-2027 will play a major role in the infrastructural and organizational coordination of certain elements of the Hungarian AKIS. It is considered a major challenge that the structure and the coherence of the different components have not been fully developed yet. In several cases there is a problem also with the quality of the components themselves. The level of professional, management, digital and language skills of farmers is low. The agricultural education is outdated and/or its infrastructure is of low quality. Furthermore, the sector is characterized by the lack of complex knowledge of their businesses.

While focusing on digitalisation in general, it is to underline that Hungary is facing a number of challenges, such as the digital and management skills shortage, and the companies' weak knowledge about the initiatives available, and how they can best capitalise on them. These issues are also reflected in the Digital Transformation Enablers' Index (EU, 2018: p. 4; p. 66.) and

the Digital Technology Integration Index (EC, 2020b; EU, 2018: p. 4) which ranks Hungary as a country lagging behind. In case of agriculture, it is to emphasize that the mobile network and internet coverage is not adequate on agricultural and forest areas. The legal background promoting the exploitation of opportunities created by digitalisation (e.g. drones, data management) is still not in place.

There is a lack of agricultural consultants with proper knowledge of agricultural informatics and innovation. The information on implemented innovative procedures is unsatisfactory. Certain technologies cannot be adopted to small farms or only to a limited extent and the return on innovative investment is also uncertain. Further challenges that are brewing for the future are as follows: still missing or outdated environmental and economic data required by efficient production needs to be made available; data right related questions need to be clarified and equal access to digitalisation and information should be provided to all farmers to avoid the exclusion of some groups.

Besides CAP, a number of strategic and other initiatives are in place to help advance knowledge transfer, digitalisation and innovation in the shorter and longer term: EIP – Agri platform, BIOEAST initiative, E-Knowledge, Vocational training 4.0 strategy (Ministry of Innovation and Technology, 2019b), Agricultural vocational training in the 21st century or Medium-term Strategy. Digital transformation is of course such a comprehensive change that is to be experienced at different levels of the economy. In Hungary, the measures are coordinated by the Digital Success Programme (2015) under the umbrella of which several agriculture related strategies have been developed: Super-Fast Internet Program, Digital Export Development Strategy, Digital Education Strategy, Digital Agricultural Strategy, Digital Food Strategy, DigKomp, Artificial Intelligence Strategy, 5G Digital Strategy, etc.

Digital solutions might contribute to more efficient use of resources, risk mitigation in production, reduction of losses, productivity growth, better traceability and quality assurance. In certain cases, they can be solutions for labour shortage. The increase in productivity has favourable impact on both environment and climate. As regards the introduction of digital applications, several challenges seem to appear such as lack of information on new technologies, lack of digital skills and limited access to reliable cost-benefit analyses of the use of technology (EC, 2019a). As to the increase in profitability, it is important to develop digital technologies based on farmers' needs and solving real problems. The National Digital Agriculture Strategy is aimed at developing the digital agricultural innovation environment and start-up ecosystem. Its objectives are to contribute to improving efficiency of agricultural production; to increase domestic and international market share of the Hungarian IT industry, to spread the use of existing ICT solutions and existing R&D results; to create information flow between research and production; to exploit benefits of advancing ICT; to support risk assessment and risk mitigation (Juhász, 2019).

However, digitalisation has negative effects as well. Its costs might cause problems mostly to smaller enterprises. Greater administrative burden might be an additional challenge and without adequate use of available data, sustainability cannot be improved. Digital technologies might have an impact both on vertical and horizontal food chain integration. The latter of which favours large food suppliers (Pesce et al., 2019).

Summary of existing foresight(s)

In the following decades, a continuous revolution of new technologies will take place. The widespread dissemination of information technology, the digitalisation and automatization of industrial processes will open new dimensions in the agri-food sector. The competitiveness of the Hungarian agri-food economy will be highly influenced by how successfully it can adapt these technologies. That is, it needs to direct its investments, change of technologies and R&D activities into this direction. Precise understanding of the production process and its environment, collecting data, building databases, development and integration of automatic intervention and decision support tools, in one word: digitalisation, is one of the determining directions of the future. For a future-oriented, efficient Hungarian agriculture it is essential to develop necessary competences and to create adequate conditions for education and the dissemination of required knowledge (Ministry of Agriculture, 2017).

The future of agri-food sector is based on information and knowledge. According to the Agri-food sector development concept of Hungary 2017-2050 the goals are to increase the profitability of the food economy, including the agricultural production, in addition to the efficient use of available environmental resources by collecting, processing, automating and robotizing technological processes. To achieve this the strategic goals are as follows: wider use of precision farming, use of management control applications in farm management, preparation of decisions and product tracking systems and online business development, while the horizontal goals are: the development of digital competences of food business operators, provision of digital agriculture advice to farmers, development of a digital agri-innovation environment, development of a digital agrarian start-up ecosystem, reducing the cost of access to public and digital services, legal deregulation for exploiting the potential of digital technology, development of sector data collection and processing, and promotion of precision management (Juhász, 2019).

A prerequisite for strengthening family farms, small and medium farms is to strengthen their market-orientation. They need to be able to supply local and regional markets, provide services and especially create and operate producer cooperation for these purposes. Productivity and effectiveness of these smaller enterprises can be increased by disseminating good practices, providing training and advisory services for them (with diversification of their activities they will be less exposed to outside economic and environ-

mental impacts). More and more farm managers should be young, trained professionals devoted to agriculture, they should have up-to-date knowledge on management and information technology, be open to modernisation and innovative solutions, as well as to cooperation for development. In the food processing, the focus should be on sector knowledge- and innovation-based products and technological developments with high value added (Ministry of Agriculture, 2017).

Technological development, an increase in automatization and the spreading of robotic technologies will support enterprises in handling labour shortages. Due to technological development and innovation, physical work is expected to become easier and thus the opinion (or view) on jobs in the agri-food sector is expected to improve among young people (Ministry of Agriculture, 2017).

Based on the vision of Hungary, companies will become able to benefit from the challenges created by digitalisation, most of them by quitting their business model based on cheap labour. An energetic, dynamic, ambitious group of enterprises will emerge with products ready to prevail on both international and domestic markets. SMEs work in a constant search for new opportunities through the utilisation of modern management methods and technologies. The operation of enterprises is successfully supported by the money and capital markets as well as by innovation support organisations and services. Entrepreneurship is appealing and honourable, entrepreneurs have a strong community organising role, their social perception is very positive. A predictable, stable business environment with low bureaucratic costs is established. Digital transition for the Hungarian economy can be the new engine for growth in the coming years. Until 2025, it can generate an additional EUR 9 billion in the GDP (Ministry of Innovation and Technology, 2019a).

Results

Challenges and opportunities

As regards challenges and opportunities in the next 20 years, experts see the opportunity in a competitive agriculture shifting toward a high-tech sustainable agriculture based on innovation, digitalisation and modernization, in retention and expansion of the intellectual strata, i.e. of highly skilled labour force, in increased demand for local products and strengthened role of short supply chains and in strengthening the role of rural areas in producing goods and providing services. According to experts, Hungary will be faced with several challenges and weaknesses until 2040.

It was also confirmed that the major challenge is to find digital/smart solutions to help rural living, especially in adapting to climate change and extreme weather conditions; to increase digital knowledge, skills, and competences and to figure out the proper application and use of technical improvements,

i.e. to educate and train farmers and consumers on how to use digital technologies in a proper way, furthermore to find ways how to keep the young generation in the rural areas. It was also emphasised that both the problem of depopulation and the diversity/heterogeneity of rural areas (in terms of e.g. closeness to the capital, density, carrying capacity, capacity for population attraction and retention) should be expressed explicitly. Additionally, raising awareness about social responsibility and environmental protection and strengthening local identity seemed to be important aspects, as well.

Vision for the future rural areas

As regards desirable future for 2040, some of the experts approached the vision from the perspective of the Common Agricultural Policy (CAP), and thought that the cessation of the CAP would be a shock for rural areas, since the CAP can help the transition to economic and environmental sustainability. Others pointed out the importance of green policy in shaping sustainability. However, according to this vision, there will always be winning and losing rural areas. To reduce differences, the importance of equal opportunities was emphasized as a solution. Other interviewees placed more emphasis on digital and technological development in their vision as it can convince and motivate young people to become farmers and not to leave rural areas. Furthermore, the popularity of healthy (chemical-free) food production and lifestyle is expected to be higher, just like special consumer demands for specific products.

As a vision for 2040, some interviewees highlighted the appreciated role of skilled individuals with digital knowledge in rural areas and the development of the countryside as an innovative space close to nature and utilizing its environmental endowments.

Based on the differences, two visions were unfolded: one for the remote, lagging-behind, struggling rural areas where aging, lack of skilled individuals and depopulation are typical, and another for the more attractive rural areas with desirable natural resources as well as more promising demographic and economic conditions[2]. Some rural areas will provide habitation for people moving out from urban areas to enjoy a more peaceful natural environment, as well as a place for home office and for home delivery. For the lagging-behind regions the threatening vision of complete depopulation could be avoided with outside help: with the community building efforts of civil and faith-based organisations, with introducing ecotourism or cross-border cooperation, where possible. According to a little brighter vision, the entire rural population will be more digitally skilled than today's population by the time we reach 2040.

[2] During the consensus meeting, MAP members were encouraged to express their opinion on the results. Overall, they accepted the results, however there was one specific area which became the main theme of the meeting.

Participating experts agreed that digitisation and digitalisation will fundamentally change the way rural areas operate and listed adequate knowledge transfer, adaptability and flexibility, the potential of community building and deeper government involvement as enablers. The importance of the vision is supported by former studies results (Gaál et al., 2020). The number of Precision Agriculture (PA) adopters was small (less than 9 per cent of arable farms based on Farm Accountancy Data Network) in Hungary in 2018 and the number of users has not increased considerably compared to FADN PA survey in 2016.

As regards the enablers to achieve the vision according to the experts, Hungarian rural areas are strong mainly because of the availability of natural resources and thanks to certain initiatives that are in place to help advance knowledge-transfer, digitalisation and innovation. The availability of knowledge such as grid-level data is considered also a strength. Mainly the culture of problem solving and policy systems enabling good partnerships should be improved. Regarding agricultural production, digitalisation and increased efficiency will require fewer human resources, and lead to less job opportunities in this sector, while through internet connection other sectors will open up for the rural population (e.g. service sector).

Among barriers, digital and management skills shortage, lack of agricultural consultants with proper knowledge of digital agriculture and innovation were mentioned. Furthermore, missing or outdated environmental and economic data; data ownership and data rights related questions, unequal access to digitalisation and information were also listed as limiting factors. According to the Survey's results, the implementation of policies supporting smart adaptation in Hungary is hindered by lack of collaboration between different levels and sectors interconnectedness of strategies between policy levels; lack of resources and instruments and local knowledge and data availability. Economic and population growth were, however, not considered important. Implementation of smart adaptation policies will be supported through opportunities emerging within the national policy framework, interconnectedness between policy levels, availability of local knowledge and small-scale data, and trust between authorities and society.

Conclusion

Among European rural areas with different characteristics, the Hungarian rural areas have undergone significant changes in recent decades and have been affected by general trends such as depopulation, ageing, urbanisation, climate change or digitalisation, and lately also by the socio-economic impacts caused by COVID-19. The EU policies are already facilitating and financially supporting the development of rural areas and they are expected to continue to do so also in the future. Besides the top-down activities there is, however, a great need for bottom-up contributions, too.

As this research aimed at analysing the digitalisation aspect of the Hungarian rural areas' future, the following concluding remarks refer to this topic. Digital improvement of rural areas requires both the development of infrastructure and the availability of digitally skilled labour force. Local communities and networks need adequate financial support and educational and training opportunities especially in lagging-behind areas, where without outside help, complete depopulation is expected to occur by 2040. Rural areas with more favourable conditions will, however, attract an increasing number of urban outmigrants. Digitisation and digitalisation will fundamentally change the way rural areas operate including economic, environmental and social dimensions. The operation of future farms (smart farms) is expected to be significantly affected by the emergence of new technologies, i.e. in addition to precision solutions, new technologies not used previously in the agricultural sector (e.g. 3D printers, drones, artificial intelligence) and a complex, automated technological ecosystem. Thus, the innovative technologies are not isolated, they communicate and function together in order to perform complex processes in part or in full automatically without human intervention.

The main enablers of a promising future vision are capacity building for knowledge transfer, adaptation for job creation and offering better quality of life, stronger community building for collaborations, deeper government involvement in creating the necessary framework conditions, and last but not least, strengthening the local identity in rural areas. Digital leap, better coordination of existing institutions and platforms, and the retention and expansion of the intellectual capital are all considered major opportunities to realize the vision of rural areas in Hungary.

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